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วารสารวิชาการอุตสาหกรรมศึกษา คณะศึกษาศาสตร์ มหาวิทยาลัยศรีนครินทรวิโรฒ  
ปีที่ 12 ฉบับที่ 1 มกราคม – มิถุนายน 2561

JOURNAL OF INDUSTRIAL EDUCATION, FACULTY OF EDUCATION, SRINAKHARINWIROT UNIVERSITY

Volume 12 No. 1 January – June 2018

## ปัจจัยที่มีผลต่อการปวดหลังของหญิงในท่าหนึ่งให้นมลูก

### Factors Affecting Back Pain Of Women Sitting Inbreast Feeding Posture

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#### บทคัดย่อ

การเลี้ยงลูกด้วยนมแม่นั้นเป็นที่ยอมรับกันอย่างกว้างขวางถึงประโยชน์อันมากมายจึงทำให้การให้นมบุตรนั้นได้รับการสนับสนุนจากทั่วโลก การให้นมบุตรในท่าหนึ่งอย่างต่อเนื่องเป็นระยะเวลานานนั้นอาจส่งผลให้มีอาการปวดหลังตามมา งานวิจัยนี้จึงได้ศึกษาผลกระทบของท่าหนึ่งในขณะที่ให้นมบุตรที่ส่งผลต่อการออกแบบเก้าอี้เมื่อเกิดอาการปวดหลัง ตัวแปรของการออกแบบเก้าอี้คือ มุมองศาของพนักพิงหลัง ความหนาพนักพิงส่วนเอว (lumbar support) และความสูงของที่เท้าแขน กลุ่มตัวอย่างที่ใช้ในการวิจัยนี้คือผู้หญิงไทยที่ผ่านการมีบุตรมาแล้ว จำนวน 12 คน โดยเริ่มต้นด้วยการสัมภาษณ์ข้อมูลส่วนบุคคลที่เกี่ยวข้อง เก้าอี้ที่ใช้ในการทดสอบเป็นเก้าอี้ที่สามารถเพิ่มมุมองศาของพนักพิงหลังที่ 90, 100, 110 และ 120 องศา. ความหนาของพนักพิงส่วนเอว (lumbar support) 0, 3, 5, 7, 9 และ 11 ซม. และความสูงของที่เท้าแขนตั้งแต่ 15, 18, 21, และ 24 ซม. เครื่องมือที่ใช้วัดการปวดหลังนั้นคือเครื่องมือวัดการทำงานของกล้ามเนื้อ (electromyography :EMG) โดยการวัดร้อยละของการหดตัวของกล้ามเนื้อสูงสุด (percentage maximum voluntary contraction :MVC) โดยใช้หน่วยเป็นไมโครโวลต์จากนั้นก็สัมภาษณ์หลังจากการทดสอบแต่ละครั้ง ผลจากการวิจัยพบว่าท่าหนึ่งให้นมบุตรบนเก้าอี้ที่มีผลต่ออาการปวดหลังมากเมื่อมีการเพิ่มมุมของพนักพิงหลังจาก 90 องศาถึง 110 องศาซึ่งส่งผลให้ค่า MVC นั้นลดลง 50 % แต่เมื่อมุมองศาของพนักพิงหลังเพิ่มขึ้นกลับส่งผลให้ค่า MVC นั้นเพิ่มขึ้น ในส่วนของการเพิ่มความหนาพนักพิงส่วนเอว (lumbar support) จาก 0 ซม. (ไม่มีพนักพิงส่วนเอว) ถึง 9 ซม. พบว่าค่า MVC นั้นลดลงได้มากกว่าสองในสาม ส่วนความสูงของที่เท้าแขนนั้นมีผลต่อค่า MVC เป็นอย่างมากซึ่งพบว่าตำแหน่งความสูงจากเบาะนั่งถึงที่เท้าแขน 21 ซม. นั้นทำให้มีค่า MVC ลดลงเกือบ 80 % เมื่อเทียบกับการนั่งโดยไม่มีที่เท้าแขน สรุปว่าท่าหนึ่งนั้นมีผลกระทบต่ออาการปวดหลังของหญิงที่หนึ่งให้นมบุตร โดยตัวแปรของการออกแบบที่สำคัญได้แก่ มุมองศาพนักพิงหลัง ความหนาพนักพิงส่วนเอวและความสูงของที่เท้าแขนโดยทั้งหมดนี้มีผลต่อ

