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USING HEAD MEASUREMENT STANDARD TO EVALUATE THE BODY PROPORTION OF ETHIOPIAN WOMEN: A CASE STUDY OF BAHIR DAR UNIVERSITY STUDENTS

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ABSTRACT

The purpose of this study is to employ head height as a measuring device to compare body proportions using conventional standards on Ethiopian women. The Representative samples were 450 female students aged 18-25 years from four regions of Ethiopia (Tigray, Oromya, Amhara and Southern Nations Nationalities and Peoples region) who are studying at Bahir Dar University. The data was collected by measuring the length of body parts from head to 7 selected different body levels (tip of chine, bust level, waist level, crotch, knee and foot). Finally, the collected data was analyzed through correlation, t-test and ANOVA analysis methods. The result showed that there is no significant difference on the proportionality of head to crotch by head, for each region which means it is possible to use the same standard measurement for all regions; on the other hand there is a significant difference between the proportionality of body measurements of each group. Especially the Amhara region female students' body structure is different from the others in all the six variables.

Contribution/ Originality: This study contributes in the existing literature by examining the body proportions of Ethiopian Women Using conventional standards. Proportions of the human bodies are the bottom line to an effective sizing system to better fitting apparel items. Which is important due to the lack of researches on problems of fit in ready-made apparel products.

1. INTRODUCTION

There are subtle differences between individuals, human proportions fit within a fairly standard range, though artists have historically tried to create idealized standards, which have varied considerably over different periods and regions. In modern figure drawing, the basic unit of measurement is the head, which is the distance from w3wethe top of the head to the chin. This unit of measurement is reasonably standard, and has long been used by artists to establish the proportions of the human figure. According to Helen [1] an average person is generally 7.5 heads tall (including the head).

Women's bodies occur in a range of shapes. Female figures are typically narrower at the waist than at the bust and hips. The bust, waist, and hips are called inflection points, and the ratios of their circumferences are used to define basic body shapes. Female body shapes are the cumulative product of a woman's skeletal structure and the quantity and distribution of muscle and fat on the body. As with most physical traits, there is a wide range of normality of female body shapes. Attention has been focused on the female body as a source of aesthetic pleasure in most human societies. There are, and have been, wide differences in what should be considered an ideal or preferred body shape, both for attractiveness, health reasons and ergonomic endeavors.

Today's manufacturers place their products on highly competitive and dynamic markets. Dissatisfaction with fit is one of the most frequently stated problems with garment purchases for women. The problem of fit in ready-made apparel has gained a lot of attention as consumer demand for well-fitted apparel has increased. Women have been reported as the most dissatisfied consumers [2]. As a result of this phenomenon, mass-customization establishments have emerged, which have been facilitated by the use of body scanners in developed countries and is slowly coming into selected Africa countries as the scanners have become more affordable to them. Through body-scan 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 [3-5]. Up-dated and current population measurements are therefore vital in most countries, to minimize fitting problems related to ready-made apparel.

Proportions of the human body are the bottom line to an effective sizing system and subsequently to better fitting apparel items. Sizing systems originate from people's measurements and body shapes . The body shape is three-dimensional, the measurements obtained from it, therefore, must be accurately taken and representative of the body's characteristics that are critical to apparel's fit. The measurements and the varied body shapes can only be accurate, consistent and representative if they are taken accurately, by correct methods, instruments and appropriate techniques employed [5-7].

1.1. Statement of the Problem

Female body shapes and proportions vary and change over time, as the result of, amongst others, nutritional changes, lifestyles and ethnicity [3, 6]. Ethnicity is a key variable in Ethiopia, which is situated on the horn of Africa bordering Sudan, Uganda, Kenya, Djibuti Somalia, Eritrea and Yemen. The country is divided into 9 regions as shown on the map as in Fig. 1. The nations surrounding Ethiopia spill over into its borders, giving the country a racial ad-mixture that makes the genotype and phenotype of its population very diverse. The Regions that border Sudan and Kenya have Black African features, while, regions bordering Eritrea Yemen, and Somalia have Asiatic and, Arabic phenotypes. For the sake of having a reference point for discussion, the differences will be examined based on the impact they have on the fit of the constructed apparel, be it ready-made or custom-made.

It has been established that ready-made apparel depend on an accurate estimate of the distribution of body shapes and sizes within a target population, it becomes necessary for every country, and even regions within countries, to establish their own sizing systems based on the target population [5].

