

Development of a jeans sizing system for young black pear-shaped South African women

Abstract

The South African Pear-shaped Black women's jeans market has been confronted by fit dissatisfaction, although there is a growing demand for jeans. This study was approached from the viewpoint that jeans do not fit a large population of this consumer group and investigated the issues related to this problem. Local manufacturers and retailers currently use an adaptation of the British sizing system to suit their customer profile. Not much research, however, has been carried out on developing a sizing system for the pear-shaped figure type, which makes up a sizeable portion of the population in the country. The aim of the study was to establish key variables for developing a jeans sizing system for Black South African pear-shaped women. A total of 60 Black women aged 18 to 35 years at the Cape Peninsula University of Technology were scanned for body measurements using a 3D body scanner. Body measurement differences were examined by using a quantitative research approach to establish the difference between waist and hip measurements. The findings revealed an average drop value of 39cm between waist and hip circumference for a Black pear-shaped figure, in comparison to a drop value of 24cm for a standardised sizing used by the clothing industry. It is recommended that the major stakeholders consider conducting a national anthropometric study to update sizing systems, by using 3D body scanning technology, which provides accurate and consistent measurements of the human body.

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Introduction

Background and context

South Africa's world of fashion has become competitive and challenging to Black females who are now occupying well-paying positions in the corporate world. These women have started to pay particular attention to their appearance in general and dressing up beautifully has become one of their top priorities in everyday life, in order to portray a positive image about the way they look and do things.

Anderson et al.,¹ cited in Nkambule,² argue that the shapes and sizes of women have been changing over the past decade while sizing standards and garment proportions used by apparel industries have not changed. Mastamet-Mason et al.³ assert that female body shapes and proportions vary and change over time, as the result of, amongst others, nutritional changes, lifestyle changes and ethnicity. Dissatisfaction with fit is one of the most frequently stated problems with garment purchases.³ This has created problems in the clothing and textile sector as garments that are produced are not meeting customers' fit expectations.

A need to revolutionise the clothing industry regarding garment sizing has become urgent. Mastamet-Mason et al.³ mention that most female sizing systems, currently in use, are based on the ideal Western figure that has well-proportioned body components. Although shapes have been classified in most developed countries to solve the problem of apparel fit, African shapes have, however, not been taken into consideration. As supporting evidence, Mastamet-Mason et al.³ have cited Kenya as a classic case of the non-classification of body shapes in the African region.

Through observations and preliminary studies, most jeans available in retail outlets are either high-waisted or have a low-rise with a slight difference in measurement between the hip and waist. This is problematic for most indigenous Black females as there is often a marked difference between their hip and waist measurements;

the norm being a narrow waist with a wider hip. Strydom and De Klerk⁴ affirm that, in some cultures, mainly in Africa, the bottom-heavy body shape typifies a substantial percentage of Black African women.

This becomes a challenge for jeans block pattern development where the block pattern needs to represent a curvier shape. McKinney (2007:2) highlights the various problems with crotch fit such as being too tight, too short, too long or too loose. Apparently, current jeans production methods are not providing garments to satisfy the fit needs of the majority of Black female consumers. To improve the jeans fit of a female, Mastamet-Mason et al.³ advise that, through body scanning technology, body dimensions and shapes are easily and rapidly extracted from a population and converted immediately into body shape categories, size charts and patterns for garment production. Body scanners are a relatively recent technology whose main function is to measure the surface topography of the human body, producing a 3D image of the individual being scanned as well as an extensive list of body measurements (Heuberger et al., 2012:1486).

Strydom and De Klerk,⁴ writing within a South African context, view the ultimate success of any sizing system to lie with the accuracy of body measurements taken, since problems with fit often originate from outdated and inaccurate body measurement data. Strydom and De Klerk⁴ state that size charts in use provide outdated size specifications, which still remain the basis for pattern development in South Africa. To revise the current sizing systems used by the South African Clothing industry, it is necessary first to obtain current measurements of the representative population for which the sizing system is targeted. The purpose of the sizing system for apparel should be to make clothing available in a range of sizes that fit as many people as possible.⁵ It has been noted that incorrect sizing is the number one reason for returns from retailers.¹

There is an urgent need to determine fit problems with jeans for indigenous Black women in South Africa, with the objective of attaining consumer satisfaction. Coetzee,⁶ in an interview, states two

critical problems for the large retail outlet where she is employed. Firstly, the outlet has a standard body measurement chart that caters mainly for a White female body shape; and secondly, there is currently no data available on the average indigenous Black female shape, although the average consumer profile is changing to indigenous Black people.