อาการปวดหลังของแม่ในขณะที่ให้นมบุตรซึ่งเป็นสิ่งสำคัญสำหรับความสบายและมีสุขภาพดี ดังนั้นการออกแบบเก้าอี้ที่มีขนาดสัดส่วนที่เหมาะสมจะช่วยลดอาการปวดหลังของแม่ในขณะที่ให้นมบุตร

**คำสำคัญ:** การให้นมลูก, การออกแบบเก้าอี้การยศาสตร์, ปวดหลัง, ทำนั้งให้นม

**Abstract:**

The benefits of breastfeeding are widely recognized and breastfeeding is being promoted worldwide. Sitting breastfeeding babies for a prolong period of time could result in considerable back pain. This paper examines the effects of breastfeeding sitting postures, as influenced by chair design, on back pain. Specific chair design variables investigated are backrest angle, lumbar support, and armrest. The participants, 12 Thai women, were asked to sit in various breastfeeding postures. The chair was adjustable so that the effects of backrest angle, lumbar support thickness, and armrest height on back pain could be studied. The percentage maximum voluntary contraction (MVC) of the back pain was measured by electromyography (EMG) in 90 min with 15 minutes breaks between different measurements. Follow up interviews were also conducted after each test. Sitting postures for breastfeeding as dictated by chair design, affect on back pain considerably. Increasing backrest angle from 90 to 110 degree resulted in a decrease in MVC value about 50% while increasing the angle further resulted in an increase in MVC value. Increasing lumbar support thickness from zero (no support) to 9 cm led to a reduction in MVC value of more than two thirds. Armrest height also had a large effect on MVC value. Using the armrest height of 21 cm resulted in almost 80% reduction in MVC value compared with the value when no armrest was used. Chair design affects back pain in women sitting in breastfeeding posture. Design variables; backrest angle, lumbar support thickness, and armrest height, all influence back pain. As back pain is important for the well-being of breastfeeding mothers, it is imperative to design chairs with proper design parameters in order to minimize back pain.

**Keyword:** Breastfeeding, Ergonomic chair design, Back pain, Breastfeeding sitting postures

## Introduction

The importance and benefits of breastfeeding is well recognized, and breastfeeding is being promoted in various parts of the world. In the USA, for example, the number of breastfed infants is increasing and there are many initiatives to promote breastfeeding (Charles E and Phelps, 2011; Lana R et al, 2011). Breastfeeding is also prevalent in Europe, particularly in Scandinavian countries like Norway and Sweden (AgnetaYngve and Michael Sjostrom, 2001;KellyMom,2016). Breastfeeding is also increasing in China although there are several problems and obstacles associated with the endeavor (FemglianXu et al, 2009). In Thailand, there are several projects initiated by government bodies as well as private and nonprofit organizations to promote breastfeeding, through the establishment of foundations, specialized clinics, and breastfeeding centers (UNICEF Thailand, 2016). Breastfeeding is not only beneficial to the health of infants but also to that of the mothers (Charles E. Phelps, 2011). Economic benefits can also be derived from breastfeeding (Bartick M and Reinhold A,2010).

There are several factors affecting breastfeeding effectiveness such as mental and physical health of the mothers, dietary intakes and others. One of the factors related to breastfeeding effectiveness is back pain of the mother. Preliminary interviews with several breastfeeding mothers revealed that sitting for a long period of time breastfeeding babies can cause a good deal of ache and pain; low back pain, neck and shoulder pain, thigh pain. Such pains would undoubtedly affect the health of the mother and consequently the effectiveness of breastfeeding (Natural childbirth V, 2016). Understanding relevant factors affecting the pains during breastfeeding would lead to possible measures that could mitigate or minimize such pains.

