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Anthropometry of Indonesian Sundanese children and the development of clothing size system for Indonesian Sundanese children aged 6–10 year

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ABSTRACT

The design of clothing that consider anthropometry approach is important. The purpose of this study is to describe anthropometry of school children aged 6–10 year in Indonesia related to clothing size and determine clothing size system for Indonesian children for this age range. Six hundred and fifty-four Sundanese children were involved in this study (mean age = 7.86 year, SD = 1.22 year, 339 female). Forty-nine anthropometry dimensions were measured consisting of 28 upper body dimensions and 21 of lower body dimensions. Descriptive statistic of the anthropometry data is presented. Standard clothing size system for Indonesian Sundanese children is proposed based on principal component analysis and implications of the result are discussed.

1. Introduction

The importance of anthropometry data in the design of product and workplace has been recognized for years (see Porter et al., 2004 for an example). The absence of anthropometric data may lead to negative consequences on the suitability of human and products or workplaces. For example, Sutalaksana and Widyanti (2016) reviewed the man-work mismatch in the design of workplace in small industries in Indonesia with safety and health consequences. Poirson and Parkinson (2014) underlined the importance of anthropometry consideration in the design of commercial pilot seats in relation to safety. Other studies related to the design of domestic and daily goods were done by Al-Ansari and Mokdad (2009) describing the role of anthropometry in the design of school furniture, and Boyles et al. (2003) describing anthropometry consideration in the design of scissors for hairdressing.

Clothes are a daily product that crucially needs suitability between the user and their anthropometric data. As a primary need of mankind, clothes play a critical role in every individual' activities. Clothes are also crucial in one's social and cultural interaction, as well as an expression of the individual's style. However, finding clothes that fit exactly for everybody's need is not easy, except for clothes that are tailor made for a certain individual (e.g., in a boutique, a tailor, etc) and for a particular need (e.g., certain sports).

Problems in garment industries arise in line with standardized clothing size due to the wide variation of the body size. Customers may find difficulties in obtaining clothes for their specific needs. The unstandardized clothing size system can lead to mistakes during purchases. The unfitted garment's size can cause a condition in which the garment will never be used by the customer along with customer' dissatisfaction or the clothes may be used once or twice only and lead to the worst situation, that is the disposal of the clothes which eventually create unwanted environmental impacts (Laitala and Klepp, 2010). The main issue for the industry is of economic matters and sizing systems practicality. Without size standards, mass production can be less accurate, less efficient, less marketable, and therefore less profitable.

A clothing sizing system classifies a specific population into several different relatively homogeneous subgroups based on some key body dimensions. Persons of the same subgroup are assumed to have the same particular body shape characteristics and therefore share the same clothing size. In other words, the goal of clothing sizing system is to select a group of sizes so that a limited number of sizes ensure a ready-made garment that best fits the individuals of

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the population (Alexander et al., 2005).

Attempts have been made in many countries to standardize clothing size based on anthropometry data. For example, Salusso (1982) developed a method for classifying adult female body form variation in relation to the US standard for garment sizing. Ujevic et al. (2006) developed standard clothing size for Croatian adults. Beshah et al. (2014) developed standard clothing size for Ethiopian adults. Gupta and Gangadhar (2004) also developed a statistical model for a garment in India. Not only for daily clothes, Laing et al. (1999) also developed the clothing size for protective clothes of the New Zealand fire service.

Also, not only standard clothing size for adults, standard clothing sizes for children have also been observed as well as in many countries. Related to children's clothing, Gautam (2005) stated that clothing plays a crucial role in childhood. Basically not only for satisfying the needs to get attention from their environment and identification of gender, fit for children clothing is very important for potential growth and body development. Clothes that fit the body, especially for children, will contribute to the good growth and development of healthy body (Cooklin, 1991). Furthermore, Kang et al. (2001) also underlined the importance of properly sized children's clothes in order, not to constraint body movements. Therefore, it is not surprising that many attempts have been made to develop standard clothing size for children. For instance, Bari et al. (2015) developed standard clothing size for Malaysian children, Ariadurai et al. (2009) for Sri Lankan children, Chung et al. (2007) and Wang et al. (2002) for Taiwanese children, and Ray et al. (1995) for Indian children. These examples underlined that anthropometry database for children that support development of standard clothing size is particularly important.