Although a considerable body of sizing and fit re-search has already been done, most of the research has been done in first-world countries. In many cases the sizing systems from such studies are used to make well-fitting clothes. These clothes are manufactured and distributed in third-world countries, so the women end up with clothes made to fit a totally different set of body dimensions and proportions. The Third-World country's consumers then have to make a decent choice based on a faulty foundation. African developing countries such as Ethiopia, and others, face severe apparel-fit problems.

The question for this research is thus: What are the distinctive body proportions of Ethiopian women's bodies?

Figure-1. The Ethiopian neighbor [1]

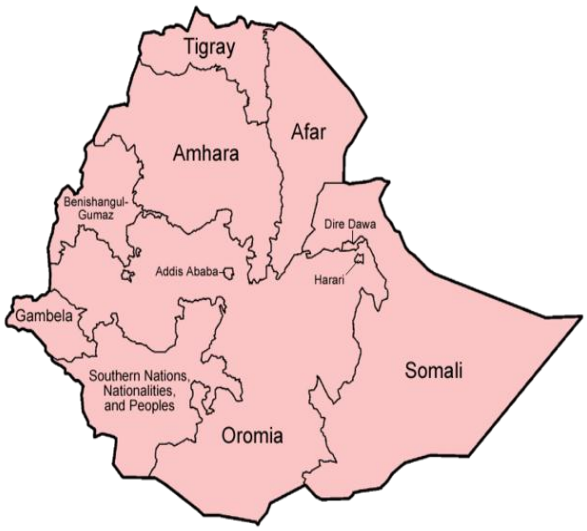

Figure-2. The Regions of Ethiopian[2]

1.2. Scope of the Study

Though this study is set to study Ethiopian women, the subjects was limited to a sample taken at the 5 campuses of Bahir Dar University due to time and budget constraints. This could be viewed as a pilot study that could aid in perfecting the survey techniques and practices for a country-wide survey in the future. The only option for obtaining measurements for the purposes of body-shape identification was traditional anthropometry.

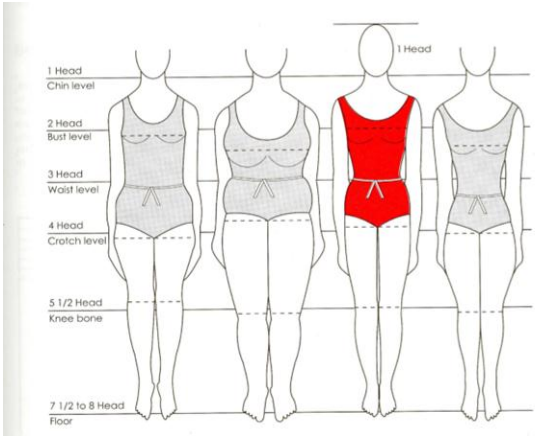

Figure-3. The standard body proportionality of females with the head length:
Source: Helen [1]

2. RESULTS AND DISCUSSION

Table-1. Sample Populations

Region		Freq.	Percent	Valid Percent	Cumulative Percent
Valid	Tigray	97	21.9	21.9	21.9
	Oromya	2	20.8	20.8	42.7
	Amhara	168	37.9	37.9	80.6
	Southern nations	86	19.4	19.4	100.0
	Total	443	100.0	100.0	

[1] **Source:** https://en.wikipedia.org/wiki/Regions_of_Ethiopia

[2] **Source:** http://voices.nationalgeographic.com/2013/07/24/geography-in-the-news-ethiopias-dam-projects/

Table-2. T test for five important variables for Garments

One-Sample Test									
	Test value	Mean	SD	t	Df	Sig. (2-tailed	MD	95% C.I of the Difference	
								Lower	Upper
The ratio of head to bust level by head	2	2.3644	0.2656	28.749	438	.0001	0.36444	0.36444	0.3894
The ratio of head to waist level by head	3	2.8848	0.39947	-6.040	438	.0001	-.11515	-.1526	-.0777
The ratio of head to crotch level by head	4	4.0324	0.39947	1.280	438	.2010	.03238	-.0173	.0821
The ratio of head to knee level by head	5.5	5.7822	.74972	7.887	438	.0001	.28221	.2119	.3525
The ratio of total height by head	7.5	7.8988	.87406	9.560	438	.0001	.39880	.3168	.4808

Out of the 5 variables the ratio of head to crotch level by head can be used for the same body standard chart for all the four regions based on the standard body measurement. For the other measurements there is a significant difference with the respective standard value. So ANOVA method was used to check whether there is a significant difference or not among the regions.