Aim of study

The aim of this study is to develop a jeans sizing system to fit the hip and waist of the Black pear-shaped indigenous women in South Africa.

Literature review

Jeans are referred to as a type of 'world dress' that has been culturally embraced or authenticated by people from all over the world. Over the past two decades, jeans have been the one fashion constant that crosses over ages, genders, cultures and countries (Wu and Delong 2006:238-239). Hegarty⁷ confirms that it is difficult to find a garment as widely embraced, worn and loved the world, over as jeans. The classic jeans symbol of the American West is now a staple in wardrobes around the world. Many fashion designers of 'fast fashion' clothing companies are now making jeans a fashion necessity. Fashion designers have even made denim tuxedos for the most formal occasions. Jeans are popular today for the same reasons they were popular when Levi Strauss first made them in the 1800s.⁸ Denim or dungarees are what people now commonly refer to as jeans. Denim jeans have been embraced by different cultures across the world. Wu and Delong (2006:238-239) assert that the rapid growth in disposable income in China coupled with a large population desiring Western products, provides the world's largest potential consumer market for jeans companies. Similarly, there is a growing market for jeans in South Africa.

When Levi Strauss (the popular American jeans company) conducted a jeans study for the African American pear-shaped figure to solve problems with jeans fit, the company extended the survey to South Africa where similar problems are encountered.⁹ In 2012, Levi Strauss launched 'supreme curve' jeans in the US market, acknowledging that there was a significant percentage of curvier women in the US who wanted a great fit for their body shape.¹⁰ Although a similar situation exists in South Africa, the South African pear-shape is different from the African American pear-shape and as a result, there is still a problem experienced with good jeans fit.

The Black South African pear-shaped body is very narrow at the waistline and broader at the hip line with more prominent buttocks.⁴ The historical Khoisan woman, Saartjie Baartman, is considered an exaggerated representation of the South African pear-shaped body.¹¹ Many Black females in South Africa are generally considered to have Saartjie Baartman's pear-shaped body.¹¹ In most African cultures, a curvier body shape might be promoted as an ideal. Mastamet-Mason¹¹ emphasises that in most African countries, thin women are not considered attractive. Until the 21st century in Africa, full-figured women were considered attractive, were respected, and their padded and curvaceous bodies represented wealth, fertility and good health (2014:113) (Figure 1).

Body measurements

Anthropometric body measurements, which refer to the measurements of the human individual¹² have intensified worldwide because of the numerous garment fit problems experienced by the ready-to-wear industry. For the purpose of this study, anthropometric measurements that are critical when constructing patterns for jeans

are waist, abdomen, hips, outer leg seam length, in leg seam length, crotch length, width of the calf, and knee and thigh measurements. Alexander, Connell and Presley¹³ note that fit problems at the waist, hip, thigh and pant length were more likely to be reported by the pear and hourglass body types than the rectangular and inverted triangle body types. Strydom and De Klerk⁴ propose that to ensure well-fitting garments and good fit in general, it is of utmost importance that manufacturers and retailers have a sound knowledge of exactly how and where on the body the various measurements need to be taken and to use equipment that will enable them to take consistently accurate measurements. Apeagyei¹⁴ states that a 3D body scanner is used to extract scientific body measurements in a valid and reliable manner. In support, Kennedy¹⁵ states that the 3D body scanner provides a powerful and flexible tool for defining measurements for pattern construction, body measurements and shape identification.



Figure 1 A picture of Saartjie Baartman.

