

ERGONOMICS DESIGN OF BABY CARRIER

NURAINI BINTI ABD LATIF

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

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SUPERVISOR DECLARATION

“I hereby declare that I have read this thesis and in my opinion this report is sufficient in terms of scope and quality for the award of the degree of Bachelor of Mechanical Engineering (Design and Innovation)”

Signature :

Supervisor : MASTURA BINTI MOHAMMAD TAHA

Date :

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Nuraini Binti Abd Latif

**This report is submitted in partial fulfillment of the requirements for the degree of
Bachelor Degree of Mechanical Engineering (Design and Innovation)**

**Faculty of Mechanical Engineering
Universiti Teknikal Malaysia Melaka**

June 2013

DECLARATION

“I hereby declare that the work in this report is my own except for summaries and quotations which have been duly acknowledge”

Signature :

Name : NURAINI BINTI ABD LATIF

Date :

Dedicated to my lovely parents

ACKNOWLEDGEMENT

Alhamdulillah, finally I had done my Final Year Project. First of all, thank Allah for giving me the chance to successfully complete this technical report after I had followed and done the project given. This is because without the good health and wellness, I would never complete this technical report.

I would also like to take this opportunity to give my appreciation to my supervisor, Puan Mastura binti Mohammad Taha that had taught me so well. I am very lucky to have her as my supervisor and very thankful to her for the encouragement, advices and motivation. This is because without all of the thoughtful guidance, continued support and interest from her, this report would not have been at the same as presented here successfully.

Furthermore, I am very thankful to all my colleagues and others who had helped me a lot and support me when completing this technical report. This is because without their tips and views to this report, I would never finish the writing. I wish to express my sincere appreciation to all my family members. My grateful also extends to the person who helps me but I have not mentioned their names in this report too.

ABSTRACT

The research is regarding the analysis about the Ergonomics Design of Baby Carrier. The objectives, scopes and also problem statements have been identified on the current baby carriers in the market. There are plenty of baby carriers these days on the market such as baby slings, baby wrap and backpack baby carrier. A lot of parents tend to put the baby in the incorrect position. An ergonomic carrier allows parents to wear baby on the front, back and hip and ensures that the baby is placed in the anatomically correct position for a healthy spine and hip development. Some carriers have openings where the baby's thighs hang almost straight down. Then the selection of material also important in order gives comfort to the baby and parents. This project objective is to analyze ergonomics aspect in the current design of baby carriers. Then to study on the standard and legal issues related to children design. In addition, the needs to improve a design of baby carrier for safety and ergonomics. Therefore, benchmarking and anthropometric analysis have been carried out to differentiate between three types of baby carrier which are baby sling, baby wrap and back pack carrier in terms of dimension and ergonomic characteristics. By using RULA Analysis, the result showed that the current baby carrier has the ergonomic characteristics, however they are still insufficient. This is because the result that is get is acceptable to the user but needs to investigate further with the score 3. Therefore, it is highly recommended that further studies for this ergonomics baby carrier should be carried out in order to improve the design and at the same time, will make the product more useful for users.

