

# Clothing needs of adults with Down syndrome

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## ABSTRACT

*A literature review showed that it is very difficult to find sufficient information concerning the market and clothes made specifically for people with Down syndrome. Especially in the case of adults with Down syndrome, it is a huge problem with clothing suiting their body shape as well as being stylish. The aim of the presented work was to analyze the needs of adults with Down syndrome in the field of clothing, and propose some useful guidelines for clothing designers. The aim was achieved by interviewing the parents/caregivers of adults with Down syndrome. Additionally, the anthropometric characteristic of women with Down Syndrome was analyzed based on the data from the literature concerning the exemplary profiles of women with Down syndrome. The analysis showed differences between body dimensions in the size charts intended for women without disability and the dimensions of the surveyed group of women.*

## Keywords

clothing,  
anthropometry,  
utility comfort,  
adults,  
Down syndrome

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## 1 Introduction

Down syndrome is not a disease but a natural form of human existence with a different course of development than the genetic majority with 46 chromosomes. The Down syndrome is also known as trisomy 21. It is a genetic disorder caused by the presence of all or part of a third copy of chromosome [1]. It is usually associated with physical growth delays, mild to moderate intellectual disability, and characteristic facial features [2]. Based on clinical observations, there are two types of trisomy 21 [3, 4]:

- thyroid type – these people suffer from hypothyroidism; the most recognizable features of these people include: short stature, massive and thick-boned body, short and misshapen limbs, hard and yellowish skin, straw hair, large and wrinkled tongue, harsh and hoarse voice, mild disposition, apathy;

- pituitary type – the most recognizable features of these people are: small body weight, small, slim body, thin tissue under the skin, slender limbs, thin hair prone to alopecia areata, coarse, rather tall and piercing voice, hyperactivity, destructive and undesirable behavior in contact with other people.

Independent from the trisomy type, the anthropometric characteristic of individuals with Down syndrome is significantly different from anthropometric characteristic of the general population presented in standardized size charts. Indicators of Down syndrome include smaller femurs and humerus bones, meaning that arms and legs are not quite as long as average. Typically, people with the Down syndrome are shorter and it is reported that some can have stomachs which are a little larger, thought by many to be a medical consequence of the condition [5].

Due to the above mentioned body features of people with Down syndrome, it is very difficult to find any clothes on the market fitting the body well. Especially in the case of adults with Down syndrome, it is a huge problem with clothing suiting their body shape as well as being stylish. At the same time the clothing worn by people with Down syndrome does not fulfill one of the basic functions – the aesthetic one. It is reported that only 20 clothing brands exist in the market or are recognized that work for individuals with Down syndrome [6]. However, most of the brands deal with children clothing. It is very difficult or even impossible to find any information or clothing dedicated to adults with Down syndrome. There are only few exceptions. In the US a young woman with Down syndrome – Ashley DeRamus [5] – began designing dresses for women of a similar shape to herself when she could not find anything in High Street shops that fitted well. The company she founded with her mother, Ashley by Design, based in Alabama, sells dresses based on Ashley’s own measurements. Providing clothes for women, the outfits include features like ruffles and overlays to cover up big stomachs [5].



*Fig. 1. Ashley DeRamus in garments of her own design [5]*

In Ohio, Karen Bowersox runs Down’s Designs, a company which makes jeans and fashionable trousers for kids and adults with the syndrome [5]. When she struggled to find clothes on line with arms and legs short enough to fit her granddaughter Maggie, she suspected that others might be having similar problems and investigated further.

These single brands of clothing for adults with Down syndrome represent a drop in the ocean of clothing needs. According to the statistical data, each year, about 6,000 babies born in the United States have Down syndrome. This means that Down syndrome occurs in about 1 in every 700 babies [7]. It is a quite big segment of clothing market, whose needs are not being met.

Due to this fact it is necessary to perform extensive research on the clothing needs of people with Down syndrome, with particular emphasis on certain limitations resulting from Down syndrome, proportions of silhouette of people with the Down syndrome and their preferences concerning color, material as well as cut and style of clothing.

The aim of this work was to analyze the needs of adults with Down syndrome in the field of clothing and propose some useful guidelines for clothing designers. The aim was achieved by interviewing the parents/caregivers of adults with Down syndrome and anthropometric analysis of exemplary profiles of women with Down syndrome.