Source: Yaneza (2016)

Otieno and Fairhurst¹⁶ point out that one fundamental concern about clothes has been 'how to assess the size and proportion of the human body in order to assign the garment size'. Similarly, Strydom and De Klerk⁴ assert that body measurements be considered together with proportions to enable a decent fit for different people. Otieno and Fairhurst¹⁶ further report that body measurement tables are used for developing clothing size charts. Size charts consist of garment measurements that include ease allowances, used for making sample garments and for use as reference during fitting trials.¹⁷

Body types and jeans sizing charts

Body shape and proportions in a population are significant factors when considering clothing fit. The demand for manufacturing clothing that considers the traits of various body types is increasing considerably. Body types differ between races. Body sizes, shapes and proportions of each are different. The female body shape of Black South African women resembles that of Saartjie Baartman, whose body shape was displayed on a London stage for the public show between 1810 and 1811, and in 1815 she was further displayed, against her will, for 10 hours a day in Paris.¹¹

Adu-Boakye, Power, Wallace and Chen¹⁸ note that research has established that the body shapes of women may differ from one geographical location to another due to different lifestyles, diets, socio-cultural values and ethnic composition of populations. Therefore, a study on body types, in order to develop a size chart, representing the population is needed. According to Faust and Carrier,¹⁰ there are three basic human body types: endomorph, ectomorph and mesomorph. Ectomorphs are slim and tall with narrow hips and pelvis, long arms and long legs. Mesomorphs are strong with highly developed bones and muscles. Endomorphs are usually curvy and have a high tendency to store body fat. Female endomorphs usually collect fat in their buttocks, legs, and hips. The Black South African pear-shaped body falls within the endomorphic figure type. Faust and Carrier¹⁰ advise that attention to specific markets has increased over the last few decades in the clothing industry, owing to the lack of well-fitting garments.

Van Huyssteen¹⁹ argues that size charts need to be developed according to the end use and the requirements of the specific target market. Size ranges available in stores usually concentrate on smaller shapes and sizes, ignoring the endomorphic figures. In 2013, South Africa had an obesity rate of 42% for women. The country also has the highest overweight and obesity rate in Sub-Saharan Africa.²⁰ Therefore, it is not practically sound to focus on smaller sizes only, ignoring bigger body size types. Body shapes must be taken into consideration when developing size charts. According to Tulin (2012:1), a new sizing and fitting chart for jeans should be based on the concept of shape, not size.

In a country such as South Africa, providing specifically made apparel for indigenous groups with unique body characteristics has not been achieved even into the 21st century.²¹ Vithanage, Jayawardana and Niles²² propose that mass production in the garment industry requires pre-defined size charts based on up-to-date anthropometric data. These standard size charts provide information for manufacturers and retailers to plan production and inventories. There is a plethora of evidence suggesting that no standard sizing charts can always be appropriate for producing ready-to-wear clothing across countries, as body shapes and sizes vary widely unless a size chart is developed for a specific body shape.^{3,21} Therefore, every country within a specific racial group should have their own sizing systems based on the target population, to provide better fit for ready-to-wear clothing, which improves customer satisfaction.³ Shin and Istook,⁹ writing within the American context, state that the demands for well-fitting jeans cause many clothing industries to manufacture customised jeans.

Since the body shape is three-dimensional, the body measurements obtained from it must be accurately taken and be representative of the body's characteristics that are critical to the fit of the apparel.³ It is critical to find the characteristics of each body type among races, or countries.²³ The major factors that have an influence on fit and satisfaction with clothing are body type and obesity. Obesity is a major public health problem among Black women living in urban South Africa.²⁴ Similarly, Popkin, Adair and Ng²⁵ mention that rapid increases in the rates of obesity and overweight are widely documented, from urban and rural areas, in the poorest countries of Sub-Saharan Africa and South Asia to populations in countries with higher-income levels.

Finding a well-fitting pair of jeans for the body shape of Black pear-shaped women in South Africa is a challenge due to contemporary apparel sizing is inadequate.²⁶ European sizing systems are adapted and used to produce garments for a Black South African pear body shape. Strydom and De Klerk.⁴ Even though there are adaptations in

body measurement charts, the correct fit has not yet been achieved.²⁶ A study conducted in South Africa by Strydom and De Klerk,⁴ states that South African clothing retailers admit to having problems with fit and body measurements with most of their Black customers. It implies that the Black South African pear-shaped consumers are interested in having accurately fitting garments, which highlights the need for a body measurement survey of the South African population.²⁶ Ola-Afolayan and Mastamet-Mason²¹ state that 59.26% of South African female students of African descent have a pear-shaped body and are forced to purchase loosely fitting ready-to-wear garments but have to incur the additional cost of adjusting the garment before being able to wear them. The authors (2013:204) assert that the South African pear-shaped body, unlike the Western pear shape, experiences fitment problems when purchasing a pair of jeans, which are based on standard measurements of a well-proportioned figure.

