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**"Strengthening Research Capacity and
Disseminating New Finding in Nursing and
Public Health"**

Editor:

Yanti Puspita Sari

Esthika Ariany Maisa

Mahathir

25 - 27 September 2017
Padang, West Sumatera

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Kampus Unand Limau Manis, Pauh
Padang, West Sumatera
Indonesia, 25163
Email: ainic@fkep.unand.ac.id, ainic.fkep.unand@gmail.com

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An ergonomic breastfeeding chair design

P. Fithri, L. Susanti, I. Arief, D. Meilani & C.T. Angelia

Faculty of Engineering, Universitas Andalas, Kampus Limau Manis, Pauh, Padang 25163, West Sumatera, Indonesia

ABSTRACT: Breast milk plays an important role in a baby's brain development and disease prevention. Indonesian government regulations require mothers to breastfeed their babies for at least the first six months of its life. There is however, a general lack of proper breastfeeding facilities in public nursery rooms. Stiffness and pain in the back, neck, legs, and arms of breastfeeding mothers is commonly found due to poorly ergonomically designed facilities. Therefore, it is necessary to design a facility for breastfeeding mothers such as an ergonomic chair. The research for the design of such a chair started with the collection of anthropometric data to determine suitable chair dimensions, and then the application of the Quality Function Deployment (QFD) method to identify priority features that should be put into the design. The final designs had adjustable armrests, a sliding footrest, a baby support cushion, a headrest, and an adjustable backrest.

1 INTRODUCTION

Breast milk (or a 'mother's milk') has very important health benefits for the baby (Agostoni, C, et.al, 2009). Besides functioning as a perfect food to help the baby's growth process, breast milk also helps increase the baby's resistance to various infectious bacteria, fungi, and viruses (Anatolitu, 2012). Due to the benefits of the mother's milk, the government of the Republic of Indonesia follows the World Health Organisation's recommendation for a mother to breastfeed a child for at least the first six months of its life to maintain the baby's health.

There are several obstacles in implementing a government regulation on mandatory exclusive breastfeeding. One of them is inadequate facilities, especially the unavailability of seats in lactation rooms. It is common that seats available in the lactation rooms, such as in the offices, business centres or even at home, do not respond to user's complaints that they are inconvenient. The only facility commonly provided are chairs which do not reflect the user's specific needs. While breastfeeding, such body parts as the back, shoulders, neck, hands and feet tend to become uncomfortable. This is because the seats do not consider the special needs of the mothers and consequently, the body position while breastfeeding will be wrong.

In accordance with the ergonomic principle of 'fitting the task to the man rather than the man to the task' (Tarwaka, 2004), it is the facility that should be adjusted to the human limitations (Nurmianto, 2004), not the other way around. Hence, the solution offered is a chair that can accommodate breastfeeding mothers through biomechanics and an anthropometric approach to reduce muscle soreness when breastfeeding.

The problem to be resolved in this study is concerned with how to design an ergonomic chair for breastfeeding mothers in accordance with their needs both in terms of dimensions and comfort, while keeping it within relatively affordable prices.

2. METHODS

2.1 Identify Customers' Needs

Customers' needs were identified through a survey on 100 nursery women. The identified needs of the breastfeeding mothers to be addressed were as follows: strong seat to support the mother and the baby; armrests or other supports on the side of the chair; a footrest; the angle of the chair's back to be comfortable for the user; comfortable seat design; a cushion to support the baby; a headrest; and moveable seat.

2.2 Anthropometric Data

The anthropometric data collection involved 30 respondents. Predetermined anthropometric variables used in this study were popliteal height, popliteal buttocks, hip width, shoulder width, shoulder height, elbow height, leg width, and leg length. Data was collected directly by anthropometric measurement of the breastfeeding mothers. 30 data sets were collected and tested using the normality test to see whether the data could be used as a reference to determine the dimensions of the chair parts.

2.3 Quality Function Deployment Method

The Quality Function Deployment (QFD) method is used to determine the characteristics that designers must meet in order to produce customer-oriented products (Cohen, 1995). In this research, the development phase of the House of Quality (HOQ) matrix consisted of several stages:

1. Creating a list of breastfeeding mothers' needs for the products to be designed (customers' requirements).
2. Determining the technical characteristics (technical response) to meet the breastfeeding mothers' needs. In this section, the designer translates what is needed and defines technical characteristics to meet the needs of the consumers. This is then validated directly by the experts in the field of production.
3. Determining the relationship between breastfeeding mothers' needs and the technical characteristics required in order to see the relationship between each of the existing characteristics. Using a strong correlation technique means that if one of the characteristics of the technique is not a match, it will significantly affect the characteristics of the other techniques.
4. Determining the relationship among all technical characteristics.
5. Creating a Phase 2 HOQ matrix that contains part characteristics or detailed technical characteristics. This phase is a continuation of the technical response to a Phase 1 HOQ matrix. In a Phase 2, the technical response is detailed by the expert in the field of production and becomes part of the characteristics that facilitates the developer in the product design stage. The stages are the same as in a Phase 1 HOQ matrix, where percentages and priorities for each part characteristic to be applied in the design are searched, which ultimately strengthens the relationship between the technical response and part characteristics.

3. PRODUCT DESIGN

3.1 Adjustable Armrest

The armrest is used to support the mothers' elbows and hands while feeding her child. The presence of an armrest can reduce fatigue on the hands.

3.2 Sliding Footrest

A footrest places the knee slightly higher or equal to the pelvis. This position allows the breastfeeding mother to feel comfortable and reduce fatigue while sitting because the legs are not hanging nor placed on the floor.

