An overview of sizing system for girls school uniform

R.Surjit[1]
{rst.fashion@psgtech.ac.in[1]}

Department of Fashion Technology, PSG College of Technology, Coimbatore, India [1]

Abstract. Sizing chart has been gaining a huge importance nowadays. The aim of this work is to study the different size charts followed for constructing girl's school uniforms and identify the complications involved in it. Although sizing charts are available for school uniforms, fitting problems arise because of the inconsistency in the charts. Various methods are used to create sizing charts like fixing primary body measurements by using correlation and then deciding the secondary requirements and thereby creating the size chart using multi integer linear programming model. This paper will be useful to provide a better knowledge on the sizing aspects and fit related issues in the uniform construction.

Keywords: sizing system, school, uniforms, knowlage.

1 Introduction

A sizing system consists of a chart with already determined sizes of the body assigned in a standard manner. The sizing system has various sizes in it. The sizes of the garment are categorized from small to extra large with categories in between like medium, large. Due to the sizing systems used by the manufacturer, the clothes often don't fit well especially for children as the sizes vary. This is mainly noticed in the case of student's uniforms as it is constructed based on very few scientific parameters and the immense growth of children leads to differences in the measurements [1] thereby leading to fit issues. There is also a lack of statistical and scientific knowledge on the various body shapes and sizes which lead to wrong manufacturing [2]. School uniform plays a very important role in the life of school going children. School uniforms have to be created by understanding the physical, social, aesthetic, functional and psychological requirement of the children who are going to use it. The requirements of clothing vary according to the age group. The clothing requirements change with respect to physical, aesthetic, functional, social and psychological aspects. In earlier days, the garment sizing system is only based on trial and error methods. But clothing requires more accurate and empirically based sizing system as there is a huge competition and lot of trends are leading us towards mass customization of the garments to fit the end user correctly [3]. In this regard, an attempt is made to study the various sizing systems used commonly and identify the areas to be improved upon to avoid the fit issues.

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2 Materials And Methods

This study involves a detailed analysis of the literature available related to sizing systems, complexity in garment sizing, need for standardization, sizing systems for school uniforms and designing size charts for girls uniform. Various databases have been referred for the collection of literature. The various sources used for collection of literature are Science direct, Springer, google scholar, research gate and academia. For the collection of literature, specific key phrases were used for search which includes sizing system, sizing chart, sizing system for girls uniform, sizing system for uniforms. Based on the literature collected, 30 articles were selected and then analysed to find the developments in sizing chart and how sizing systems have evolved for girls uniform production.

3 Results And Discussions

The literature collected has been assessed and the key findings are provided in the area of sizing systems and their need, sizing systems available for girls uniform.

Sizing system design:

The sizing system is designed by performing an anthropometric study of the population in a particular area, city or country. Using this study, the measurements are selected and finalized. The problem faced with respect to sizing is that these studies are done in the past and they don't provide the present data. The old anthropometric data used is the main reason for lack of fit. Another reason that can be attributed is the non availability of standard size label systems [4]. The design of a sizing system is very difficult and complicated as it varies greatly based on region, race and age. The understanding of a sizing system is not easy for the customers as different apparel manufacturers use different methods [5]. The clothing industry creates a scientific basis of size range with the use of available anthropometric data [6].

Any sizing chart created can be validated only by the garment manufacturers as they are the ones who have to accept them as a standard. In order to select the key dimensions, the population is divided into size groups. The process of choosing the size groups in limited edition is the ultimate goal of any size system. It will lead to creation of garments that will be fitting for most of the targeted population [4]. There are various studies that have been conducted to prepare sizing systems that can be accepted by the garment manufacturers to be used during their production process. The methodologies and procedures have been developed to study the anthropometric data of school going children and using those data to create sizing chart with body measurements that can fit the school going children. However, there are complexities noticed which hinder the progress.

The complexity of garment sizing:

There are lots of complexities involved in garment sizing. Various initiatives have been taken to address the size and fit issues in different countries. In India, National Institute of Fashion Technology has started an initiative to create a national size chart that would fit the entire public. This activity has been continuing since 2018 and the sizing chart has not been provided for general use [7,8]. Countries like UK and Sweden have done extensive work in preparing sizing charts and there was huge cost involved in developing those systems with more consumption of time. The Size UK activity done in 2000 involved a cost of £1.2 billion and Size Sweden activity was done for five years. The issue of data collections and data analysis arise due to the extent of time and money required for garment sizing. The data

collected should have extensive information with respect to the size specifications. It should be of 3 dimensional nature providing measurements on width, height and length. The problem arises when these data are not proper and it would lead to difficulty for customer as he or she has to try the dresses many times to check for fit before buying the right one that suits his or her purpose. As discussed above and mentioned by researcher Ashdown in 1998, using outdated data, incorrect measurements, time consumed, cost involved lead to difficulty in having a proper sizing system [4].In reality, a particular garment may not fit two different wearers properly due to the difference in sizing system although their age group is same.

