ORIGINAL ARTICLE

REDESIGN OF BREASTFEEDING CHAIR FOR NURSERY ROOM

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ABSTRACT

Breastfeeding chair is one of the essential facilities in the airport. This study designs the breastfeeding chair for the nursery room in Minangkabau International Airport. Quality Function Deployment (QFD) was used to investigate the customer requirements by distributing questionnaires to 100 mothers in Padang West Sumatra. Anthropometry data was also measured form those respondents. The study resulted in a design of ergonomic breastfeeding chair which was used features obtained from the voice of the customers. The design has considered the condition of the mother giving birth by normal as well as a cesarean. The design has an adjustable back seat with an angle of 95º,105º, and 110º; it has an adjustable footrest with 120º, 140º, and 180º angles. The chair has a headrest, baby support pad, a portable baby cushion, an adjustable baby bearings. The chair has also equipped with an assemble torn neck, a small drawer on the side of the chair, and a palm rest that can be used or not by adjusting the height.

***Keywords**: Ergonomic, breastfeeding chair, airport, anthropometry, nursery room, Quality Function Deployment (QFD)*

INTRODUCTION

Air transport is an important element of tourism aspects because it can make tourist reach their destination fastly[1]. These days many people would agree that airports should invest in enhanced facilities and higher levels of service quality to attract passengers[2]. Minangkabau International Airport is one of the air transport infrastructures that serve flights to West Sumatra, Indonesia which is managed by PT Angkasa Pura II (Persero). The increasing number of passenger flights makes Minangkabau International Airport strives to provide good service by displaying performance and quality performance for the satisfaction of its users. Good service quality is a significant factor for airport performance indicators and should be managed with the same level of importance as profitability[3].

Minister of Transportation Regulation No. 20 of 2005 has determined that the enforcement of Indonesian National Standard (SNI) 03-7046-2004 at the airport passenger terminal as a mandatory standard for the realization of the services provided by the airport to the public[4]. Implementation of SNI at the airport passenger terminal one of them has the completeness of space and public facilities that are useful for passengers, visitors and airport employees. One of them is the facility for a lactation room or nursing mother's room. Minangkabau International Airport is one of the places frequented by people in Padang City and some communities from other areas and is one of the public places that have lactation room facilities. Lactation rooms with these facilities can be seen in Figure 1.

Figure 1. Lactation rooms

According to Pak I Ketut Senimanta (2018) currently Minangkabau International Airport is still not by the desired standards, one of the seat facilities for breastfeeding mothers who still use a long sofa chair in general. Interview with breastfeeding mother at an international airport called Lisa said that while in the lactation room, Mother felt less comfortable with the use of a long sofa chair. As a result of the use of seats that have no insulation and cannot be used properly by the family, breastfeeding mothers who cause maternal privacy when breastfeeding with other mothers become very disturbed. Mr. I Ketut Senimanta said that in the Lactation Room there are no written regulations regarding the prohibition of entry other than mother and baby. In addition to issues concerning privacy when breastfeeding mothers, the use of a sofa chair with the wrong breastfeeding position can cause problems that make your mother physically very tired and her success in giving breast milk to her baby is not smooth.

The results of the survey concluded that the performance of the sofa chair Breastfeeding mothers at the Minangkabau International Airport is still experiencing a lot of problems in terms of the design and comfort of the mother when using it. These problems can be overcome by designing a product that can help you avoid these problems, namely an ergonomic chair for nursing mothers in the Minangkabau International Airport lactation room.

METHODS

Quality Function Deployment (QFD) method was used in this study to attain customer requirements into the language of production techniques becomes a necessary component in designing breastfeeding chairs. QFD is a substantial methodology to improve customer satisfaction and decrease product expenses and cycle time [5], [6]. Some so many researchers use this methodology to investigate the design requirements in a product design process[7,15].