Figure 2 shows the difference between a Western pear-shaped figure as opposed to a South African pear-shaped body. The South African pear shape has specific needs and expectations from the retail outlets that need proper investigation in relation to jeans sizes. Strydom and De Klerk⁴ contend that scientific garment cutting is based on measurements of the human form and therefore, the correct set of key measurements related to the specific product, is vitally important. Body shape in this regard is crucial for garment patternmaking and cutting.

Figure 3 displays different body shapes found in South Africa's diversified races, and none of these body shapes is characteristic of a South African pear-shaped body, clearly indicating a need for size chart development for this specific body type.

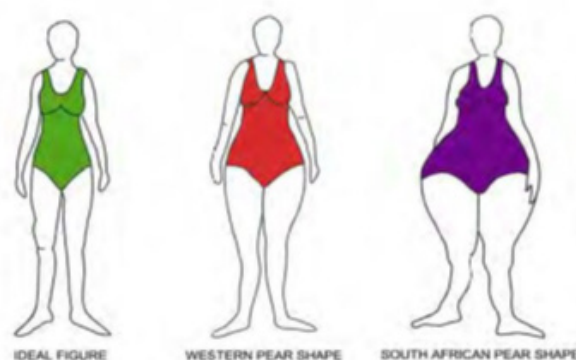


Figure 2 The Ideal, Western and South African pear-shaped figures.

Source: Ola-Afolayan and Mastamet-Mason (2013:205)

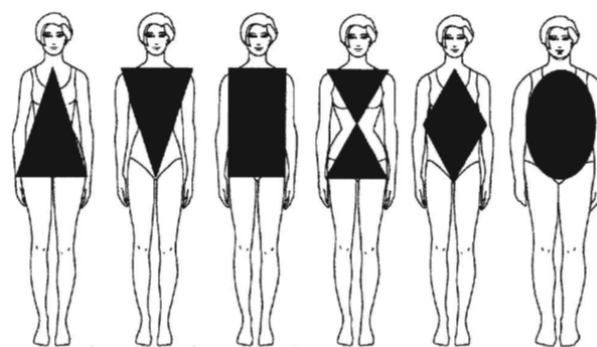


Figure 3 Illustration of the different body types and shapes.

Source: Mastamet-Mason 2009; Van Huyssteen 2006; Felton 2013

Images in **Figure 3** depict the following shapes:

- 1) *Pear*: The hips are slightly larger than the waistline;
- 2) *Inverted triangle*: The bust circumference is larger than the hips;
- 3) *Rectangle*: The bust and hip measurements are fairly equal. There is no clearly defined waistline;
- 4) *Hourglass*: There is a small difference in the comparison of the bust and hip circumferences;
- 5) *Diamond*: The stomach, waist and abdomen measurements are more than the bust. There are several large rolls of flesh in the midsection protruding away from the body; and
- 6) *Rounded*: The average of the stomach, waist and abdomen measurements is less than the bust measurement.^{19,27,28}

Ready to wear clothing

The South African clothing industries such as Foschini, Truworthe, Edgars, Woolworths and so forth manufacture ready-to-wear garments that are mass-produced for different customers. Most South African retail customers still need to alter these garments before wearing them.⁴ Shin and Istook⁹ confirm that the ready-to-wear jeans market increased by 75% in 1998 and that was the largest growth in women's denim clothing in the United States of America. The authors stated that in 2005, American women between the ages of 35-54 years spent 31 billion US dollars dressing themselves in jeans, which was a 4.5% increase from the previous year. Although there is a high demand for jeans, jeans fit remains a huge challenge for the jeans market. Shin and Istook⁹ present that jean's global fit vs local fit is an important issue for a global business such as Levi Strauss that aims to benefit from economies of scale, stemming from worldwide advertising and standardised products. Strydom and De Klerk⁴ state that fit is determined by pattern making and pattern making starts with utilising accurate body measurements.