Back pain can result from internal factors such as disc degeneration, sprains or strain, and external factors such as gender, age, and occupation (Thomas Reilly et al, 2006). A study on back pain showed that 21% resulted from sitting postures (Van Niekerk et al, 2012). Sitting in bending postures results in bending of spine (Andrew Claus et al, 2008) causing muscle more strain due to increased pressure on disc, which ultimately lead to fatigue and discomfort (Falk Mörl and Ingo Bradl, 2013). To minimize back pain resulted from prolonged sitting, it is necessary to avoid sitting postures that cause bending of the back and minimize the pressure on the disc. The disc pressure was found to be considerably reduced when lumbar support and armrests were used when sitting on chairs (Steven M. Carcone and Peter J. Keir, 2007; Beach et al, 2005) found that bad sitting posture could cause backward rotation of pelvis and suggested that degeneration of lumbar could be prevented or ameliorated by using a well-design low-back support. Some of the mass of a seated body can be supported by a backrest thus reducing apparent mass and reduce the possibility of back pain (NaserNawayseh et al, 2004).

In addition, it was found that the upward reaction forces of the armrest on the arms, generated when leaning with the armrests, reduced spine compression (Antonius Rohlmann et al, 2011). The armrest reduced the mean maximum hip moment (Ulf P. Arborelius et al, 1992) and reduced seat forces by carrying some of the body weight (Tom Defloor and Maria H.F. Grypdonck, 1999). Arm supports were found to reduce loads on the trapezius (T. Murphy et al, 2011) supraspinatus and anterior deltoid (Ericson, M.O. and Goldie, I, 1989)

and shoulder pain (Arne Aarås et al, 2001). Most of the studies on back pain were conducted with workers, drivers, children, the elderly, and disable people as subjects. There has been no study on back pain of breastfeeding mothers published in open literature.

## Research Objectives

This research aims to explore the effects of breastfeeding sitting postures, as influenced by chair design, on low back pain. Specific variables to be investigated are; lumbar support thickness, backrest angle, and height of armrest. The knowledge from this research will be very useful for designing and developing breastfeeding chairs that are more comfortable and specifically suited for breastfeeding mothers.

## Significance of the Research

1. Know aboutto effects of breastfeeding sitting postures, as influenced by chair design, on back pain.
2. Use basic guidelinesfor ergonomic chairs design.

## Scope of the Research

### Participants

The participants in this study were all Thai women. They have aged20-35years old that were aged of pregnancies on average between 20- 35years.All of the 12 subjects had breastfeeding experience. The participants were ordinary people leading normal lives and having no serious health problems or other medical complications such as serious accidents or chronic diseases. Personal details of the subjects are summarized in Table1.

Table 1 Personal details of subjects

Subjects No.	Heigh (cm.)	Weight (kg.)	Age (years)	BMI (kg/m <sup>2</sup> )	Occupations
1	157	53	20	21.50	Housewife
2	156	50	25	20.55	Automobile assembly worker
3	152	51	30	20.07	Housewife
4	160	46	28	17.97	Weaving factory worker
5	154	40	22	16.87	Part time
6	150	58	24	25.78	Part time
7	164	54	27	20.08	Weaving factory worker
8	156	55	32	22.60	Automobile assembly worker
9	150	70	23	31.11	Weaving factory worker
10	153	54	20	23.07	Housewife
11	150	48	32	21.33	Weaving factory worker
12	155	54	33	22.48	Weaving factory worker

**Variable**

This paper examines the effects of breastfeeding sitting postures, as influenced by chair design, on back pain. Specific chair design variables investigated are backrest angle, lumbar support, and armrest.

**Methodology*****Instrument and Protocol***

The low back pain in this study was measured indirectly by electromyography method. A surface electromyography (EMG) device, the Muscle Tester (Mega ME3000P4, Mega Electronics Ltd, Finland), offers a comprehensive tool for the assessment of muscle activity. EMG measurement is accessed by attaching electrodes to the surface of the skin and recording the changes in electrical activity in the muscle directly beneath them. The Muscle Tester consists of a ME3000P4 Measurement Unit, a 4MB memory card, and two EMG preamplifier cables each of which have two measurement channels which attach to the electrodes. This EMG device is run on a MegaWin software program. The sampling rate was set to 1000Hz, and one minute of data were collected and stored during each of the performance test.