## **2 Interviewing the caregivers of adults with Down syndrome**

In order to identify the needs of people with Down syndrome regarding the needs of appropriate clothing, interviews with the caregivers of adults with Down syndrome has been conducted. The interview was performed with 9 parents/caregivers whose proteges attend the classes at the Association of Parents and Caregivers of People with Down syndrome in Lodz "Trisomia 21 Association". The proteges of interviewed parents/caregivers were at the age of 22-38, 7 of them represent the thyroid type of the Down syndrome, 2 the pituitary type. Overall, 38 questions were the topics for the discussion. All questions in the interviews were open-ended. They concerned: available information about clothing for adults with Down syndrome, availability of clothing designed for adults with Down syndrome, mobility and manual limitations of adults with Down syndrome, problems in daily life of adults with Down syndrome and their caregivers, preferences of adults with Down syndrome regarding the type of clothing, cut, colors and materials, etc. Some exemplary questions:

- Is there a problem with choosing the right clothes appropriate to age of adults with Down syndrome?
- Are there any clothing-related problems noticed in everyday life?
- Would increasing the size of the button be a helpful solution in improving the daily functioning of adults with Down syndrome?
- Are there any allergies or excessive sweating or irritability caused by clothing materials?

Based on the interview and analysis of the responses the following main conclusions have been drawn:

- Most of the available sources of information concern children with Down syndrome, there is a lack of information about adults with Down syndrome;
- the dimensions and proportions of body dimensions of adults with Down syndrome deviate from the typical anthropometric characteristics of adults. Among others, the circumferences of arms, thighs, abdomen and buttocks are significantly increased in overweight adults with Down syndrome;
- parents of adults with Down syndrome do not know the brands that offer clothing for their charges, they also noted a lack of manufactured clothing for figures with unusual shapes. Consequently, they often have to buy clothes in stores intended for children, due to an ability to adjust the clothing to the height;
- it is not possible to purchase clothing in stores intended for adult people without making corrections, usually shortening the sleeves or legs, as clothes in general stores usually have long sleeves and legs;
- there are problems with choosing the right footwear for adults with Down syndrome;
- there is a problem with choosing the right bra for women with Down syndrome;
- there are also problems with the selection of caps matching the circumference of head, which often makes caps slip off;
- adults with Down syndrome have frequently problems with blood circulation, for this reason oftentimes they feel cold, which should be taken into account when choosing or designing clothes for these people;
- generally, adults with Down syndrome do not show problems with self-dressing, however, they are unable to fasten hooks or buttons, because of their size (too small). Adults with Down

- syndrome also have problems with binding, often do not possess this skill, and therefore the best solution for them is clothing fastened with larger, stiffened zippers and Velcro fasteners;
- there are problems with a selection of shirts due to an inability to fasten buttons at the neck. Shirts must be made to measure;
  - too small neck cut is also common problem in other products, e.g. T-shirts, because of the very wide necks and shoulders of people with this disability;
  - adults with Down syndrome prefer clothes with a ribbing or elastic tape on the end of sleeves, legs and waist;
  - pants with Velcro fasteners at the waist are a good solution;
  - in order to mark the waist in dresses, it is recommended to sew an elastic tape;
  - clothing with hoods, preferably loose-fitting with strings, is suitable. Because not each person with Down syndrome is comfortable with a hood, a detachable hood would be good solution;
  - preferred thickness of the garments and their colors are an individual matter, but people with Down syndrome mainly focus on comfort, they like colorful clothes. Sportswear, stretchy, elastic and soft in touch is preferred type of clothing;
  - knitted or stretch fabrics, preferably made of natural fibers, are the best materials for clothing for people with Down syndrome. Materials should be flexible, soft, air and vapor permeable, hypoallergenic, not skin irritating, showing increased resistance to dirt;
  - introducing appropriate structural modifications and improving the functionalization of clothing for adults with Down syndrome will improve the quality of life for both these people as well as their parents/caregivers.