In Indonesia, clothing size system has gained substantial attention as well. Indonesian garment industries play an important role in Indonesian economy since garment contributes significantly to the Indonesian Gross Domestic Product, second only to oil and gas industries. Particularly related to this, currently, there is no standard for all categories of Indonesians. Indeed, some industries adopt European standards with some adjustments. Cehi (2013) mentioned various children clothing size in Indonesia that were adopted from USA, UK, Japan, and China. Some others simply based their clothing size groupings on their own estimations. The inexistence of size groupings with clear reference to a well-developed standard may cause difficulties for Indonesian to choose clothes that fit their children.

Very limited research has been conducted in Indonesia considering the anthropometry in the clothing size system. To the best of the authors' knowledge, only one effort has been made to develop and propose Indonesian standard clothing size system for boys based on Indonesian Standard Body (Badan Standar Nasional or BSN in Indonesian) that is Fileinti and Nurtjahyo (2013). However, the study used a very limited number of anthropometry data ($n = 155$). There is also the need to update the standard since BSN also underlined the importance of updating standard due to several reasons (BSN, 2015).

Numerous previous literature has discussed the method to group clothing size based on anthropometry data. For example, Beazley (1998) described that the mean and standard deviation are the values required in the development of clothing size. M (medium) size is determined based on the mean value of anthropometry data. L (large) size is determined by adding the standard deviation to the mean value. Whereas S (small) size is determined by subtracting the mean value with standard deviation. In addition, Beazley stated that height measurement is used as a standard size for a child belongs to a group. Despite its advantage of easy grading and easy labeling, the system does not reflect the population well.

Another method known as Centilong system was proposed by Aldrich (1999). This system is used by manufacturers in the UK. According to this, the M size is determined based on 75th percentile. The interval between size groups is based on height measurement that is 6 cm in this case. Thus, L size is 75th percentile plus 6 cm and S size is 75th percentile minus 6 cm. Despite its easy grading and easy labeling feature, this method can only cover 75% of the population of children. For children clothing size standard, this system has been applied in developing a Malaysian standard (Bari et al., 2015) and Sri Lankan standard (Ariadurai et al., 2009). The main disadvantage of the methods is in their limited coverage of the population concerned.

Some optimization methods have been proposed. Such a method has the advantages of generating an optimal sizing system, but the irregular distribution of the optimal sizes increase the complexity of the grading system and the cost of production for garment industries will be high (Chung et al., 2007). Chung et al. mentioned several techniques included in this method. They are data mining techniques such as cluster analysis (Moon and Nam, 2003), neural networks (She et al., 2002) and decision tree approach (Hsu and Wang, 2005). Optimization in clothing size system provides a higher coverage rate of population (about 85% according to Chung et al., 2007). However, it provides too many size groups (36 size group in Chung et al., 2007). This system has been used in Korea (Kang et al., 2001) and has been proposed in Taiwan (Chung et al., 2007).

The present study aimed to describe anthropometry data of Indonesian children related to clothes and develop a standard sizing system based on the anthropometric data of school-aged children in Indonesia. The major work of the research includes carrying out the anthropometric survey and applying the method of clothing size system for Indonesian children's anthropometry data.

2. Method

2.1. Participants

This study involved 654 Sundanese-Indonesian children with a mean age of 7.86 year and standard deviation (SD) of 1.22 year, consisting of 315 males and 339 females. They were between 6 and 10 years of age: 111 children aged 6 years (58 female), 152 children aged 7 years (80 female), 167 children aged 8 years (90 female), 124 children aged 9 years (66 female), and 100 children aged 10 years (45 female).

This range of age was chosen because the market for children wears is generally divided into three categories that are infant, toddler, and children (Zakaria, 2016). Older primary school students have recently been categorized into teen generation. In addition, The International Association of Athletics Federation (IAAF, 2009) which described the stage of growth and development from childhood to adulthood, defined 10 years as the childhood limit of females and 11 years for males, i.e., before reaching the stage of puberty.

Participants were chosen by a convenience sampling method in three elementary schools in Bandung, West Java. All participants belong to the Sundanese, the largest ethnic group that live in West Java. The restriction based on ethnicity is critically important since ethnicity plays an important role in anthropometry data differences in Indonesia (see Widyanti et al., 2015 for a review). The permit had been obtained from the respective headmasters after a request letter sent to the school which was followed by an explanatory and discussion session about the purpose and procedure of anthropometry measurement for their pupils. In order not to disrupt their regular study hours, measurement was conducted during the children' free time (e.g., break time). The participation of students were based on assignment by the headmaster, in particular, considering the available time of students. The sample size was about one-third of the total student population in each school.