The design of the ergonomic breastfeeding chair in this study features a sliding footrest which is not separate from the seat. The sliding is able to change the buffer position by pulling and extending it.

The footrest slider has rails on each side of the chair to pull and lengthen the footrest. The maximum reach of the slider withdrawal was designed to be 40 cm in order to meet the maximum percentile of respondents. An image of the sliding footrest used in this study is shown in Figure 1a. The footrest has a flexible angle that can be changed as per the user's convenience.

3.3 Support for the Baby

Breast pads are often used by mothers to support their sleeping babies while breastfeeding and the pads are separate from the chair. The breastfeeding chair in this study was designed to have a straightforward indivisible pad which negated the need to add another cushion to support the baby. The design considered the thick anthropometry of the stomach so that the nursing mother could comfortably use a breastfeeding pillow. The thickness of the breastfeeding pad used was 5 cm, with a soft foam type. This was based on a recommendation for a 3.8 cm thick 'comfortable' foam (Perwita, 2009) which offers a high level of comfort that is required for a newborn.

3.4 Headrest

The survey within this research revealed that some respondents wanted headrests to be more comfortable. The chair was designed with a headrest, which consisted of two designs: directly attached to the seat frame and cannot be removed; and made separately from the seat frame so that it can be removed (because not all respondents considered the headrest as important). The second design, nevertheless, was technically more difficult when compared to the first headrest design.

3.5 Wheels

Some respondents wanted a breastfeeding chair equipped with wheels for easy movement. The type of wheel used in the chair design for this study had a lock to keep the chair immobile while being used.

3.6 Adjustable Backrest Tilt

According to the American National Standards Institute (ANSI) in Perwita (2009), the recommended backrest angle for breastfeeding mothers is 105°. However, some respondents to this study considered that an adjustable backrest angle should be included in the chair design. Such an adjustable feature certainly adds a high value of comfort to the users while feeding.

The backrest of the chair in this study was based on the ANSI recommendations, but was also designed to be manually adjustable into several angles of 95°, 105° and 110°.

3.7 Design Specification for an Ergonomic Breastfeeding Chair

The design of an ergonomic chair for this study was based on the dimensional calculations and a determination of the required features. The chair design featured an adjustable armrest, a sliding footrest, was foam coated, and contained seat cushions that could support the baby during nursing. However, additional and alternative features were also considered. This culminated in

the design of four slightly different ergonomic breastfeeding chairs, and these are discussed further in paras 3.7.1–3.7.4.

3.7.1 Design 1

Design 1 was constructed with reference to predetermined dimensions, predefined features, and added features, such as a head cushion attached directly to the seat frame, and an adjustable angle for the backrest. Design 1 is presented in Figure 1(a).

3.7.2 Design 2

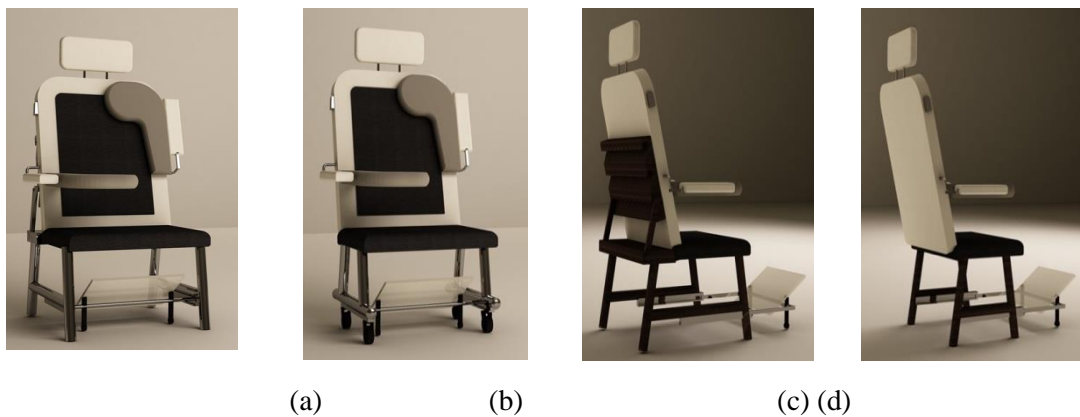
Design 2 has many similarities to Design 1, but with different additional features, such as removable headrests and wheels. Design 2 is shown in Figure 1(b).

3.7.3 Design 3

Design 3 has some additional features, such as an adjustable angle for the backrest and headrests that are directly embedded into the seat frame. Design 3 is shown in Figure 1(c).

3.7.4 Design 4

Design 4 has similar material to Design 3, but had a removable headrest. Design 4 is shown in Figure 1(d).



(a) (b) (c) (d)
Figure 1 Designs 1 to 4 of the proposed ergonomic breastfeeding chair.

4 CONCLUSIONS

The most important features of a breastfeeding chair that will meet the needs of breastfeeding mothers includes an adjustable armrest, a sliding footrest, a cushion to support the baby, a headrest, foam coating, an adjustable backrest angle, and wheels. The different designs shown and discussed in this study were found to meet the ergonomic needs of breastfeeding mothers because they took into account their anthropometric data and the biomechanical analysis using the Ovako Work Posture Analysis System method. This research can be further developed in the creation of prototypes and the evaluation of the technical details of each chair design to the stage of manufacturability.

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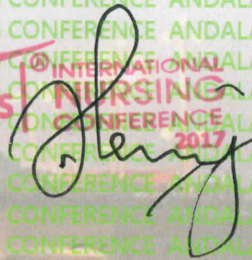
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