

# Development of Portable Hammock Set Products through Anthropometric Aspects to Fix Product Dimensions

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**Abstract.** A product design intended to facilitate the user, so a design usually refers to the target user who will use the product. The Portable Hammock Set product is a design aimed at users who want to relax enjoy the scenery using a hammock without searching for a binder or tree. After this product is designed, the authors tested using Kawakita Jiro Method to test the product feasibility according to the respondents. From the results of these studies, respondents argue that the framework of this product looks not strong. This is reinforced by a direct experiment using the product and the result when the user is used, the framework's hammock is bent. When a product cannot accommodate a user, then one factor is the determination of an inappropriate user percentile. So this problem is discussed in anthropometry. By reviewing the percentile of users in anthropometry, then use the comparative method to find the size of the framework that corresponds to the type of portable hammock designed. The results are the percentile requirements of users with body weight, height of the user and accompanied by the pole distance size and height of the framework as a reference of the new product dimension.

**Keywords:** Portable Hammock Set, dimension, anthropometry.

## 1 Introduction

Portable Hammock Set is a product design that is done in the course of Product Design Studio 5. The Product Design Studio 5 discusses product design that refers to the market potential. Portable Hammock Set is a product design that prioritizes market potential. This market potential is seen from the results of questionnaires from 100 respondents who argue that in using hammocks, respondents have constraints in finding trees with a close distance occupies the largest percentage, which is 35%. So Portable Hammock Set product is a tool that aims to facilitate users in using and operating the hammock inside and outside the room without the need to look for the pole tie. This product is called portable because it is a skeleton, with a roof (hood) and a hook to connect a hammock that is easy to use anywhere.

According to Pangesti, Kawakita Jiro Method (MKJ) is a method used to solve problems by a group based on 4 steps: card making, card grouping, chart making, and verbal / written explanation [1]. Therefore, MKJ is widely applied by various educational institutions,

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companies, and research in Japan. This method serves as a method for solving the problem. Then this method is used to find out the problems contained in Portable Hammock Set products.

From the results of MKJ testing of Portable Hammock Set, respondents argue that this product has a problem in the framework. Respondents argue that the framework of the product has a strong impression. After a direct use experiment it is known that the product framework is not strong because when the user occupies the hammock, the skeleton is wobbly and bent when holding the user load. Though known material of this product is stainless steel, which is kind of strong material.

When a product cannot accommodate a user, then one factor is the determination of an inappropriate user percentile. So this problem can be discussed in anthropometry. Anthropometry is a collection of numerical data related to human body characteristics such as size, shape, and strength and application of the data for handling design problems. Anthropometric data can be useful in designing or reviewing or evaluating the use of a product or space [2]. It can thus be concluded that anthropometric data will determine the exact shape, size and dimension associated with the designed product [3].

From the above background then conducted a research on the percentile user with the dimensions of the product framework in accordance with the anthropometric approach. This study will use a comparative analysis approach to analyze good hammock mounting size data with the size of the Portable Hammock framework available on the market. This data will be the reference to generate a skeletal dimension with a specified new percentile. Therefore the need for research on the development of Portable Hammock Set products through anthropometry aspects to improve the dimensions of the product framework.

## **1.1 Hammock Hang**

According to Hansen, Derek mentions that in installing hammocks there are several things to note [4]. In the picture above mentioned that the distance between the poles of approximately 4.57m, the hammock swing length of 2.74 m, the length of the suspension or rope from the pole to the swing is 1.05 m, the swing hammock height of the sitting position to the ground is 45.7cm, the height of the placement of the string bonds on the pole or the tree is 117.6 cm and the angle to be formed from the hammock position is 30 degrees.

The angle in hammock installation is very important to note because it can affect how good body position in using the hammock. When the height of the sitting position with the distance between the piles is constant, then the angle formed on the hammock swing can affect the point of the swing, the length of the suspense rope and how the user uses the hammock. Due to the larger angle that is formed, it will be the more loose pull between both sides of the swing that causes the user must lie in the opposite direction with both ends of the swing in order to remain balanced and safe in its use.

## **1.2 Anthropometric**

Anthropometry is a collection of numerical data related to physical characteristics of the human body which includes the size, shape and strength and application of the data for handling design problems. Here is a systematic design procedure in anthropometry: a) Determine the user population to use the design object. b) Determine the body dimension associated with the design object. c) See available anthropometry database. d) Make your own measurements if the database is not available. e) Determine the percentage of the population to be accommodated. f) Determine the design approach to be used. g) Determine the basis of selecting the percentile to be used. h) Add an amount of allowance. i) Visualize the design. j) Evaluation of design results [3].

There are three approaches that can be used in designing, among others, designs based on large or small individuals, adjustable design, and design based on the average individual. In the book described that the design based on large or small individuals (percentiles large or small) is a design that is used as a barrier to the size of the user population that will be accommodated by the design. A design capable of accommodating 100% of users is required when safety factors are considered, for example, high alarm hazard positions. In a design, anthropometric data is usually processed in the form of percentile value. Information about this percentile is important to determine the presence of the user population to be accommodated by the designed product. One of them is a large percentile or P95. This percentile is used when those of large or high sized bodies will find it difficult to use a design if made too small or short. But for people who are small or short, this is not a problem even though the size is too big [3].