2.2. Procedure and equipment

Forty-nine body dimensions were measured. These dimensions were chosen following ISO ISO8559, 1989 about anthropometry survey for garment industry (Fig. 1). Of 49 anthropometry dimensions, 21 are for vertical dimensions, 8 for depth, and 20 for the circle. 28 of them are in parts of the upper body, whereas 21 are for lower body dimensions. The dimensions are presented in Fig. 1. Height and weight were also measured and used as the control dimensions (Shin and Istook. 2007; Ujevic et al., 2006). These control dimensions play an important role as a basic guide for the customer to choose clothing size, and are the fundamental element in a size chart.

The anthropometry data collection was conducted using Martin anthropometer, which was calibrated before the measurement. This manual measurement, instead of sophisticated measures (such as body scanner) was chosen for a practical reason, since measurements were conducted in situ, in every school in which participants were based. For the measurement of circumference and girth dimensions, the measuring tape was used.

The anthropometry data collection was conducted by ten research assistants who have experiences with anthropometry measurements. Following Widyanti et al. (2015) and Sutalaksana and Widyanti (2016), in order to minimize intra-observer error (i.e., error when repeated measurements were taken by the same observer (Kouchi et al., 1999)) and inter-observer error (i.e., error when repeated measurements were taken by different observers), standard procedure and equipment were set, and training was given to the research assistant prior the measurement about 1 h each day in five consecutive days. We performed random checks to ensure correct measurement and valid obtained data. During measurements, research assistant was equipped with a piece of paper depicting anchor points of measurement for each anthropometry dimension. Two research assistants measured one student. While one research assistant measured student' anthropometry and read the result of measure measurement, another research assistant checked the result and wrote it down in a piece of paper.

Prior to measurements, the subjects changed their clothes in a private room with specially tailored clothes that exactly fitted the children's body. Subjects were barefooted during measurement. Time measurement for each subject was about 10 min. In the end, subjects were given snacks as a reward for their participation in the anthropometry measurement.

2.3. Statistical analysis

Descriptive statistic was presented for each anthropometry dimension. Beside control dimensions (i.e., height and weight), other anthropometry data can be used as a reference dimension for size system. According to Chung et al. (2007), reference dimensions are not critical dimensions for clothing size, but necessary for improving pattern making and fashion design. For example, Ujevic et al. (2006) proposed chest girth, waist girth, and hip girth for reference dimensions in European countries. To determine appropriate reference dimensions for the Indonesian children clothing size system, factor analysis (Principal component analysis/PCA with varimax rotation) was applied to extract critical factors from those 49 anthropometric dimensions (Chung et al., 2007). The dimensions with factor loading greater than 0.7 were selected as reference dimension.

3. Results

3.1. Descriptive data of Indonesian children's anthropometry data related to clothes

Each individual data were recapitulated in a piece of prepared paper. After data entry, data screening was conducted in order to rectify data entry errors and remove outliers or missing data. The outlier was determined based on mean plus minus three standard deviations. Separate descriptive statistic (mean and SD) based on gender for each anthropometry dimension can be seen in Table 1.

Significant differences between male and female subjects were found in all of the dimensions (all $p < 0.01$), except for neck girth ($p = 0.01$). For those dimensions, male subjects have bigger and longer dimensions than the female subjects.

3.2. Proposed clothing size for Indonesian children

PCA was applied to determine reference dimension.

The result of PCA can be seen in Table 2 and Table 3 for boys and girls respectively.

Centilong system was applied to the above-mentioned reference anthropometric dimension. Percentile 75 is determined as Medium (M) size, Small (S) size is determined by subtracting M size with 6 cm for both girth and length dimension, whereas L (Large) dimension is determined by adding M size with 6 cm for both girth and length dimension. Regarding the 6-cm interval, not only proposed by Aldrich (1999), this interval has also been suggested by several other researchers. For example, Eberle and Kilgus (1996) and Chung et al. (2007) stated that optimum size interval for girth is 4–6 cm whereas optimum *size interval* for height is 5–10 cm. Eventually, the proposed size system for Indonesian children for both upper and lower garment can be seen in Table 4 for boys and girls.