### 3 Anthropometric analysis of adults with the Down syndrome

Due to the limitations of people with Down syndrome, interviewing them directly would be very difficult. Even more, participation in anthropometric measurements would be a serious problem for both people with Down syndrome and their caregivers. It was confirmed by the parents/caregivers of adults with the Down syndrome that their proteges are not willing to participate in such procedures. Due to this fact the anthropometric analysis has been performed on the basis of the anthropometric data available in the literature [8]. The data presented by Barboza et al. [8] were the base of the analysis. The authors applied the 3D Body Scanner KBI-Kinect Body Imaging to measure 32 adult participants with Down syndrome. The number of the participants is not too big. However, they are the only data available in open access literature concerning the analyzed topic. For 13 females the authors presented 33 body measurements including height.

Based on the above data, the analysis of body dimensions and proportions of women with the Down syndrome has been performed. In the analysis the following dimensions have been considered: height, hip circumference, chest circumference, neck circumference and shoulder circumference. The anthropometric data of particular female participant [8, Table 1] have been compared with the women size chart of the KAWI company [9].

The base of classification of particular female with Down syndrome to the appropriate size was the hip circumference, because it is usually the largest circumference of the female body. According to the hip circumference the analyzed female individuals have been classified into the following sizes: M/40, M/42, L/46, L/48, XL/50, XL/52 and S/34. Next, the mentioned above dimensions of analyzed women have been compared to the tabular dimensions.

The disproportion index (DI) has been proposed as a quotient of the actual and tabular dimension, according to the equation:

$$DI = \frac{\text{real dimension}}{\text{tabular dimension}} \quad (1)$$

The values of the DI for particular women participating in the analysis and particular dimensions are presented in Table 1.

Table 1. Values of the DI for particular women with Down syndrome participating in the anthropometric measurements\*.

Participant ID	Hip circumference** (cm)	Tabular size	DI value			
			Height	Chest circumf.	Neck circumf.	Shoulder circumf.
002	100.39	M/40	0.83	0.92	1.13	0.96
006	104.86	M/42	0.85	1.10	1.14	0.92
007	111.10	L/46	0.78	1.01	1.13	0.94
008	112.15	L/46	0.78	1.01	1.13	0.94
009	115.06	L/48	0.79	1.04	1.11	0.91
010	128.70	XL/52	0.87	0.90	1.01	1.10
011	117.87	L/48	0.92	0.92	1.05	0.86
014	109.66	L/46	0.84	0.95	1.12	1.29
015	104.82	M/42	0.91	1.09	1.01	1.23
016	121.41	XL/50	0.90	1.11	1.18	1.30
019	84.06	S/34	0.91	1.04	1.02	1.17
020	99.59	M/40	0.70	1.04	1.17	1.38
023	121.45	XL/50	0.85	1.02	1.08	1.14
<b>Average</b>	-	-	<b>0.84</b>	<b>1.01</b>	<b>1.10</b>	<b>1.09</b>

\*) Participants ID according to the data in the literature [8]

\*\*) Participant's hip circumference according to the data in the literature [8]

As we can see, the values of the DI parameters are different depending on the dimension being analyzed and on the participant. Generally (Fig. 2), the DI value for height is below 1. It means that all women analyzed are shorter than tabular dimension designed for the tabular size appropriate for individual women. The values of the DI parameter for height are in the range from 0.78 to 0.92 with average value 0.84. It means that women with the Down syndrome being analyzed are ca. 15% shorter than women with anthropometric characteristic corresponding to the tabular sizes.

The average value of the DI parameter for the chest circumference is 1.01. It seems that the chest circumference of women with the Down syndrome is very close to the tabular value. But it is not true. The dispersion of the DI value for chest circumference is from 0.90 to 1.11. It means that chest circumference of women with Down syndrome can be even 10 % lower or 11 % bigger than the tabular chest circumference for a given size to which the analyzed women was classified. It confirms that it is very difficult or even impossible to elaborate one general size charts for people with Down syndrome.

Similar results have been obtained for the shoulder circumference. The average value of the DI parameter is 1.09 and individual results are in the range from 0.86 to 1.38. In some cases, the values of the DI parameter are lower than 1, in other cases they are higher. In the extremal cases the shoulder circumference of women with the Down syndrome is 38 % and 30 % bigger than the tabular value. This shows how difficult it is for people with Down syndrome to choose clothes matching their figure from among the products offered on the market corresponding to tabulated sizes.