ABSTRAK

Kajian ini adalah mengenai reka bentuk yang ergonomik untuk pembawa bayi. Objektif, skop dan juga pernyataan masalah telah dikenalpasti pada pengangkut bayi yang telah sedia ada dipasaran. Terdapat pelbagai jenis pengangkut bayi yang berada dipasaran seperti beg silang bayi, pembalut bayi dan beg sandang. Kebanyakan ibu bapa lebih cenderung untuk meletakkan bayi dalam kedudukan yang salah. Sebuah pembawa bayi yang ergonomik membolehkan ibu bapa untuk memakai bayi di depan, belakang dan pinggul dan memastikan bahawa bayi itu diletakkan di dalam kedudukan anatomi yang betul untuk tulang belakang yang sihat dan pembangunan pinggul. Sesetengah pengangkut bayi mempunyai bukaan di mana paha bayi tergantung hampir lurus ke bawah. Pemilihan bahan sangat penting bagi memberi keselesaan kepada bayi dan ibu bapa. Objektif projek adalah untuk menganalisis aspek-aspek ergonomik dalam reka bentuk yang terdapat pada pembawa bayi sedia ada. Kemudian untuk mengkaji isu-isu piawai dan peraturan yang berkaitan dengan reka bentuk kanak-kanak. Disamping itu, perlu untuk memperbaiki reka bentuk pembawa bayi sedia ada supaya lebih ergonomik dan selamat untuk dipakai. Oleh itu, analisis penanda aras dan antropometrik telah dibuat untuk membezakan tiga jenis pembawa bayi dari segi ukuran dan ciri-ciri ergonomik. Dengan RULA analisis ia menunjukkan bahawa pembawa bayi ini mempunyai ciri-ciri ergonomik tetapi masih tidak mencukupi. Hal ini kerana keputusan yang didapati selepas melakukan analisis menunjukkan bahawa reka bentuk ini boleh di terima pakai dalam kalangan pengguna tetapi perlu di selidik dengan lebih terperinci dengan skor 3. Oleh itu, pada masa akan datang dapat menambahbaikkan dalam reka bentuk untuk menjadikan produk lebih bermutu untuk pengguna.

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LIST OF ABBREVIATION

QFD	Quantity Function Development
HOQ	House of Quality
VOC	Voice of Customer
PDS	Product Design Specification
CATIA	Computer Aided Three-dimensional Interactive Application
CAD	Computer-Aided Design
SWOT	Strength Weakness Opportunities Threat
BOM	Bill of Material
RULA	Rapid Upper Limb Assessment

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CHAPTER 1

INTRODUCTION

1.1 BACKGROUND

“Making your life easier and simpler” is one of the common tagline that has ever been heard in every product that were made. This classical tagline is what people are looking forward to because people nowadays desire to have a simple yet convenient life in order to save time, money and energy. In addition, with more people having affluent lifestyles, creativity has become the main important thing in designing a product. Products that are valued in the market are easy and simple, yet efficient for the users. Therefore, take a look around, money is not a matter of problem because people have money, what people do not have is something that can make life easier and most importantly, satisfaction is essential to the human being. Ergonomic is one of the most important things when designing a product. Ergonomics is defined as human engineering, meaning that it is the relationship between human and machine. Then ergonomics can be known as a science focused on the study of human fit, and decreased fatigue also discomfort through product design. Therefore, when a product were design fit the user, the result will be more comfortable, less stress and higher productivity. (Taylor, 2006) As the title suggested, this project focuses on the design of the baby carrier which includes the ergonomics in the design itself.

Thus, in this context, the aim of this project is to analyze the ergonomics interaction between the baby carrier designed and human being especially baby with their parents. Child bearers have been around for many years. It is before the early 1900s, parents from worldwide utilized mixtures of long shawls, scarves, fabric and even a mattress sheets to cuddle up their toddlers and additionally run the errands. Indeed, today numerous conventional sorts of toddler transporter are still utilized as a part of the advancing nations, in spite of the fact that as we know this is for the most part confined to indigenous groups where child wearing is completely typical with a need and a lifestyle. Every nations of the planet has a conventional toddler transporter outlined to meet their desire and particular needs such as hot or cold climate, type of work parents do and also cultural wearing positions. Over the time, toddler wearing becomes increasingly recognized as an important parenting tool. This is because, people in the medical and bay worlds are beginning to understand the quality of a toddler wearing as a method of close holding with the infant and supporting growth.

In addition, infant wearing was not like something extraordinary and it is different as a perceived today. Moreover, mothers had to work hard and didn't have much time to stop for entertaining their babies. It is a common sense for parents to use a baby carrier to make their life easier. The key question in designing a product includes who is the target market? Who is willing to buy it once it has been brought into the market? What are the points of interest in this item that will make individuals purchase it? These inquiries will lead to the research on one product before it is designed. For baby carrier, the disadvantages will be examined, thus by eliminating the disadvantages and substitute it with some advantages. Therefore, a redesign for the new baby carrier for human comfort, safety and thus their satisfaction is one of the most important purposes in this project.