4. Discussion and conclusions

This study aims to describe the Indonesian children anthropometry data in relation to clothes and to propose clothing sizes for Indonesian children aged 6–10 years, both for boys and girls. Separated analysis of data based on gender is particularly important since as expected, there are differences between male and female data for almost all anthropometry dimensions of Indonesian children. This result is in accordance with the result of other studies, in particular for Indonesian adult anthropometry data (e.g. Widyanti et al., 2015; Sutalaksana and Widyanti, 2016, which showed gender differences in anthropometry data).

The method used in this study to develop clothing size system for Indonesian children was based on Aldrich (1999). The reason for choosing this method was its high sample coverage. The optimization method proposed by Chung et al. (2007) was not used in this study since it resulted in too many size groups, despite it's larger coverage rate i.e. about 85%. Even though the coverage issue is particularly important, the practical aspect of the sizing system for garment industries (such as not too much size group) is particularly expected by Indonesian garment industries.

In this study, height and weight were selected as the key dimensions for sizing system, both for upper and lower body, and for boys and girls. The selection was based on high factors loading (i.e.,0.832 and 0.851 for boys and 0.832 and 0.836 for girls, both for height and weight respectively). This selection is in tandem with other previous research which stated that height must be a key dimension in a sizing system (i.e., Kang et al., 2001; Zakaria, 2010;