QFD method by doing several steps are :

1. Establishment of House Of Quality Matrix QFD Phase One (Product Planning)
   This stage is the second phase in the QFD method by performing several steps, namely:

a. Identification of Consumer Desires and Needs
b. Consumer Interests
c. Planning Matrix
d. Determination of technical characteristics
e. Determining the Relationship of Consumer Needs with Technical Characteristics
f. Engineering Priority Matrix
g. Technical Correlation

2. Establishment of House Of Quality QFD Phase Two Matrix (Component Planning)
   This stage is the second phase in the QFD method by performing several steps, namely:

a. Components of Technical Characteristics
b. Relationship between Technical Characteristics and Components of Technical Characteristics
c. Priority Matrix component of the Technical Characteristics

The questionnaires are developed by considering the voices of customers collected through an interview with the breastfeeding mothers in a lactation room. The mothers interviewed were selected as those who had used chairs and lactation room facilities at the airport to ensure that the research objectives were achieved. Fill in the interview protocol regarding complaints, needs, and expectations about comfortable chairs for nursing mothers.

The interview results are then summarized and used as customer requirements (attributes) to develop the seats of nursing mothers in the questionnaire. These requirements are then evaluated to determine which types of requirements are important and have a greater influence on customer satisfaction. The requirements obtained are presented in Table 1.

The assessment aspects of the criteria used in this questionnaire were developed based on the quality dimensions set by David A. Garvin[16]. The aspects used are 4 of the 8 dimensions of product quality. Other aspects of the quality dimension cannot be used in research because the respondent cannot provide information related to that aspect. The selection of these aspects is adjusted to the condition of the current breastfeeding mother's chair. Based on the condition of the product, the appropriate aspects are performance, durability, aesthetics, and features.

This questionnaire was used as a Likert rating scale with a range of 1- 5. The questionnaire designed is an assessment of the level of perception and the level of importance of the design of a breastfeeding mother's chair. The important level questionnaire is designed to assess the important variable to be implemented. The scales used are the Likert scale (1 = not important to 5 = very important). The satisfaction level questionnaire is designed to assess the satisfaction level of the customer toward the product. The scales used are the Likert scale (1 = not satisfy to 5 = very satisfy).

RESULTS

The population and sample used in this study are nursing mothers in the city of Bukittinggi. The choice of location of the study is assumed to be able to describe the population and sample of nursing mothers in any area. Based on this, it can be said that the population of breastfeeding mothers has a very large amount and always changes every time.

In this study, the sample selection or sampling technique used is a non-probability sampling. This sampling is used because the population of breastfeeding mothers in the city of Bukittinggi is spread throughout the region, so sampling is done randomly because each sample has different characteristics and is not generalized. The sampling technique used was purposive sampling because the respondents in this study were determined according to the expected criteria.

The measurement of samples in this study was carried out using the Lemeshow method. Because of the population (N) of Breastfeeding Mothers in Bukittinggi City is not known with certainty so that to calculate the minimum number of samples needed using the Lemeshow formula. Based on the Lemeshow formula, the number of n = 96.04 ≈

100 respondents was obtained. So that for extracting data from at least 100 respondents.

A validity test has been obtained using r table and the results remain the same, and the instrument is reliably acceptable.

Table 1: Customer Requirements of Ergonomic Chairs for Breastfeeding

No.	Dimensions	Customer Requirements
1	Features	The seat has a soft foam holder
		The chair has a left and right armrest
		The seat has a footrest
		The chair has a height / low footrest
		Chairs have a backrest
		The chair has a back slope adjustment
		The chair has a pillow to support the baby
		Seats have headrests
		Chairs have pads on the neck
		Chairs can be raised lower as needed
		Chairs can be rotated in all directions
		Chairs have a place to put tissue
		seats have a place for a bottle of drink on one side of the chair
		Chairs have small drawers to store breastfeeding equipment
2	Performance	The chair has a soft seat layer
		The seat is strong or not easily broken
		The seat holder layer is not easily damaged
		The seat foam is not hot
		The seat height regulator is not easily damaged
		The footrest height controller is not easily damaged
3	Durability	Chairs have a size that matches the size of the body
		Seats can be taken anywhere
		The chair is made of lightweight material
		Chairs can be folded
		Seats that are designed do not harm users
4	Aesthetics	Chairs designed like sofa chairs
		The chair has a unique and attractive design
		Seats have a contemporary design
		The seat holder is green
		Layer seat holder has a soft color (pastel)