## 2 Results of Data Collection Questionnaire

Here is the exposure of the questionnaire that has been filled by 100 respondents about their experience using hammock products that are currently sold on the market described in a narrative. Based on field data, respondents in this study aged 21 to 30 years with a percentage of 58%, ages 16 to 20 years as many as 27%, 10 to 15 years as many as 15%. most respondents have a hobby of traveling, that is as much as 65%. Besides having a hobby hiking or mountain climbing as much as 20% and camping or camping as much as 15%. Of the 100 respondents, 90% know the type of hammock on the picture and 10% do not know the product. Of the 100 respondents, 55% had used and installed their own hammocks and 45% never used and installed their own hammocks. Most respondents use this product at camps with 19% presentation, 17% insights and mountains, 16% on beaches, 15% in home and forest yard, inside their house as much as 1%. This shows that users not only use this product outdoors but also indoors. Obstacles from users of hammocks vary, among others, the most experienced respondents are difficulty in finding a tree adjacent to the percentage of 31%, then the most obstacles in the second position is difficult to determine how to tie the hammock rope for strong use, 17% percentage of difficulty determine the height hammock rope bonds, a 16% percentage of difficulty climbing the first hammock, and the lowest percentage of 13% of respondents difficulties in determining the hammock swing tension.

### 2.1 Trials Of hammock usage

At this moment the writer asked a respondent to try to use the Portable Hammock Set. It is known that the user weighs 57 kg, height 163cm and user age is 21 years. The user's first experiment occupied the hammock with the help of two people to hold both ends of the hammock pole.



**Fig. 1.** First Experiment Using Portable Hammock

In this experiment the user is able to sit well above the hammocks though with an anxious expression as it feels the framework begins to vibrate while holding the user load. In this case the frame position remains straight and upright.



**Fig. 2.** Second Experiment Using Portable Hammock

From this second experiment the user tries to use the hammock with lying position. In this experiment, the user simply tries to lie with the position of one foot fixed above the ground and another on the swing. In this position, the framework still looks straight and erect and is still assisted by two people to hold both ends of the framework.



**Fig. 3.** Third Experiment Using Portable Hammock

In this section, the user tries to use a hammock with a 100% body position above the hammock swing and without help to hold the skeleton. The result is that the hammock frame is bent in due to the user's load. In addition, one end of the frame that was not held seemed to float above the ground and soon the user fell to the ground due to the vibrations from the hammock.

From experiments using the hammock, it can be concluded that the framework of the Portable Hammock Set cannot be used optimally because the framework is not strong enough to support the burden of the user. Whereas it is known that these users only weigh 57kg at the age of 21 years, which is around the 50<sup>th</sup> percentile.

## **2.2 Results of Kawakita Jiro Method**

In proving that a product has problems, Kawakita Jiro method is a method that can facilitate in mapping the focus of the problem on a product. This method uses the opinions of respondents as a benchmark of the problems to be concluded. In implementing this method the authors prepare sticky notes, pens and a board to stick to the opinions of respondents. After that install the Portable Hammock Set product not far from the location of the research, which is in addition to the building Telkom University Convention Hall. This place was chosen because of the many students who pass around the place, from among students, lecturers, security guards, and others. So the respondents from this research are students of Telkom University. a) Distribution and Filling Sticky Note. In this stage, the authors and the team distributed sticky notes to the student respondents who were in the vicinity of the

location. Respondents write 2 words on 2 sheets of sticky note in the implementation of this research. b) Word Grouping. After the process of filling a sticky note with the respondent, the authors categorize the words that have the point of view and the meaning of the word matching with other words. c) Chart Making & Aspect Determination. After the words are grouped, the author named the group into a 5 aspects discussion, namely visual aspect, comfort aspect, aspect of form, aspects of perception and framework aspects. Once named, the author positioned the aspect on the chart according to the nature of the written word. Are negative, positive or positive negative. d) The result of Kawakita Jiro Method. The result of this KJ method shows that the most serious problem with this product is in the framework. Because according to the respondent, this product framework is horrible, fragile, and others. So the authors conclude that the Portable Hammock Set product has a problem in terms of the framework of the KJ method that has been implemented.

### 3 Method of Analysis

The analysis technique of this research is comparative analysis technique. The comparative analysis method is a method that compares field data and literature with theory or analysis between data one with other data, then taken appropriate to analyze the object of study [5]. Meanwhile, according to Meikalyan, Rizzal, comparative method is a method used to compare data drawn to new conclusions [6]. This method will be used to compare the results of the literature review of the user dimension with the researched product size data to improve product dimensions.

## 4 Result and Discussion of Analysis

### 4.1 The Dimensions of the Human Body

In order to improve the hammock product framework, data on the dimensions of the human body dimension will be the dimensions of the product to be made, including weight as the determinant of the load to be charged by the product and the height as the distance between the poles of the product framework. Here is the anthropometry table data based on the smallest and largest percentiles.