Jeans dissatisfaction by Black South African women

Bickle, Kotsiopoulos, Dallas and Eckman,²⁹ writing within an American context, explain that the dissatisfaction with jeans fit has been well documented in popular press articles. Contributing factors mentioned include outdated manufacturers' sizing systems and numerical size codes. Whilst, Macdonald, Lazarchak and Currie³⁰ confirm that sizing is an issue for many women; one woman in their study commented that they do not know their sizes because they can wear a certain size in one store and another size somewhere else.

The search for total satisfaction because of clothing fit problems has culminated in a number of anthropometric studies and surveys being conducted; to improve the accuracy of data obtained.¹⁸ The importance of taking accurate body measurements can, therefore, no longer be ignored and the problem should urgently be addressed by the local clothing industry.⁴

The 3D body scanner

The 3D body measurement system is designed to provide the user with accurate and consistent measurements of the human body rapidly, primarily for use in making better fitting garments.³¹ Pandarum, Yu and Hunter³² state that non-contact 3D body scanning is easy to use and can extract extensive anthropometric data in a very short time. Song and Ashdown³³ confirm that the 3D body scanning technology has shown the potential of providing anthropometric measurement data to improve the fit of clothing. Strydom and De Klerk⁴ state that key measurements from the scanner are used for creating sizing systems,

drafting garment patterns, grading patterns, choosing fit models for fit testing and for communicating the size designation of garments to the consumer. Therefore, the creation of a jeans size chart for a curvier body shape will assist in developing jeans block patterns and grade rules to match the proportions of the target population.

Capturing market share

These recurring problems are because sizing charts and systems used were based on the European white female body shape.⁴ The other factor is that during the apartheid era, few Black South African women could afford shopping in leading retail stores due to their low-income jobs, among other factors.⁴ Access to more disposable income has led to an influx of Black people shopping at leading clothing retail stores. Consequently, retailers are now keen on capturing the Black market share.⁴ Retailers are facing a huge challenge as the sizing system does not accommodate this population group. Strydom and De Klerk⁴ view the development of three-dimensional body scanners as instrumental in opening up new possibilities for the measurement and analysis of the human body.

The body shape of White women and Black women

Body type comparison between countries allows the opportunity to discover ways to improve the sizing systems of each country, as well as influence the development of international sizing standards that could have a significant impact on brands manufacturing products for a variety of international consumers who have different body sizes and shapes.²³

Overstreet, Quinn and Agocha³⁴ assert that Black and White women differ in the features that make a curvaceous body shape attractive. That is, White women will consider slender body types more attractive than Black women and Black women will consider shapely body types more attractive than White women. Black and White women are different in body shape. An average Black woman is curvier, and an average White woman is narrower.

It is evident that, in South Africa, the majority of Black women have prominent buttocks. Mastament-Mason, De Klerk and Ashdown (2012:107) document that body classification based on the target market ensures that consumers within that market will be able to purchase apparel with a better fit.

Jeans sizing system and consumer satisfaction

In designing women's wear, apparel companies do not want to follow a standard sizing system because different firms have different target populations of women, whose lifestyles, incomes and body shapes differ considerably.¹³ Shin and Istook⁹ have concluded that 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 a population. Sizing to cater for different body shapes in South Africa is a challenge because a consumer who wears one style of a jean in a store might not fit into a different style.⁴ This poses a challenge for researchers to conduct studies that identify different body shapes, to develop size charts and blocks in preparation for jeans development, in local contexts.

This size-fit problem is not unique to South African women. For example, according to Bruner,⁵ within the American context, the average woman tries on more than ten pairs of jeans before finding a suitable one (if they find one at all). Simmons and Istook³⁶ establish that two people are never alike in all their measurable characteristics. This uniqueness has been the object of curiosity and research for over 200 years.