Tests of maternal breastfeeding anthropometry data consist of test normality data which the method used to test data normality one of them uses the Kolmogorov Smirnov method because the method can be used in all size samples without categorizing so that all data results can be used [17].

QFD Design

1. Determine the customer requirements and the important customer ratings

The identification of the customer requirements was conducted by distributing developed questionnaires to 100 respondents. The answers were weighted to obtain the measured value. The collected questionnaire data ere tested for validity, reliability and adequacy. The results show that all data obtained were valid, reliable and sufficient for the next analysis. Table 2 shows the customer requirements and important customer ratings for the redesign of ergonomic chairs for breastfeeding.

2. Determine the technical requirements

Technical requirements used to represent the voice of developers.

Table 2: Customer Requirements and Important Customer Ratings.

No	Customer Requirements	Customer Important Ratings
1	Layer seat holder has a soft color (pastel)	4.49
2	The chair is made of lightweight material	4.44
3	Chairs designed like sofa chairs	4.43
4	The seat height regulator is not easily damaged	4.38
5	Seats can be taken anywhere	4.37
6	The seat is strong or not easily broken	4.28
7	Chairs have a place to put tissue	4.28
8	Chairs can be rotated in all directions	4.24
9	Chairs have a size that matches the size of the body	4.20
10	The seat foam is not hot	4.20
11	The chair has a pillow to support the baby	4.19
12	The footrest height controller is not easily damaged	4.18
13	Chairs have a backrest	4.18
14	The chair has a unique and attractive design	4.15
15	Seats that are designed do not harm users	4.15
16	Seats have headrests	4.14
17	The seat has a soft foam holder	4.14
18	The chair has a back slope adjustment	4.12
19	Chairs can be folded	4.06
20	The chair has a soft seat layer	4.06
21	The seat has a footrest	4.04
22	Seats have a contemporary design	4.02
23	Chairs can be raised lower as needed	4.00
24	The chair has a left and right armrest	3.97
25	Chairs have pads on the neck	3.95
26	The seat holder layer is not easily damaged	3.93
27	The chair has a height / low footrest	3.93
28	Chairs have small drawers to store breastfeeding equipment	3.90
29	seats have a place for a bottle of drink on one side of the chair	3.89
30	The seat holder is green	3.60

The next step is to translate the desires of consumers into technical form. At this stage, it is translated directly by those who are experts in the field of chair production Mr. Yal 4 Brothers Furniture at Jln. Piai No.122 RT 02 RW 01.

The technical requirements are presented below:

- Cover the seat with super foam with a webbing system
- The armrest is foam coated with a webbing system
- Make an adjustable height footrest
- The backrest is made by a lever system on the side of the chair so that you can adjust the tilt level
- Make a cushion to support the baby's body on the armrest
- Headrests are made above the neck cushions
- Neck cushions are made above the backrest
- The heigh seat adjuster system makes the seat height adjustment
- The seat is made to be flexible so that it can rotate in all directions
- Make a place to put tissue, bottles and small drawers by the chair
- The chair is made with a type of linen fabric with soft colors
- The chair is made of the iron skeleton
- The regulator is made flexible
- The chair is made according to the dimensions of the body
- The chair is made with a portable system
- The chair is designed according to the development of the times

3. Determine the relationship between the customer requirements and the technical requirements

The process of determining the relationship between the customer and technical requirements was done through discussions with the engineering experts in the field of chair production. The relationships were represented by several categories such as strong (• = 9), moderate (o = 3), weak (Δ = 1), and there is no relationship(0). For example, the relationship between the variables " The seat has a soft foam holder" with the variable "Cover the seat with super foam with a webbing system". The relationship between them is expressed "strong", because to make the seat soft, it needs cover like super foam with a webbing system.