Among the sizing systems for different category of age groups, the children's sizing system is more complex as there is a shortfall of exact anthropometric data which is not updated to the present requirement. The two important factors that affects children's body shapes characteristics are age and gender. The growth in girls is normally higher than the growth in boys at the age group of 8 to 12. They reach puberty during that age and that leads to significant changes in their body structure and proportions which requires deep analysis to have a proper sizing system developed. A study by Meng reports that the children with segmental relations have higher variations than the adults [9]. There are few sizing systems for children which are developed based on the figure types. The figure types were classified with respect to children of different age group. Some systems have been developed based on the adult sizing systems. In the case of adults, the most used versatile method to classify the types of figures is drop value method. However, it was observed that drop value method does not fit well while applying it for classifying the types of figures for children [10]. A study done indicates that there is only a 20% population matching the measurements of an 'average figure', whereas the sizing systems are expected to encompass at least 80% of population and leave out only 20% which cannot be covered due to significant difference in proportions and sizes. Those 20% can be noted as special categories like differentially able people and plus size people [11]. The current garment sizing systems have failed to reflect the growth rate of today's children or body sizes for children's wear [12,13].

The sizing systems for garment are available to cater to different measurements and different proportions of the body. It caters to various body proportions like waist height ratio, bust to hip ratio, etc. Since the proportions vary, it is not possible to take a single measurement and fit it to the population. It should be a process where the key measurements are decided and based on those group of measurements, the similarities in the group measurements are identified and similar population are grouped together. Hence, multiple dimensions and measurements are to be considered for deciding on the right size for a group of population and it is not and should not be based on single measurements. of these multiple dimensions. When the multiple dimensions are considered and grouped, it should be kept in mind that there cannot be many gradations and differences in sizes as that will lead to increased inventories for the seller selling readymade garments and it will lead to increased costs [14]. Hence, the size categories should be ensured to be minimal and at the same time, it should cover the maximum population. Such complications add more problems in developing the right sizing systems [15, 16].

A study done in 2007 proposed that there should be more difference between sizes in a size chart to get wider tolerance in fitting and to have a reduced margin of error. Another interesting observation made is that the number of sizes required should be based on the garment type. So this involved, size requirements changing for each garment type which again increases the load in creating a sizing system [17]. Again, the issue in mass production is that the need for greater sizes increases when fit is looked as an aspect. It is based on the tightness or looseness of the garment. Another study highlighted the basic dimensional aspects of

human body where it said that the hips, waist and bust are known as inflection points. The ratios between the circumferences of these three parts define the basic shape. These circumferences vary based on the height and weight of a person normally. The inward inflection is more in a female body towards the waist region [18]. These complexities discussed pose a major problem for having a standardised sizing system. However, there is a need for it to go for mass production and to avoid fit issues.

4 Need for standardisation

There has always been a need for standardized products and methods. The main objective to have standardised sizing charts for textile clothing is to enable mass production with minimum fit issues based on the garment purpose [19]. Another need for standardization is to ensure fitness of use for a product [20]. The process of standardizing addresses the various garment fitting issues and makes garment fit to anybody based on the size, shape and proportion even when there is a difference within the age group and ethnicity [21]. Then the sizes mentioned vary between countries based on the type of wear. In Britain, the size of manufactured garments mentioned refers to the body hip measurement in the case of women's outerwear whereas it refers to the measurement of bust in European countries like Germany and France. France or Germany, it relates to the bust measurements. It is found that the smaller numbers indicate smaller sizes and as the larger numbers are put, they denote larger sizes. In some cases, even the equivalent sizes vary in the designation of size between various manufacturers [22,23].

The process of standardization is required for apparel retailers and manufacturers to ensure consistency across brands for various sizes and various products. This leads to the need for development of sizing systems catering to the present population size and fit requirements with the help of accurate data. The data should have enough allowances to avoid any misinterpretations and issues for the manufacturers, retailers and customers with respect to the fitness of use of the garment [12]. Since many manufacturers use their own sizes and measurements, it leads to lot of differences in sizes [24,25]. Although, the need has been stressed so intensely by so many researchers, it has been difficult to standardise the sizes and create charts due to the issues mentioned earlier. But, children are the ones who require very comfortable clothing as they are at a growing stage and no inconvenience should be experienced by them at the stage due to a physical requirement and hence there is a requirement to create sizing systems for children especially for the school uniforms.

Sizing sytem for school uniforms:

There are various ranges of body sizes in children's wear. The ranges vary based on the height, width and girth. A study by Park et. al. identified significant differences between age groups on the basis of height [25]. It is also observed that there is a significant increase in the length related to height with respect to children [26,27] Therefore, in sizing of children's wear, more than the weight, the girth and length measurements are important. A study in Malaysia on creating a sizing system for functional clothing was able to divulge data for providing better fit for school uniform. The study was able to create a proper sizing system and give proper size designations.