In conclusion, several studies in South Africa revealed that jeans length is not a problem in the country as many women are similar in height. Apeagyei, Phoebe and Mandeya³⁷ state, that because of the popularity and versatility of jeans globally, it is important for consumers to be able to purchase well-fitting pairs of jeans based on their selected sizing and fit. Problems identified by several studies indicated problems with jeans gaping at the back waist, dropping to below the back waist or being too tight at the hip area. Rahman³⁸ states that there has been an ongoing challenge for clothing manufacturers to produce well-fitting jeans to satisfy their consumers' needs and aspirations. Hanna³⁹ confirms that most jeans bought by female consumers have the same problem of gaping backs. Zwane and Magagula⁴⁰ assert that many women with a bottom-heavy figure profile are dissatisfied with the fit of current clothing sizes sold in retail outlets.

Methodology

Research design

This study employed a positivist view which, according to Krauss,⁴¹ is the idea that observation and measurement are at the core of scientific endeavour. According to the positivist view, the researcher made a point of observing the different pear-shaped bodies (small waist and large hips and thighs) of indigenous Black women in South Africa. A cross-sectional study was chosen as appropriate for this study. Data were obtained from the Cape Peninsula University of Technology, Bellville campus over a period of 27 days. CPUT was the only institution of learning in South Africa, at the time of the study, which was known to have a 3D body scanner and moving it to other settings was not feasible.

The quantitative method was used to collect and analyse data for this study. According to Johnson and Onwvegbuzie,⁴² the benefits of using a quantitative research approach are that data collection is relatively quick, providing precise information and quantifiable numerical data. Data analysis was also relatively less time-consuming using SPSS (Statistical Package for Social Science) version 22 for data interpretation. The population comprised 9 727 Black African female students.

Sampling strategy

A total of 60 participants between the ages of 18-35 were scanned for measurements, although the register recorded 83 participants on the first day of recruitment. Only Black South African indigenous female students at the Cape Peninsula University of Technology participated in the study. In summary, the following stages of sampling, referred to as multi-staged sampling, were followed:

Stage 1: All South African Black indigenous women (students) were invited to attend the information session of the study at the Bellville campus, Department of Clothing and Textile Technology;

Stage 2: After the presentation, all women were measured at the waist and hip line using a tape measure; and Stage 3: All those whose waists and hip measurements fell within the pear-shaped eligibility range were requested to participate after completing the short questionnaire, and then to proceed for scanning. At this stage, all those who did not meet the required criteria were excluded from the study. A 3D body scanner, housed at CPUT (Bellville campus), was utilised to obtain accurate lower body measurements of pear-shaped Black participants (Figure 4).

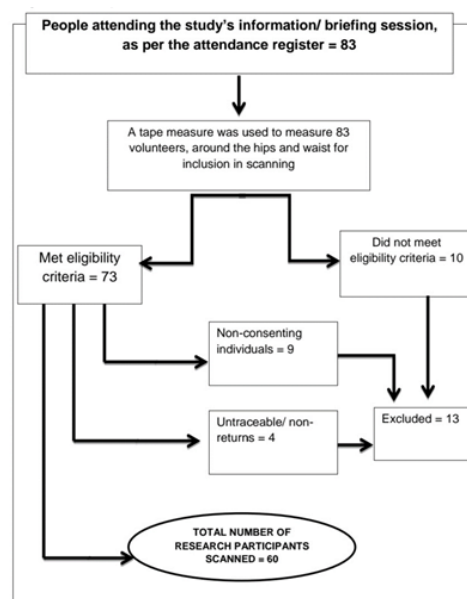


Figure 4 Participant selection flowchart.

Source: Self-generated

Measurement instrument and data collection

The [TC]2 NX12 3D body scanning technology, which uses a safe white light (with no lasers or radiation sources), was utilised to scan the participants. The 3D body scanning took place at the Cape Peninsula University of Technology's, Clothing and Textiles Technology Station. Approximately 5 to 10 participants were scanned per day. The researcher was always available for scanning.

In order to avoid problems which could occur when taking body measurements manually, a 3D body scanner was used to extract accurate body measurements. The waist and the hip drop value (difference in the waist and hip circumference measurements) were the most significant measurements that differentiate a South African pear-shaped figure from a Western pear-shaped body, due to problems of exaggerated gaping in the back waist. The anthropometric body measurements collected were then collated in readiness for analysis.

Data processing

Gupta and Gangadhar⁴³ confirm that the process of developing body size charts involves taking anthropometric body measurements of the target population and its division into homogeneous groups for the purpose of garment manufacturing.