4. Determine the interactions between the technical requirements

The interactions between the technical requirements designed to identify the design conflict and complementary characteristics. It is also useful to see how a technical requirement affects other technical requirements. There are five types of relationships used in this matrix. They are strong positive relationship (■), medium positive relationship (▭), no relationship (no symbol), medium negative relationship ( ), and strong negative relationship (▲).

An example of the relationship between the technical requirements is "Cover the seat with super foam with a webbing system" and " The armrest is foam coated with a webbing system". The relationship between those requirements is categorized as a strong positive relationship.

5. Determine the priority of the technical requirements

The process of determining the priority value of each technical requirement was done by summing the results of multiplying the important customer ratings with the score of the relationship between the customer requirements and the technical requirements. Figure 2 shows the matrix of customer requirements, important customer ratings, the relationship between the customer requirements and the technical requirements, the interactions between the technical requirements, and the technical requirements' priority (the House of Quality 1).

Product Design

The next stage in designing a breastfeeding chair is adding some features to the breastfeeding chair that are based on the needs and desires of consumers in the Quality Function Development phase one. The addition of these features can help make it easier for mothers when breastfeeding their babies. The ergonomic breastfeeding chair was designed based on the HoQ results in Figure 1. It was designed based on the required characteristics in functions, appearance, safety and assemblebility. Additional features were designed to improve the breastfeeding chair design. Then, anthropometric data were applied in the process of designing to fit the product with human use. Additional features in this product are listed in the next sections.

a. The chair has back slope adjustable (95,105 and 110 degrees)

A chair that has a backrest is one very important feature for nursing mothers. The process of breastfeeding for a very long time causes your back to be tired so that you need a backrest that can be adjusted.

b. The chair has a footrest that can be set at the height

In general, when mothers breastfeed their babies, it is strongly recommended that the feet do not hang. These goals are recommended so that the mother's feet do not get tired quickly due to a very long nursing position. So that the footrest is designed to provide comfort for the mother when sitting.

c. The chair has a headrest

This breastfeeding chair is designed to meet the needs of mothers in public places, one of which is the airport. The need for headrests on this part of the chair greatly helps the mother to comfort her breastfeeding her baby. Traveling by plane sometimes takes a while to make you tired.

d. The chair has a baby body support cushion

The cushion used as a support for the baby's body is one of the latest innovations that can help mothers breastfeed their babies. This cushion will relieve the fatigue experienced by the mother in the forearm and upper arms. This cushion aims to support the baby's body without having to be supported by your arms. These pads will be equipped with soft foam with an iron frame underneath. The iron frame aims to ensure that the bearing is strong and the baby remains safe in the arms of the mother.