It is important to focus on the problem that is created by the baby carrier nowadays. Current baby carrier is already suitable for users but somehow it has problems in the design of baby carrier. Many parents tend to put the baby in the incorrect position. Not like a kid hanging in the poor design carrier and a few carriers have openings where the infant's thighs hang generally straight down. This design does not

provide sufficient and adequate support. That is the weakness that has to overcome by redesigning the baby carrier as a product for safety and ergonomics.

1.2 PROBLEM STATEMENT

Nowadays, many young mothers like to travel and go shopping. Most of them have a baby so it is difficult for them to bring the baby in the stroller as the stroller size is large and difficult to carry especially when shopping. Because of that problem many young mothers prefer to use a baby carrier. According to Lawrence Robinson, use of baby carrier will make baby close to their mothers. The relationship between mother and child is stronger with the use of baby carrier. There are a lot of baby carriers but many parents do not know which one is suitable and comfortable to use. For them, as long as comfortable and pleasant to use are adequate but they never emphasize in the structure and safety of the baby and themselves. They do not know whether the baby carrier is ergonomic or not.

There are plenty of baby carries these days on the market such as baby slings or backpack carriers. Many parents tend to put the baby in the incorrect position. This will cause the baby and the parents in an uncomfortable situation. An ergonomic carrier allows parents to wear baby on the front, back and hip and ensures that the baby is placed in the anatomically correct position for a healthy spine and hip development. This will avoid baby from hip dysplasia and a long term effect. Many of them does not concerned and know about this problem (hip dysplasia).

In addition, safety ergonomic carriers also important in order to ensure that baby and the caregiver comfortable in their position. Not like a child hanging in the poor designed carrier like the one we can see very often on the streets or maybe our relatives doing so too. Generally baby carriers do not guarantee the right positioning. A few carriers have openings where the baby's thighs hang essentially straight down. This design does not give sufficient support. In a few cases, a squatting leg position is not just unrealistic, however in the face-to-face orientation, the thighs and knees of the child are pressed up against the adult person. With each step of the baby wearer, the child's knees

are pushed backward. The point when this happens, the extra force from the child's thighs builds the measure of extending on baby hip joints. In addition, people like to follow in the traditional ways like swaddling and never concerned regarding to the science healthy. On the other hand, the selection of material is also important in order to provide comfort to the baby and parents. This is because if the materials being used were poor in quality and condition or have a low strength, it will cause uncomfortable for the baby especially.

1.3 OBJECTIVES

The objectives of this project are:

- i. To analyze ergonomics aspect in the current design of baby carrier
- ii. To study on standards and legal issues related with children in design
- iii. To improve or redesign the existing design of baby carrier

1.4 SCOPE

The scope of this project is to study on the anthropometric data of children and the caregiver for ergonomics analysis of baby carrier, includes with the legal standards considerations on design product. Some example of data anthropometric are height of baby and parents, width of waist, chest breadth and others length. Moreover, this project includes analysis and redesign of the baby carrier for safety and ergonomics. After design it, an analysis of RULA analysis are used in order to analyze its ergonomics. In conjunction with this, the project will analyze ergonomics relationships between the baby carrier and human.

1.5 SYNOPSIS

This project is about 'Ergonomics Design of Baby Carrier'. The objective of this project is to analyze ergonomics aspect in current design of baby carrier. Then need to improve the design of baby carrier for safety and ergonomics. Nowadays, many young mothers like to travel and go for shopping. Most of them have babies and do not know which one is suitable and comfortable to use. In addition, many parents like to put baby in incorrect position. An ergonomics carrier allow parents to wear baby on the front, back and hip to ensure that the baby is placed in the anatomically correct position for healthy spine and hip development. Not like a child hanging in the poor designed carrier like people can see very often on the streets. Some carriers have openings where the baby's thighs hang almost straight down not 90 degrees position of thigh. Therefore, this design does not provide an adequate support. In other hand, the selection of material also important, in order to gives comfortable to both baby and parents. Therefore, from this problem, need to redesign and do RULA analysis instead of to get the result whether it is ergonomics or not. After that, benchmarking and anthropometric analysis have been carried out to differentiate between three types of baby carrier which are baby sling, baby wrap and back pack carrier in terms of dimension and ergonomic characteristics. By using RULA Analysis, the result showed in terms of score because each score have its own definition. The product will be result as ergonomic and acceptable to user are with score 1 to 2. But if the result show score between 3 and 4 is define as it is acceptable to the user but needs further investigation. For score 5 to 8 is not safety and ergonomics enough to user.