Data Analysis

Methods used for analysing the questionnaire and scanned data are discussed below.

Questionnaire analysis:

- Similar responses from the questionnaire were coded manually.
- Coded data was uploaded onto an SPSS spreadsheet.
- Percentage frequency results from SPSS were displayed on graphs.

Scanned body measurements analysis

- i. Raw measurements were coded manually according to similarly categorised measurements.
- ii. Five groupings of measurements were established.
- iii. Scanned measurements were uploaded on SPSS to obtain the mean values, standard deviation, and maximum and minimum values.
- iv. Mean values were used to develop the sizing system.
- v. SPSS results provided the incremental value between each size.
- vi. A table of measurements was presented as a sizing system for the Black South African pear-shaped body.
- vii. A size 12 block and a master pattern were developed to construct a jeans sample, to test fit.
- viii. The size 12 master pattern was graded down to a size 10 and up to a size 14 to construct sample garments to test fit.

Findings

For this study, increments or intervals between sizes were not created. Measurements presented in Table 1 may be somewhat inconsistent because of the small sample size. However, Van Huyssteen¹⁹ asserts that increments are not necessarily equal in size and value. Instead, they may be consistent or inconsistent depending on the specific measurements of the study population. Drop values in Table 1 almost double in comparison to the standardised sizing system by Aldrich⁴⁴ shown in Table 2. Marked differences between waist and hip circumferences of Black women were established in the new

Table 1 Proposed jeans sizing system

Sizes	Drop Values (Waist & Hip)	Bust	Waist Full	Hips Full	Knee	Underbust	Crotch Full	In Seam	Out Seam	Body Rise	Crotch to Knee	Waist to Hip
10	43	87.5	70	113	41	71	78	71	100.5	27	34	20
12	40	92	76	116	42	75	85	71	98	28	34	20
14	42	98	79	121	43	78	87	73	102	33	34	20
16	41	105	84	125	43	83	88	69	100	35	34	21
18	42	109	91	133	45	91	92	72	99	38	34	22

Table 2 Aldrich measurement chart

Size Code	6	8	10	12	14	16	18	20	22	24
Aldrich Waist Full	60	64	68	72	76	80	84	88	94	100
Aldrich Hip Full	84	88	92	96	100	104	108	112	117	122
Aldrich difference (drop value waist & hip)	24	24	24	24	24	24	24	24	23	22

Source: Aldrich (2008:13)

The drop value in Table 2 (Aldrich-British sizing system) remains consistent from size 6 to size 20, while the drop value in Table 1 (which is the proposed jeans sizing system) is inconsistent because of the marked difference between the waist and hip. Measurements from the proposed jeans sizing system in Table 1 have been used to construct a jeans sample shown in the image above. There is no gape at the back waist, there is no pull across the front belly area, and the jeans fits the pear-shaped figure perfectly. The buttock shape is lifted to make the overall fit of the jeans on the wearer appear more appealing.

Conclusion and recommendations

sizing system. The ten measurement variables were selected based on the assertion by Faust and Carrier¹⁰ that when creating a garment that fits the body well, apparel experts recommend that, size development should be designed according to the specific part of the body. These measurements for size development were obtained from the 3D body scanner. The scanner measured the waist at its narrowest part and the hip measurement at its widest part.

Measurements from Table 1 were used to construct a sample pair of jeans in 100% cotton denim fabric to test fit. A mock-up was constructed to check fit and shape and fitting trials were conducted at this stage. Alterations on the mock-up and block pattern were made to improve fit. A size 12 block and master pattern were corrected after alterations were made and perfected. The result is shown in the Figure 5 below.



Figure 5 Jeans sample (100% cotton denim, non-stretch).