Technical Characteristics	Cover the seat with super foam with a webbing system	The armrest is foam coated with a webbing system	Make a height adjustable footrest	The backrest is made by a lever system on the side of the chair so that you can adjust the tilt level	Make a cushion to support the baby's body on the armrest	Headrests are made above the neck cushions	Neck cushions are made above the backrest	The seat height adjustment is made by the height seat adjuster system	The seat is made to be flexible so that it can rotate in all directions	Make a place to put tissue, bottles and small drawers by the chair	The chair is made with a type of linen fabric with soft colors	The chair is made of iron skeleton	The regulator is made flexible	The chair is made according to the dimensions of the body	The chair is made with a portable system	The chair is designed according to the development of the times
Customer Requirements	***Relationship Matrix***															
The seat has a soft foam holder	•															
The chair has a left and right armrest		•			•											
The seat has a footrest			•													
The chair has a height / low footrest			•													
Chairs have a backrest				•			•									
The chair has a back slope adjustment				•												
The chair has a pillow to support the baby		•			•											
Seats have headrests						•										
Chairs have pads on the neck						•	•									
Chairs can be raised lower as needed								•								
Chairs can be rotated in all directions									•							
Chairs have a place to put tissue										•						
seats have a place for a bottle of drink on one side of the chair										•						
Chairs have small drawers to store breastfeeding equipment										•						
The chair has a soft seat layer	•										•					
Seat is strong or not easily broken				O	•			Δ	O			•			O	
The seat holder layer is not easily damaged											O					
The seat seat foam is not hot	•															
The seat height regulator is not easily damaged			•										•			
The footrest height controller is not easily damaged													•			
Chairs have a size that matches the size of the body														•		
Seats can be taken anywhere												•			O	
The chair is made of lightweight material												O				
Chairs can be folded												•			•	
Seats that are designed do not harm users				•					O				O	O	O	Δ
Chairs designed like sofa chairs												•				Δ
The chair has a unique and attractive design			O	O		•	•	Δ					Δ			O
Seats have a contemporary design			O	O				Δ					Δ			O
The seat holder is green											O					Δ
Layer seat holder has a soft color (pastel)											O					Δ
Priority Values	7	10	1	3	5	9	8	13	14	4	12	2	6	15	11	16

Figure 2: House of Quality

e. The chair has a neck rest that can be disassembled put

Neck pads that can be disassembled installed in a chair are one of the innovations that are desired by some respondents breastfeeding mothers. Due to the posture of your neck which often bends when breastfeeding so that makes you get tired quickly. The need for neck cushions on this part of the chair helps the mother comfort in breastfeeding her baby.

f. The chair has several small drawers on the side of the chair

One feature that mothers want when breastfeeding their babies in a public place is that the chair has several small drawers and several places to put breastfeeding equipment such as tissue and drinking bottles. The purpose of designing the drawers is to provide other functions to the chair. These drawers can make it easier for you when you breastfeed your baby, and you don't have to bother to take the equipment in the bag.

g. The chair has an armrest that can be set at the height

The chair is designed very considering the comfort of Mother when using it. One of the comforts provided is the height-adjustable armrest feature. The armrest will adjust your desire to raise and lower the baby's cushions and make room for you to be free to use the breastfeeding chair.

Based on the features of this chair, here is a picture of the design of a breastfeeding chair that can be seen in Figure 3.

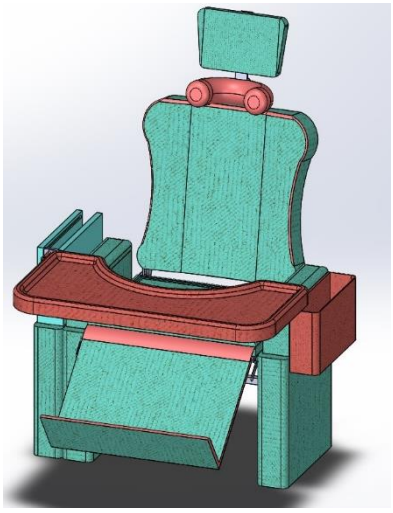

Figure 3: Ergonomic Breastfeeding Chair Design

DISCUSSION

Based on the results of customers' important rating on the importance of breastfeeding mothers the highest value is the statement of the color of the chair that is soft, the material is light and the chair is not easily broken the highest. These are some of the most important things Mother desires when breastfeeding. The lowest level of importance is the statement of the chair

has a green color which means that respondents feel the color of the chair is not very important when breastfeeding.

Consumer desires regarding a soft seat and not easily heat can be technically translated into a chair made using super foam with a webbing system. The seat holder is soft and does not heat easily, the chair is given super foam because it is not easily deflated, strong, and durable.