The research started with interviewing the subjects to gather relevant personal information. These include the number of children they have, breastfeeding periods and durations, personal experience during breastfeeding, age, occupation etc. They were then measured for their weights and heights.

The skin corresponding to the lumbar area was cleaned using cotton with alcohol. When the skin was dry, two surface electrodes (Blue Sensor P-00-S) were placed at L3 area one each on either side of the spine and at the distance of 3 mm from the spine. The pain of the subjects were measured in terms of percentage maximum voluntary contraction (MVC), the unit was in microvolts.

After the personal resistances of individual subject were measured, each subject was instructed to carry a baby doll (weight 6 kg.) on the right hand and sit on an adjustable chair in the breastfeeding posture as shown in Figure 1. That infants breastfed to only 6 months had weight of 6kg in average. In this research a baby doll was used because the nature of infants have different of temperaments such as movement, response to stimuli and changes of emotion.

The chair can be adjusted to have different backrest angles such as 90, 100, 110 and 120 degrees. The lumbar support thickness can be adjusted from zero (representing no support) to 3, 5, 7, 9, and 11 cm. The armrests height can also be adjusted from zero (representing no armrest) to 15, 18, 21, and 24 cm. All the supports were made from polyurethane foam.

The length of time used in measuring MVC for each test was 90 minutes with 15 minutes breaks between different measurements. Behaviors of the subjects such as body movements and facial expressions were observed and recorded during the experiment.

After each test, all the subjects were interviewed regarding to comfort or discomfort during the experiment and general feeling about the experience when different backrest angles, lumbar support thickness, and heights of armrest were used.



Figure 1 Sitting posture of the subjects

## Results

### *Effect of backrest angle on MVC*

The effect of backrest angle on MVC is as shown in Figure 2. The results showed that MVC values decreased when the backrest angle was increased from 90 to 110 degrees and increased slightly when the backrest angle was further increased to 120 degrees.

The changes in MVC values as measured at the left hand side of the spine are slightly different from those measured at right hand side. The left hand side MVC values changed rather rapidly dropping from about 37 mV to approximately 16 mV when the backrest angle was increased from 90 to 100-110 degrees before increasing as the backrest angle was further increased to 120 degrees. The change in MVC values for the right hand side was more gradual dropping from about 34 mV to 18 mV when the backrest angle was increased from 90 to 110 degrees. The results demonstrated that backrest angle had profound influence on back pain of women sitting in breastfeeding postures. We can tentatively conclude from the present experimental data that the optimum backrest angle corresponding to minimum back pain is around 100-110 degrees.

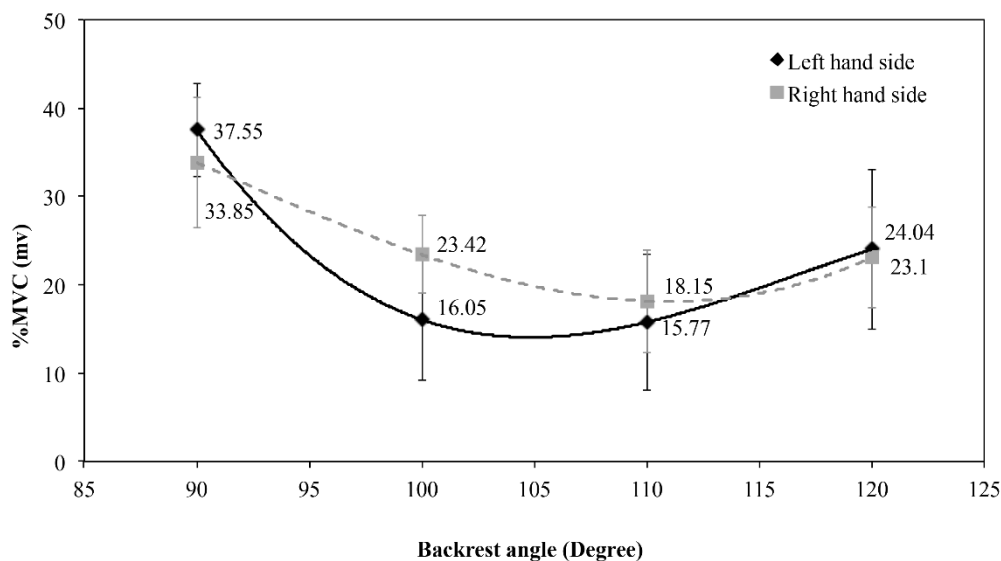


Figure 2 Effect of backrest angle on MVC

### **Effect of lumbar support on MVC**

The effect of lumbar support thickness on MVC is as shown in Figure 3. The results showed that MVC values decreased significantly when the supports were used.