Source: self-generated

Conclusion

The current situation in South Africa regarding the supply of well-fitting jeans for the pear-shaped figure is challenging for both the clothing industry and the consumer. The objective of the study was to obtain a comprehensive list of lower body measurements for the pear-shaped figure, required for developing a new jean sizing system, utilising a 3D body scanner. The bust and the underbust measurements were included in the study as these are key measurements that define a pear-shaped body. The pear-shaped body is characterised as a silhouette in which the hipline area and upper thigh region are much fuller than that of the hourglass silhouette,

while the upper torso/bust area is smaller than the hourglass silhouette with narrow shoulders.^{45,46–48}

Implications

Findings from the study provided valuable information regarding the implications of drop values as these measurements identify the critical difference between the waist circumference and the hip circumference. The drop values assist in differentiating a Western pear-shaped body from a South African pear-shaped body. The size 12 block pattern for this study was constructed according to the scanned measurements obtained from the 3D body scanner, to create an improved jeans fit. This study addressed some of the flaws in current jeans sizing, specifically related to waist and hip measurement drop values within the targeted group (pear-shaped South African Black women). Based on the results of the study, the conclusion can be made that customizing a sizing system for this consumer group is both necessary and possible. The proposed sizing system presented in this study cannot be generalised to a larger population due to the small sample size who volunteered their participation in the study. Instead, it could serve as a base for further research in developing a jeans sizing system for pear-shaped women, which can be useful to the clothing industry.

Challenges

The sizing system used by the South African clothing industry is not based on current research. The effectiveness of an anthropometric study depends completely on body measurement data, which can be used for solving fit problems. In this study, the success of data collection depended on participants who were extremely pear-shaped, resembling a Saartjie Baartman type of body shape. There is a possibility that the data collected may be skewed due to a relatively small sample size. Challenges that contributed to not obtaining a larger sample size were:

The 3D body scanner that was used during the time of obtaining data for the study was said to be the only scanner in the country and the researcher was given a specific time to work on the scanner.

The time allocated for the use of the scanner was during an examination period and student recruitment for 3D body scanning proved to be problematic, as students were busy preparing for their examinations.

Recommendations

Recommendations for the industry

Stakeholder engagement and participation are recommended, especially if the results are expected to statistically represent the population of pear-shaped Black women in the country. Stakeholders could assist with funding the project for it to run successfully. A high level of expenditure in terms of research assistance was desirable for this study. Sponsor support could have contributed to purchasing scanning garments for each participant (to retain after the scan) and providing incentives for participation. This would more than likely, have encouraged additional recruitment of participants, resulting in a larger sample.

Results of the study also revealed a need for a better understanding of jeans sizing and fit for pear-shaped indigenous Black women in South Africa. The following recommendations are offered to the clothing industry and major stakeholders:

South African jeans retailers and manufacturers should focus on specific body types and develop a jeans sizing system for different body types, depending on their market.

Retailers should engage in jeans sizing and fit research in order to standardise sizing systems, so as to avoid confusion when consumers select sizes from different retailers.

Stakeholders should form a partnership with the Department of Trade and Industry to fund an anthropometric survey in South Africa, using a 3D body scanner to scan participants for measurements. If this can be done, fit problems, in general, might be reduced in the country. This will result in bigger profit margins for manufacturers and retailers.

Recommendations for future study

It is recommended that a comprehensive anthropometric study of a better-represented population of South African pear-shaped Black women be conducted. Consequently, the findings can be generalised to a larger population. It is recommended that a study be undertaken by academics in collaboration with the industry, to obtain current data by means of 3D body scanning technology, to update the outdated and ill-satisfying sizing systems currently in use.

From the scholarly literature and the researcher's own experience, this kind of study is time-consuming and will require substantial funding and months to update sizing systems. The findings indicate that the currently used sizing systems are not representative of the current Black pear-shaped women's measurements.

General conclusions and contribution to knowledge

The results of this study serve as a basis for future development of jeans sizing systems for the young Black South African pear-shaped figure. The most important finding was the waist-to-hip drop value which revealed a need to follow up with a more extensive survey, to cater to this consumer group.

The following conclusions can be drawn. The hip circumference measurement of the participants was much larger than those used by the industry and the waist measurements of the participants were much smaller. Because the body measurements of participants were varied, they were clustered according to similar measurements, to formulate the sizing system for the study.

It was concluded that the South African sizing systems being used in the clothing industry are based on the European body shape and adapted to suit South African Black indigenous women. Therefore, garment sizing needs to be urgently updated to meet the needs of this consumer market.

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Conflicts of interest

Author declares that there is no conflict of interest.

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