Assess the strength of the relationship with a scale of numbers or symbols. Experts have assessed the relationship between consumer needs and technical characteristics. The seat has a soft foam holder which has a very strong rating with the seat coated with a super foam holder with a webbing system. Experts consider that there is a very strong and influential relationship in meeting the needs of consumers. The chair has a contemporary design that has a moderate influence with the seat backrest that can be adjusted in height. The experts consider that there is a significant influence in meeting the needs of consumers. And so on for the assessment of experts on the relationship of consumer needs with technical characteristics.

The experts in the field of chair production in designing these chairs have a level of difficulty that can make consideration in determining the priority characteristics of the technique. The greatest difficulty is found in the high-low seat regulator, the chair can be rotated in all directions and the chair is made with a portable system. Experts consider this in designing the breastfeeding chair for mothers who are calculated in determining priorities using the contribution formula and the normal contribution. So that obtained characteristics that will be improved in the process of designing a breastfeeding chair for mothers. The 10 of the 16 priorities were selected based on the difficulties that have been considered by experts in the field of chair production, namely covering the seat with super foam with a webbing system, armrests covered with foam with a webbing system, making adjustable footrests, backrests made with a lever system on the side of the chair so that you can adjust the level of the tilt, make a cushion to support the baby's body on the armrest, headrests are made on the neck pillow, neck pads are made on the back of the back, make a place to strip tissue, bottles, and small drawers on the side of the chair, the chair is made from basic materials wooden and iron frames, and regulators made flexible.

The relationship between each of the technical characteristics is located at the top and its shape resembles a roof. Symbols express the determination of the technique's correlation. The relationship between covering the seat with super foam with the webbing system and with the foamed armrest with the webbing system has a strong positive relationship because the relationship of the technical characteristics is mutually supportive of making the chair very soft. The relationship between chairs made of iron and wood has nothing to do with chairs made by the times.

The results of the ergonomic breastfeeding chair design are very different from breastfeeding chairs that are commonly used by mothers when in public places. Field observations that have been made at the Minangkabau International Airport show some of Mother's complaints about the seats she uses. The chair is just a long couch in general. One of the mothers felt uncomfortable using the long couch. It occurs due to the use of chairs that do not have a divider and cannot be utilized properly by the family. Breastfeeding mothers that result in mothers when breastfeeding with other mothers becomes very disturbed.

The results of Quality Function Development are vastly different from today's breastfeeding chairs. The chair designed is not a long sofa chair but a single chair that is devoted to nursing mothers. The results of this design will provide comfort and awareness to others not to carelessly use a chair to sleep and some other activities that can interfere with other nursing mothers. The next difference is that the chair is more designed considering the ergonomic comfort of the mother when breastfeeding her baby.

The design of this breastfeeding chair is done by adding some ideas and innovations from the designer. The QFD results that have been obtained are then combined with several designer ideas so that a chair is produced that complements the needs of the mother in breastfeeding her baby. Some of these feature ideas are that the chair has a backrest that can be tilted at an angle of 95.105, and 110 degrees with the help of a handle, the chair has adjustable footrest with an angle of 120, 140, and 180 degrees with the help of a handle, the chair has a headrest, the seat has a baby body support cushion that can be used or not, the cushion can be adjusted in height, the padding can be moved forward and back, the chair has a removable neck pad, the chair has a small drawer on the side of the chair and the chair has a usable armrest or not by adjusting its height.

CONCLUSION

This study showed that the redesign of the breastfeeding chair had been made using an ergonomic approach. The design has considered 105 anthropometric data for breastfeeding mothers whose statistics have been tested. This consideration will be a reference in the selection of percentiles and allowances that fit in the dimensions of the ergonomic nursing chair

dimensions. Appropriate dimensions will provide comfort for breastfeeding mothers at Minangkabau International Airport. The seat features are as follows: the chair has a backrest that can be tilted at an angle of 95.105, and 110 degrees with the help of a handle, a height-adjustable footrest with an angle of 120, 140, and 180 degrees with the help of a handle, has a headrest, baby body support cushions, has a small drawer on the side of the chair, has an armrest that can be used or not by adjusting its height.

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