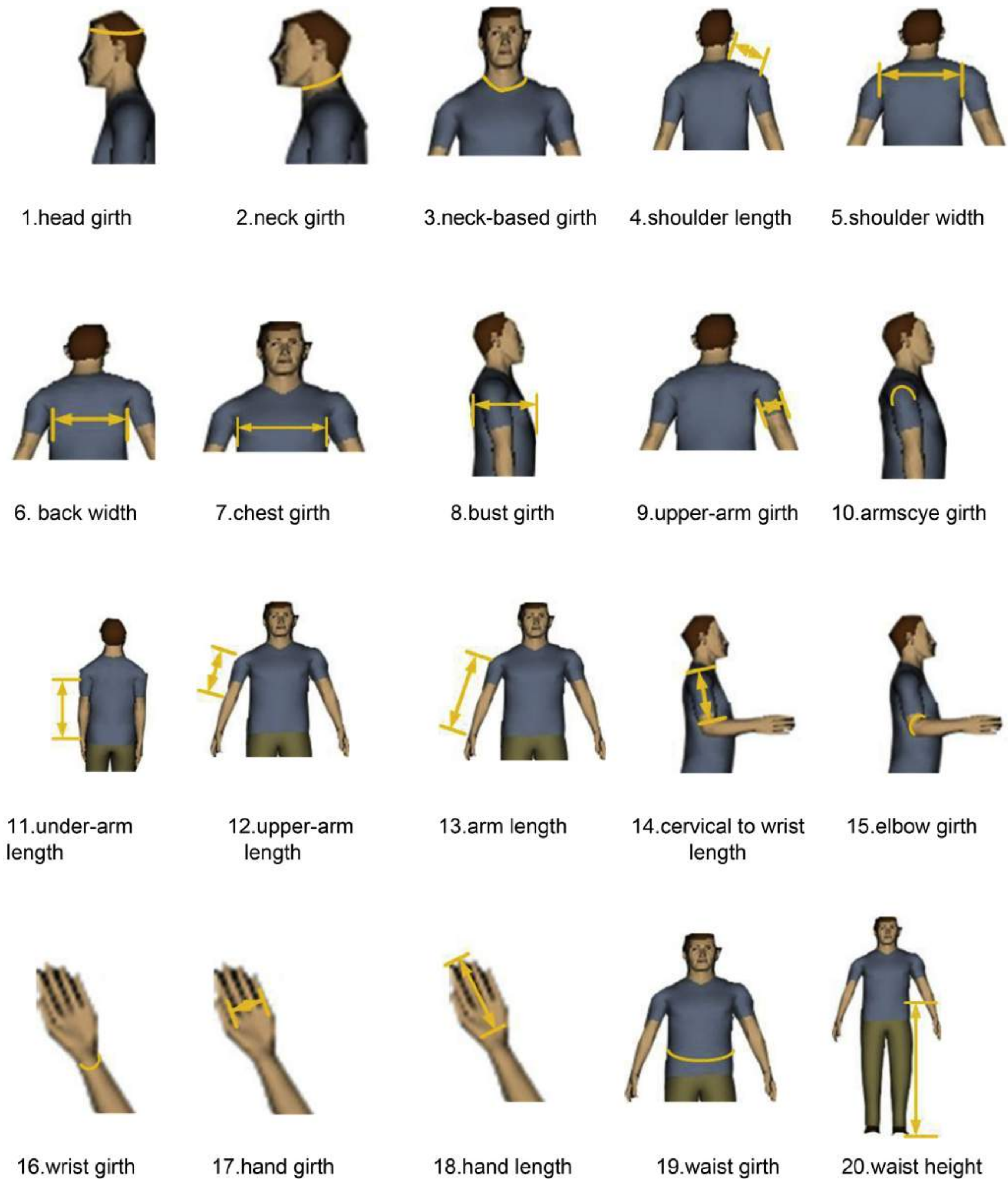

Fig. 1. Anthropometry dimensions for garment industries according to ISO 8559/1989.

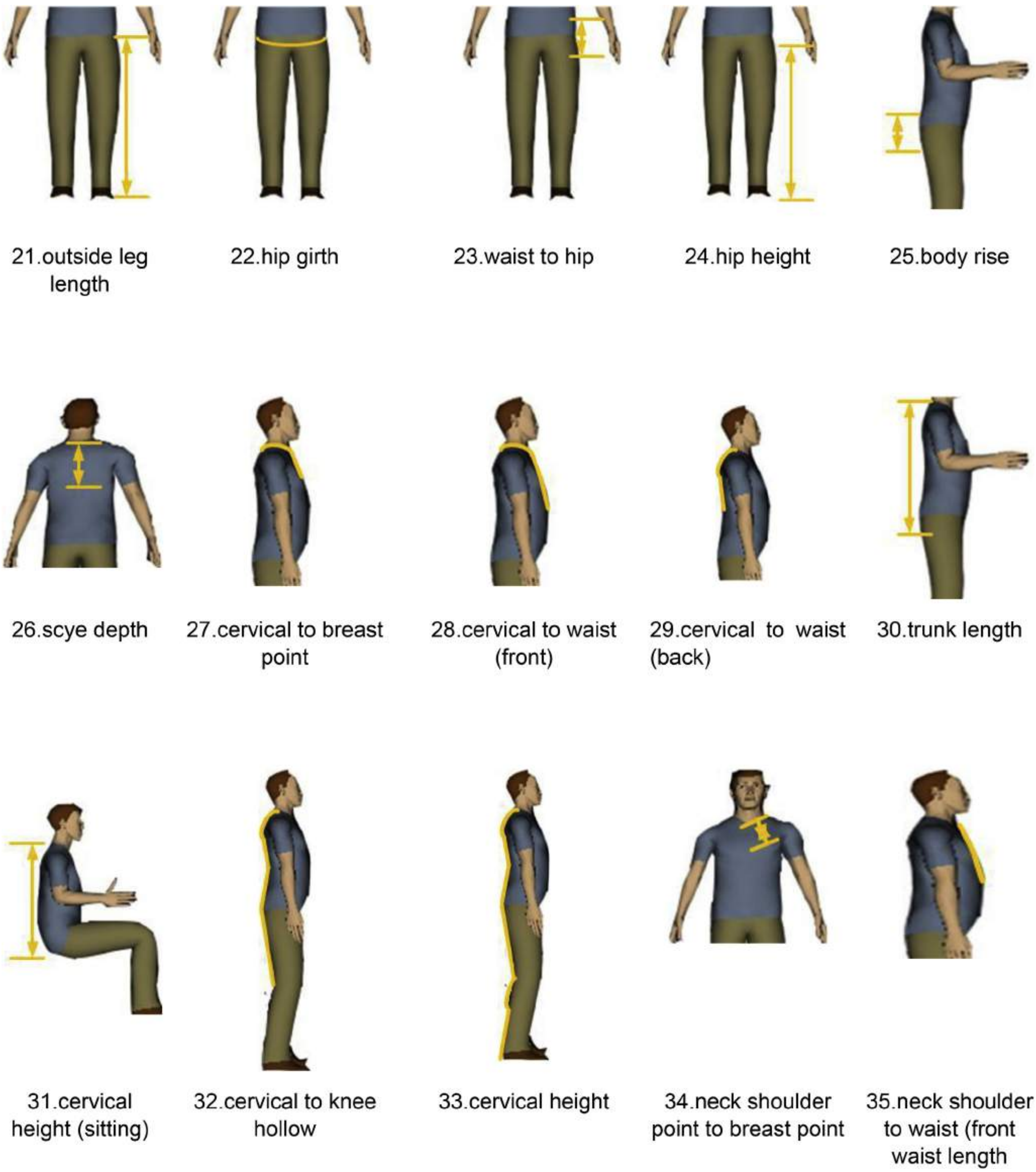

Fig. 1. (*continued*).