**Table 1.** Table of Human Dimension In Anthropometric

Category	Men		Women	
	Percentile 5	Percentile 95	Percentile 5	Percentile 95
Age	18 – 79 years old	18-79 years old	18-79 years old	18-79 years old
Height	156,7 cm	184,9 cm	145 cm	170,4 cm
Weight	57,2 kg	96,2 kg	47,2 kg	77,1 kg
Shoulder width	43.2cm	48.3cm	33 cm	48,3 cm

From the above anthropometric data can be summed up into the following parameters: a) The maximum data to be used in determining this largest percentile is the maximum data from men. Because men have bigger dimensions than women. b) The minimum data to be used to determine the minimum product height is the smallest female percentile data. c) Minimum height in women in the 5th percentile is 45.5cm 95<sup>th</sup> percentile is 59.4cm. e) Maximum man's weight at 95 percentile is 96.2kg. f) Men's maximum shoulder width at the

95th percentile is 52.6cm. g) The maximum height of a man according to the 95th percentile is 184.9cm.

## 4.2 Framework Dimensions

After determining the dimensions of the user who will use the hammock, in this stage will be done comparative analysis between manual hammock mounting rules with the dimensions of Portable Hammock products that already exist. The results of this comparative analysis will be used to determine the size of the hammock frame based on the average size obtained in an existing hammock portable product. Here are the terms of dimensions in installing manual hammocks with trees according to Hansen, Derek on the website [www.theultimatehang.com](http://www.theultimatehang.com) are the distance between poles of 4.57 meters, 1.17 meters high mast, swing length of 2.76 meters, high swing from ground 0.45 meters and maximum load is 90.72 kg [7]. Here is the comparative dimension comparative data from hammock portable products that already exist in the market.

**Table 2.** Comparison Tables Of Portable Hammock Dimension

Product Name	Product Analysis		
	Dimension	Weakness	Advantages
<i>Zeni Double Hammock</i>	Distance between poles = 2.9 m Pole width = 1.2m High pole = 1.23m Maximum load = 204kg	The distance between the poles is shorter than the distance between the poles in the manual hammock	-Able to hold the burden of 2 users of percentile 95. -The pole height exceeds the height of the manual hammock pole.
<i>Sunnydaze Brazilian Hammock</i>	Distance between poles = 3.14m Width of pole = 1m High pole = 1.33m Maximum load = 200kg	The distance between the poles is shorter than the distance between the poles in the manual hammock	-Able to hold the burden of 2 95 percentile users. -The pole height exceeds the height of the manual hammock pole
<i>Outdoor Garden Portable Hammock</i>	Distance between poles = 2.27m The width of the pole = 0.8m High pole = 0.69m Maximum load = 150kg	-Able to with stand 1 user percentile 95. -The distance between the poles is shorter than the distance between the poles in the manual hammock -Higher pole lower than manual hammock pole height	-
<i>Portable Folding Hammock</i>	Distance between poles = 2.16m The width of the pole = 0.81m High pole = 0.7 meters Maximum load = 102kg	-Only able to withstand the load of 1 95th percentile user. -The distance between the poles is shorter than the distance between the poles in the manual hammock -Higher pole lower than manual hammock pole height	-

From the comparative dimensions of portable hammock products that already exist in the market and the table of hammock installation terms, it can be concluded as follows: a) Three of the five products discussed can only accommodate the burden of 1 user category 95th percentile, with the average user's maximum load of 125kg. b) Three of the five products discussed have a lower pole height than a manual hammock pole. With the average height of the pole is 0.8 meters. c) All the products discussed on average have shorter inter-pole distances than the pole spacing on manual hammocks, averaging 2.8 meters.

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## 5 Conclusion

Portable Products Hammock Set is a portable product that allows users to use a hammock without the need for a pole or tree as a binding point. The research problem discussed is about fixing the Portable Hammock Set product framework that was initially considered not strong by the respondents KJ method results and reinforced by skeletal bending when experimental direct use by a 50th percentile user. When a product cannot accommodate a user, the percentile specified in the manufacturing process of the product is not appropriate.

So in this study, the authors determine the percentile of 95 men as the largest percentile that should be able to accommodate by the new framework by using the height, weight, shoulder width as a reference dimension of the framework to be updated. In addition to the largest percentile, a comparative analysis of the dimensions of the existing portable hammock framework with the provision of manual hammock mounting emphasizes the advantages and disadvantages when compared to manual hammocks.

The result of this research is the percentile used is the 95th percentile, with the mean of the maximum user load that is 125kg. The height of the pole to link the hammock is 0.8 meters and the distance between the poles of 2.8 meters. Problem-solving in this study has been limited to the improvement of dimension through anthropometric aspect only, so it needs to be applied to a structural aspect to test the result of this research.



**Fig. 4.** Portable Hammock Set after Re-Design

In a product design needs to consider the target users who will use the product such as consideration of percentile users, age, weight, and so that the product will be designed to accommodate the user who has been set. To ensure the strength of a product, anthropometric aspects need to take precedence in product design rather than the type of material to be used, because strong materials may not be able to accommodate the intended users of the product.

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