In the case of the neck circumference the clear tendency is observed. In all cases the real size is bigger than the tabular size. The average value of the DI parameter for the neck circumference is 1.10 while the results scatter from 1.01 to 1.18.

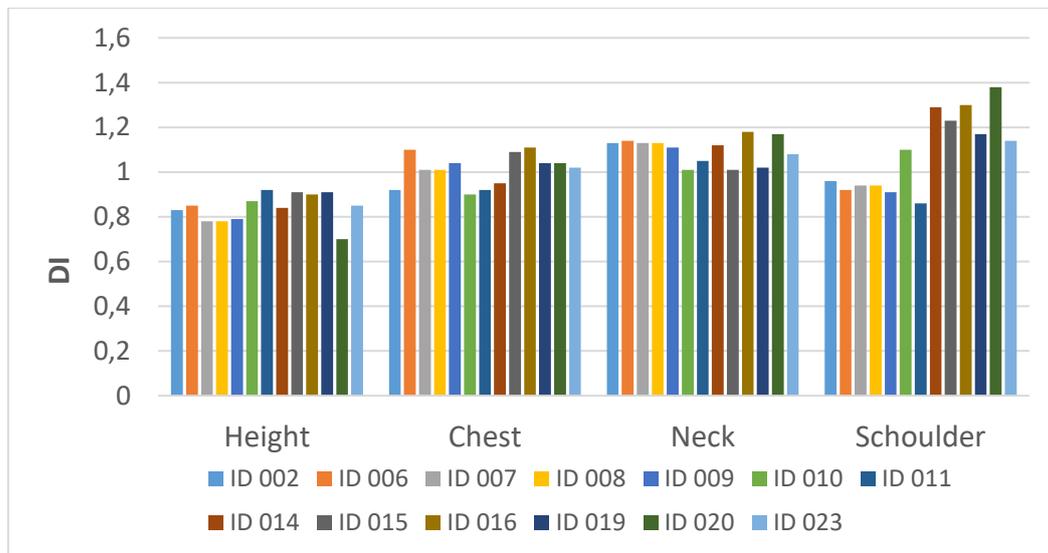


Fig. 2. The DI values for individual measurements

#### 4 Guidelines for clothing designers

On the basis of the interview results and anthropometric analysis, the following general guidelines for clothing designers and manufacturers have been formulated to support the design and production of clothing for people with Down syndrome:

- clothing for adults with the Down syndrome should be made of materials containing natural fibers, pleasant to the touch and flexible,
- the cut of clothes should be adjusted to the proportions of the figure of adults with Down syndrome including: shorter height, shorter upper and lower limbs, greater circumference of the neck and often greater circumference of the chest and hips,
- due to manual problems worsening with age, appropriate fasteners should be used such as larger, stiffened zippers and Velcro fasteners,
- an application of finishes in the form of ribbing or elastics tapes allows for better matching the garment to the user in terms of size,
- adults with Down syndrome prefer colorful clothing what should be taken into consideration while designing clothing for them.

#### 5 Conclusions

An analysis of the literature and clothing market has shown that there is insufficient information or a lack of information on clothing for adults with Down syndrome. Based on a literature review and the answers given in the interview, it is stated that there is only a small number of sources presenting the anthropometric dimensions of the group of people in question. The results of the review confirmed that generally in stores there is no clothing intended for adults with Down syndrome available, due to their unusual body dimensions. Purchase of appropriate clothing, tailored to the needs and dimensions of the body of adults with Down syndrome, makes it difficult for their parents. Analysis of the dimensions and proportions of the body of women with Down syndrome showed differences between body dimensions in the size charts intended for people without disability and the dimensions of the surveyed group of women. Size charts based on measurements of adults with Down syndrome would be extremely helpful in design the structure and cut of clothes intended for them.

#### Author Contributions

M. Matusiak: supervision, formal analysis, guidance while anthropometric analysis, methodology, co-writing – original draft preparation, visualization; Nina Kuryłło: conceptualization, investigation, resources, data curation, co-writing – original draft preparation. All authors have read and agreed to the published version of the manuscript.

## Conflicts of Interest

The authors declare no conflict of interest.

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