Fig. 1. (*continued*).

Chung et al., 2007). In addition, according to Otieno and Fairhurst (2000), height was a better estimator of size than age. More importantly, it is easy to measure.

As stated by McCulloch et al. (1998), an effective sizing system must fulfill three criteria, including fewer size groups, higher coverage of the population, and better fit. However, it is very difficult to obtain all the three criteria at the same time for perfect sizing system. A trade-off always happens and one must choose to emphasize on the crucial criteria. In this study, the number of size groups is only three (S, M, and L) that is considered very few. The coverage population of the proposed size system is 75%. An additional survey study conducted parallel with data analysis shows

Table 1
Indonesian children anthropometry dimensions related with clothe.

Dimension	Boys				Girls			
	Mean	SD	P5	P95	Mean	SD	P5	P95
Head girth	52.38	2.18	49.00	55.59	51.93	2.26	49.00	55.60
Neck girth	28.95	3.56	24.70	35.14	28.38	3.91	24.00	36.03
Neck-base girth	41.46	5.64	32.00	51.00	39.46	5.78	30.40	49.70
Shoulder length	10.34	2.12	7.20	14.07	9.77	1.88	6.50	13.21
Shoulder width	31.81	4.07	24.88	38.13	31.38	3.98	25.00	38.00
Back width	18.18	5.80	12.08	30.18	19.07	6.92	11.00	32.00
Chest girth	65.88	9.21	52.63	85.00	65.75	8.84	55.00	83.63
Bust girth	67.41	9.36	55.30	86.00	65.61	9.07	55.19	83.65
Upper-arm girth	21.44	3.76	16.86	28.38	21.53	3.98	16.50	28.80
Armscye girth	30.42	5.52	21.92	40.00	32.04	6.63	24.00	41.20
Under-arm length	42.15	20.60	21.88	93.00	40.00	19.79	24.19	91.10
Upper arm length (shoulder to elbow)	24.37	3.39	19.38	30.00	25.42	4.32	20.00	34.00
Arm length (shoulder to wrist)	43.95	4.52	37.00	52.00	44.72	5.42	37.00	54.50
Cervical to wrist length	56.96	7.10	41.66	66.92	57.87	6.52	46.43	67.03
Elbow girth	20.24	3.20	16.00	26.03	20.09	3.08	16.30	26.00
Wrist girth	13.39	1.42	11.20	16.00	13.15	1.83	11.00	16.30
Hand girth	15.59	1.89	12.85	18.03	15.45	1.49	13.20	18.00
Hand length	14.45	1.21	12.30	16.50	14.48	1.33	12.50	16.80
Waist girth	64.50	10.07	52.58	83.63	62.02	8.96	51.10	82.20
Waist height (waist to floor)	74.25	7.11	60.98	85.33	76.45	7.68	64.00	89.20
Outside leg length	77.69	6.80	67.00	88.32	79.23	7.17	67.59	92.00
Hip girth	70.18	9.34	58.50	88.65	69.91	9.32	57.00	87.50
Waist to hips	10.31	2.82	6.30	15.50	9.87	2.65	6.00	15.01
Hip height	66.86	6.46	54.96	76.52	69.30	7.84	57.50	82.00
Body rise	21.43	4.71	12.75	29.93	23.19	6.31	14.00	35.48
Scye depth	16.85	4.17	12.00	25.80	15.98	3.48	11.00	21.10
Cervical to breast point	26.31	3.49	21.00	32.50	26.36	6.08	20.40	31.60
Cervical to waist (front)	42.29	5.56	34.74	52.43	39.62	5.00	32.00	47.70
Cervical to waist (back)	32.76	4.46	25.48	40.04	31.26	4.51	25.70	37.30
Trunk length	48.58	7.83	34.67	61.68	48.34	6.95	38.00	58.36
Cervical height (sitting)	44.26	6.72	35.75	53.50	44.99	5.81	37.80	52.31
Cervical to knee hollow	73.11	7.10	60.33	84.17	73.57	6.82	63.20	85.53
Cervical height	107.50	9.01	92.84	120.50	108.33	8.68	94.74	123.54
Neck shoulder point to breast point	18.17	2.88	14.18	23.26	18.39	3.82	14.49	22.81
Neck shoulder to waist (front waist length)	34.09	5.59	26.50	44.29	31.50	4.92	23.94	40.18
Crotch	57.08	10.62	40.72	77.20	59.76	11.19	42.00	78.00
Trunk circumference	123.46	14.02	106.00	147.43	121.95	14.74	104.00	146.00
Thigh girth	42.43	7.88	32.83	56.68	40.68	7.56	31.50	52.30
Thigh length	21.45	5.33	13.50	32.75	23.39	6.20	14.88	34.50
Inside leg length/crotch height	55.91	6.36	46.48	66.00	58.57	7.04	47.94	70.75
Mid-thigh girth	35.64	5.92	27.00	47.06	34.71	5.35	27.00	44.05
Knee girth	28.99	4.06	23.90	36.85	28.49	3.65	23.79	35.01
Knee height	34.43	3.26	29.06	40.14	35.27	5.11	28.67	42.03
Lower knee girth	26.53	3.87	21.50	34.00	25.97	3.37	21.39	32.50
Calf girth	27.11	3.72	22.00	34.50	26.50	3.51	21.60	33.00
Minimum leg girth	19.53	2.36	16.00	23.50	19.12	2.39	16.00	23.00
Ankle girth	22.61	2.69	18.56	27.50	23.19	3.03	19.00	28.70
Ankle height	6.79	1.52	4.50	9.22	7.04	2.55	4.50	9.91
Foot length	20.23	1.93	17.00	23.13	20.37	2.09	17.50	23.50
Height	126.76	10.68	110.00	140.84	126.54	11.61	110.00	142.30
Weight	28.69	9.25	17.00	47.25	27.55	8.33	17.00	44.30