New sizing system for the garments are devised to have better accommodation of the proportional differences found among children, bringing clothing sizes into closer conformity with commercial sizing, and developing a single sizing system for all lower body garments. In

measuring methodology, there is a requirement to have accuracy and hence in this regard, draft compendium is developed. The draft compendium helps the person who is in charge of measuring to take care of the measuring process in the right way and segregating the measurements properly according to the parameters decided before the start of the process [28]. Such systems lead to the right selection, evaluation of the process, procedure used, instruments used along with correctness in selecting the person for size estimation.

Actually, for analysing the data obtained, that is the measurements taken, scatter plots act as a useful mode. In the scatter plots, the measurements are plotted against age and the areas where there are sparsely filled points indicate that very few children have same measurements and vice versa. There will always be statistical outliers with the highest and lowest measurements occupying the top and bottom of the scatter plot. The scatter plots indicate that the variation is higher in the case of the measurements of girls than the boys in any age category. The studies done indicate that there was higher variation for both boys and girls when the measurements were of age 14 than all the other ages and this could be due to the immense growth happening in that age across all genders.

Otieno et. al. used correlation coefficients for identifying the important measurements that are required for designing the sizing systems along with the tables and size charts [21]. The correlation coefficient values in fact, signify the linear relationships between variables used in measurement. The strength factor was considered for compiling the key measurements and get meaningful output for size system design. With the selection of the key measurements, the body measurement tables can be developed. The height measurement is considered to be the second highest correlation coefficients with very strong relationship as a key measurement in child. Compare to horizontal measurements, vertical measurements have stronger relationship with respect to age for both male and female. Such sizing systems are being developed for school uniforms of boys and girls and various tools are being utilised for the development of the same. In the case of girls uniform, the sizing system involves more tedious approach than that of boys due to the various factors as discussed in the earlier sections.

Designing sizing chart for girls uniform:

The sizes in women are divided based on the height thereby leading to various size types which will fit according to different body shapes. Similar process is followed for dividing the various size groups for girl children to have fitness for use. The variations occur with respect to difference in body measurements at hip, waist and bust. These variations have to be considered while designing the standards. The EN 13402 European clothing size standards are discussed below as these standards are used for labeling clothes sizes. The unit of measurement used is centimeters..

1. The body dimensions list is provided in the first part of the standard along with the procedure of measurement.
2. The primary and secondary dimensions of the body are indicated in the second part.
3. The third part of the standards defines measurements and intervals.
4. The fourth part of the standards defines coding system.

International apparel sizing systems covered from 84 cm to 103 cm. The smallest bust size is 68 cm and it is found in the Chinese standards. The largest bust size is 152 cm and it is found in the Euro standards. The study done in Taiwan for different school students of elementary, middle and high school level used cluster approach and developed 12 sizing systems to categorise the measurements of the students. It was two stage cluster analysis that was used and it was able to provide coverage for about 85% of the population of girl students thereby making it an effective approach [9].

Another study in Sri Lanka was done with a sample size of 160 students of the age group between five and twelve and it was found that height is the major component to base the size difference on and seven size charts have been developed based on the collected data [29]. In another study, three main measurements of body were considered for classification namely the girth of chest, waist and hip [30].

The best choice of designing a size chart based on the various studies is that to arrange the sizes as close as possible. It will help while designing close fitted garments and will lend to all degrees of fit. Apparel sizes for children are designated by height or age. There are lots of sizes available in the retail. They are plus size, plus size teens. The children's body is in constant change as they grow and mature. Particularly for girls, who have too short waist and crotch length. In that case, the apparel becomes tight. And all that customers share similar anthropometric measurements within each category. The youth alpha size system is used in many countries. It is the combination of US size system and EUR size system. The three basic measurements are taken as a key dimension, such as height, waist, chest measurements. The Chinese garment sizing system defines the body type of women by drop value of chest-waist. The Korean garment sizing system defines the body type of women by hip- bust drop value. The German garment sizing system defines the body type by height and hip proportions. The key dimensions for women garment are waist girth, chest girth, hip girth, and height. For upper body garments or whole body garments, the bust girth measurement is the most common key dimension. And for skirts and pants, waist girth is the key dimension. Sometimes an outside leg length or hip girth is added as secondary dimensions. Sizing systems are developed by creating a multi integer linear programming model. In the future, various models can be used to further simplify the understanding process of the customers, manufacturers and retailers so that the fitness of use will always be retained.

5 Conclusion

The various research papers have been reviewed to understand the sizing chart usage of apparel. The necessity for garment sizing and its complexities are highlighted in this paper. The cost involved, complications, time consumption for designing several sizing systems in various countries are discussed for better understanding. Length and girth measurements have been used to determine the size of the school uniforms. The sizes are identified by length measurement and are strengthened by their weight measurement. Girth measurements are influenced by the person's weight. Therefore, designers should take some measurements like height, chest circumference, hip circumference and waist circumference. Therefore, these measurements should be taken accurately to produce the correct uniform size. Because of the differences in some anthropometric measurements used to make clothing sizes, there is a difference in size between the age groups. They need the exact size before producing their uniforms because the shape of the human body is unique and has its own size. Thus, the development of size chart should produce an accurate size that fits the school uniforms and this can be achieved by developing various models like multi integer linear programming model.

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