1.6 SUMMARY

Ergonomic is one of the most important things when designing a product. Ergonomics is defined as human engineering, meaning that it is the relationship between human and machine. Then ergonomics can be known as a science focused on the study of human fit, and decreased fatigue also discomfort through product design. Many parents tend to put the baby in the incorrect position. An ergonomic carrier allows parents to wear baby on the front, back and hip and ensures that the baby is placed in the anatomically correct position for a healthy spine and hip development. This will avoid baby from hip dysplasia and a long term effect. But most of them does not concerned about this problem. Generally baby carriers do not guarantee the right positioning. A few carriers have openings where the baby's thighs hang essentially straight down. This design does not give sufficient support. On the other hand, the selection of material is also important in order to provide comfort to the baby and parents. The objective that must achieve is to analyze ergonomics aspect and to improve the existing design of baby carrier. In order to do this, anthropometric data of children and parent need to study. After that, an analysis of RULA analysis is used in order to analyze its ergonomics.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

A literature review is a grouping of content that means to review the critical purposes of current learning including substantive findings as well as theoretical and methodological contributions to a particular topic. Literature reviews are optional sources, and as being what is indicated, do not report any new or original exploratory function. Likewise, a literature review could be interpreted as a review of an abstract fulfillment. This chapter will explain about the basic concept of ergonomics product design. The introduction of the product and the ergonomics will also be introduced. In addition, this chapter also gives information about the parameter and analysis technique involved in this ergonomics design of baby carrier product.

2.2 BACKGROUND PRODUCT OF BABY CARRIER

There are three types of baby carriers which are baby slings, baby wrap and backpack baby carrier. Baby sling is a piece of fabric that goes over parents shoulder to form a pouch to hold the baby. In addition, a baby wraps is known as a simple piece of long fabric that is wrapped around parent body and also the baby. In this way, wrap baby carriers can offer in numerous diverse positions for holding the baby at different ages.

Then for a baby carrier, these carriers are more likely like a backpack and it is generally designed for older babies and toddlers that to be worn on parent body's front, back or hip. According to Kirkilionis, D. 2000 the back of baby carrier should be wrapped tightly around the baby and parents. This will prevent the child from slouching while sleeping and this will make sure that the baby should be held by the parent in upright position. In order to support the head, the back of the baby carrier must reach above the baby's head. This is because, if the carrier is snug. This will provide a stability to both sides of the head and it will prevent the head from falling backwards or sideways.

Each baby carrier has their own specifications, such as recommended weight limit, age limit based on average child size, carrying position and also its special carrier features. Furthermore, by carrying a heavy or older toddler can put a strain on a wearer or parent's back. Therefore, selection of baby carrier that promotes the well-being of both parent and baby will become the most important factor (Tai Lee, 2007).

The comparison of these three types of baby carrier is shown in the Table 2.1 (Boba Family 2012; Ireland, K. 1998). This comparison is about the advantages and disadvantages of this product which are baby slings, backpack carrier and baby wrap. Advantages of baby slings are easy to on and off and it is perfect for a fast errand on the grounds that it can additionally be worn in horizontal or upright position. But its disadvantages are only head over one shoulder, can give you disproportionate feeling. In addition, for backpack carrier the advantages are have a back and hip support. It will support legs in flexed abducted (froglike) position with naturally aligns with hips, pelvis and spine. But weight distribution mainly on waist and shoulders of carrier, so this will cause pain especially on parent's shoulder. Lastly, for baby wrap the advantage are have an optimal head or neck help and likewise fundamental for when the child falls asleep. Other than that, with correct leg help, fabric could be extended to the back of the knees to guarantee proper sitting position. But back wearing is not safe and it is not prescribed with stretchy wrap. Then, woven wraps have different holds position; however fabric may dig and not be as accommodating as stretchy wraps.