that both Indonesian customers and garment industries, mostly prefer to have a system with a limited number of size groups since it is easy for the customer to choose and it has a less demanding labeling process for the producers.

This study had several limitations. First, the unbalanced number of boy and girl participants. Since the analysis was conducted by separating the anthropometry data based on gender, the unbalanced number did not influence the overall result. Second, the limited number of participants. Although there was no reason to think that it influenced the result since the amount of data was already enough based on a statistical power calculation, it is worth noting that the more data obtained, the more representativeness of the data compared to the population and the more statistical power obtained. The third limitation was that participants were limited to only the Sundanese ethnic group. The consideration of ethnicity is crucial in anthropometry study in Indonesia since Widyanti et al. (2015) had proven that there are ethnic differences in Indonesian anthropometry data. Therefore, it is worth noting for future studies to develop and compare standard clothing size for children other than Sundanese children.

In conclusion, this study initiates a step in developing standard clothing size for Indonesian children. The absence of clothing size system results in disadvantages for both consumer and garment industries. Our result could contribute to future study in the development of a new sizing system for other than children' clothes in Indonesia, as well as update clothing size system for Indonesian children. Together with the development of other clothing technology development (see Thomassey and Bruniaux, 2013 for an example), updating clothing size is particularly important. As suggested by Li et al. (2005), time and technology development change

Table 2
Principal component analysis (PCA) result for Indonesian boys anthropometry data, both for upper and lower body.

			Principal Component 1 (girth)	Principal Component 2 (length)
Control Dimension		height		**0.832**
		weight	**0.851**	
Reference Dimension				
Girth	Upper body	Bust girth	0.901	
		Upper-arm girth	0.890	
		Waist girth	0.884	
		Chest girth	0.883	
		Elbow girth	0.849	
		Wrist girth	0.806	
		Neck girth	0.718	
		Armscye girth	0.715	
		Trunk circumference	0.715	
	Lower body	Thigh girth	0.879	
		Hip girth	0.872	
		Mid-thigh girth	0.868	
		Calf girth	0.862	
		Lower knee girth	0.861	
		Knee girth	0.854	
		Minimum leg girth	0.754	
		Ankle girth	0.745	
Length	Upper body	Neck shoulder to waist (front waist length)		0.775
		Cervical to waist (front)		0.706
		Shoulder length		0.778
		Cervical to wrist length		0.729
		Upper arm length (shoulder to elbow)		0.854
		Arm length (shoulder to wrist)		0.705
	Lower body	Hip height		0.861
		Inside leg length/crotch height		0.799
		Ankle height		0.777
		Waist height (waist to floor)		0.759

Table 3
Principal component analysis (PCA) result for Indonesian girls anthropometry data, both for upper and lower body.