Table-3. ANOVA test

ANOVA						
		Sum of Squares	**df**	**M. Square**	**F**	**Sig.**
The ratio of head to bust level by head	Between Groups	2.407	3	0.802	12.252	.001
	Within Groups	28.491	435	0.065		
	Total	30.899	438			
The ratio of head to waist level by head	Between Groups	4.138	3	1.379	9.125	.001
	Within Groups	65.758	435	.151		
	Total	69.896	438			
The ratio of head to knee level by head	Between Groups	11.499	3	3.833	7.104	.001
	Within Groups	234.694	435	.540		
	Total	246.193	438			
The ratio of total height by head	Between Groups	18.568	3	6.189	8.519	.001
	Within Groups	316.054	435	.727		
	Total	334.622	438			

From table 3 above the ANOVA test shows all the four variables with the value of $p < 0.05$, which means there is a significant difference between the groups as a whole. On the next table 4, the post hoc test was used to show how each region differed from another on each of the four variables.

In table 4 above Post hoc test for the first variable (the ratio of head to bust level by head) for the regions Tigray & Amhara, Oromya & Amhara and Southern Nations & Amhara region in all cases $p < 0.05$, and the confidence of interval (CI) does not include (-0.0624, 0.2307) , (0.0025,0.01763) and (- 0.2705, -0.0954) respectively.

In general Amhara region female students' body ratio is different from all the three regions Tigray, Oromya and Southern Nations.

Table-4. Post hoc test result

Multiple Comparisons							
Tukey HSD							
Dependent Variable	**(I) Region**	**(J) Region**	**Mean Difference (I-J)**	**Std. Error**	**Sig.**	**95% Confidence Interval**	
						L. Bound	**U.Bound**
The ratio of head to bust level by head	Tigray	Oromya	.05714	.03768	.428	-.0400	.1543
		Amhara	.14655*	.03264	**.0001**	**.0624**	**.2307**
		Southern nations	-.03640	.03791	.7720	-.1342	.0614
	Oromya	Amhara	.08940*	.03368	**.0410**	**.0025**	**.1763**
		Southern nations	-.09354	.03881	.0770	-.1936	.0065
	Amhara	Southern nations	-.18294*	.03393	**.0001**	**-.2705**	**-.0954**
The ratio of head to waist level by head	Tigray	Oromya	.10143	.05658	.2780	-.0445	.2474
		Amhara	.23755*	.04980	**.0001**	**.1091**	**.3660**
		Southern nations	.04820	.05759	.8370	-.1003	.1967
	Oromya	Amhara	.13613*	.05064	**.0370**	**.0055**	**.2667**
		Southern nations	-.05323	.05832	.7980	-.2036	.0972
	Amhara	Southern nations	-.18936*	.05176	**.0020**	**-.3229**	**-.0559**
the ratio of head to knee level by head	Tigray	Oromya	.16367	.10690	.4200	-.1120	.4394
		Amhara	.37519*	.09408	**.0001**	**.1325**	**.6178**
		Southern nations	.02434	.10879	.9960	-.2562	.3049
	Oromya	Amhara	.21152	.09568	.1220	-.0352	.4583
		Southern nations	-.13933	.11017	.5860	-.4235	.1448
	Amhara	Southern nations	-.35085*	.09779	**.0020**	**-.6031**	**-.0986**
the ratio of total height by head	Tigray	Oromya	.27076	.12405	.1300	-.0492	.5907
		Amhara	.51043*	.10918	**.0001**	**.2288**	**.7920**
		Southern nations	.11688	.12625	.7910	-.2087	.4425
	Oromya	Amhara	.23966	.11103	.1370	-.0467	.5260
		Southern nations	-.15388	.12785	.6250	-.4836	.1758
	Amhara	Southern nations	-.39355*	.11348	**.0030**	**-.6862**	**-.1009**

*. The mean difference is significant at the 0.05 level.

3. CONCLUSION

The result showed that there is no significant difference on the proportionality of head to crotch by head for each region which means it is possible to use the same standard measurement for all regions. On the other hand, there is a significant difference between the body measurements proportionality of each group; especially, the Amhara region female students' proportionality from different body parts to their head height is different from the other three regions in all the six variables. It will be approved by further researches whether the difference is related to African ethnic groups of Sematic, Cushitic and Omotic.

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