			Principal Component 1 (girth)	Principal Component 2 (length)
Control Dimension		height		0.832
		weight	0.836	
Reference Dimension				
Girth	Upper body	Waist girth	0.903	
		Upper-arm girth	0.887	
		Bust girth	0.886	
		Chest girth	0.874	
		Wrist girth	0.869	
		Elbow girth	0.845	
		Calf girth	0.842	
	Lower body	Lower knee girth	0.837	
		Thigh girth	0.833	
		Mid-thigh girth	0.819	
		Hip girth	0.815	
		Knee girth	0.744	
		Trunk circumference	0.739	
		Armscye girth	0.738	
		Hand girth	0.726	
		Minimum leg girth	0.720	
		Ankle girth	0.708	
Length	Upper body	Outside leg length		0.788
		Cervical height		0.779
		Arm length (shoulder to wrist)		0.776
		Inside leg length/crotch height		0.772
		Upper arm length (shoulder to elbow)		0.738
		Neck shoulder to waist (front waist length)		0.733
		Scye depth		0.868
	Lower body	Hip height		0.727
		Waist height (waist to floor)		0.725
		Hand length		0.713
		Waist to hips		0.833
		Ankle height		0.771
		Knee height		0.770
		Thigh length		0.798

Table 4
Proposed standard clothing size for Indonesian boys and girls.

Size			Boys S	Boys M	Boys L	Girls S	Girls M	Girls L
Control Dimension		height[a]	127.1	133.1	139.1	126.6	132.6	138.6
		weight[b]	27.0	33.0	39.0	26.0	32.0	38.0
Reference Dimension								
Girth	Upper body	Bust girth	65.0	71.0	77.0	64.0	70.0	76.0
		Upper-arm girth	18.1	24.1	30.1	17.8	23.8	29.8
		Waist girth	63.7	69.7	75.7	60.8	66.8	72.8
		Chest girth	63.5	69.5	75.5	64.7	70.7	76.7
		Elbow girth	16.0	22.0	28.0	15.8	21.8	27.8
		Wrist girth	8.3	14.3	20.3	8.0	14.0	20.0
		Neck girth	24.5	30.5	36.5	24.0	30.0	36.0
		Armscye girth	28.0	34.0	40.0	28.9	34.9	40.9
		Trunk circumference	125.0	131.0	137.0	123.6	129.6	135.6
	Lower body	Thigh girth	40.4	46.4	52.4	38.7	44.7	50.7
		Hip girth	69.4	75.4	81.4	69.6	75.6	81.6
		Mid-thigh girth	33.0	39.0	45.0	32.3	38.3	44.3
		Calf girth	23.1	29.1	35.1	22.4	28.4	34.4
		Lower knee girth	22.5	28.5	34.5	22.0	28.0	34.0
		Knee girth	25.0	31.0	37.0	25.0	31.0	37.0
		Minimum leg girth	15.0	21.0	27.0	14.4	20.4	26.4
		Ankle girth	18.5	24.5	30.5	18.9	24.9	30.9
Length	Upper body	Neck shoulder to waist (front waist length)	31.4	37.4	43.4	28.2	34.2	40.2
		Cervical to waist (front)	39.8	45.8	51.8	36.6	42.6	48.6
		Shoulder length	5.6	11.6	17.6	5.0	11.0	17.0
		Cervical to wrist length	56.3	62.3	68.3	56.0	62.0	68.0
		Upper arm length (shoulder to elbow)	20.5	26.5	32.5	21.3	27.3	33.3
		Arm length (shoulder to wrist)	40.9	46.9	52.9	41.8	47.8	53.8
	Lower body	Hip height	65.5	71.5	77.5	68.5	74.5	80.5
		Inside leg length/crotch height	53.6	59.6	65.6	57.2	63.2	69.2
		Ankle height	1.6	7.6	13.6	2.0	8.0	14.0
		Waist height (waist to floor)	73.5	79.5	85.5	76.0	82.0	88.0

[a] All girth and length dimension in cm.
[b] Weight in kg.

lifestyle and causes changes in the body shape. Thus, developing, reviewing, and updating clothing size should be conducted, with ideal time in every 10–15 years (Beazley, 1998).

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