The MVC values dropped rapidly to almost one half once a 3 cm thick lumbar support was introduced compared with the values when no lumbar support was used. As the lumbar support thickness was increased, the MVC values further decreased but at a lower rate. The optimum lumbar support thickness that resulted in a minimum MVC values was found to be around 9 cm. The results demonstrated conclusively that the use of lumbar support is effective in reducing back pain of women sitting in breastfeeding postures. Using appropriate lumbar support could reduce back pain as much as 300%.

The post experiment interviews regarding the use of lumbar supports revealed that most of the subjects (57%) felt most comfortable when the chair had supports with thickness of 9-11 cm. Some participants (20%) felt that 7 cm support thickness was the most comfortable while 14% felt 5 cm thickness was the best. All participants agreed that the chair with lumbar support was much more comfortable than that without support.

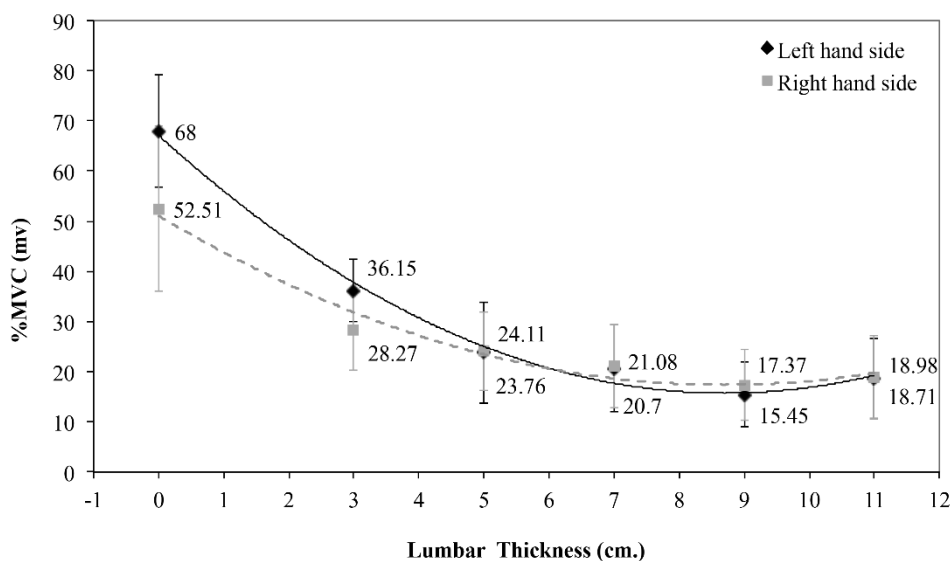


Figure 3 Effect of lumbar support thickness on MVC

#### **Effect of armrest height on MVC**

The effect of the height of armrest on MVC is as shown in Figure 4. The results showed that MVC values decreased significantly when the armrests were used.

It can be seen that the introduction of armrest, like lumbar support, significantly reduced the MVC values. The MVC values were lowered by some 50% when a 15 cm armrests were introduced compared with those when no armrest were used. As the height of the armrests was increased, the MVC values decreased by almost 80% of the original values. The optimum value of the armrest height was around 21 cm. The results demonstrated that the use of armrests with appropriate height could reduce back pain significantly for women sitting in breastfeeding postures.

It can be seen that the armrest height had a profound effect on MVC values. Appropriate value of armrest height can reduce the MVC value as much as 80%.

The post experiment interviews regarding the effect of armrest revealed that most of the subjects felt most comfortable when using the armrest with the height of 21 cm. Some participants felt that 18 and 24 cm arm support height were the most comfortable. The results again showed that the 'feeling' of the participants and the measured MVC values are not 100% in agreement. All participants, however, agreed that the chair with arm support was more comfortable than that without support.



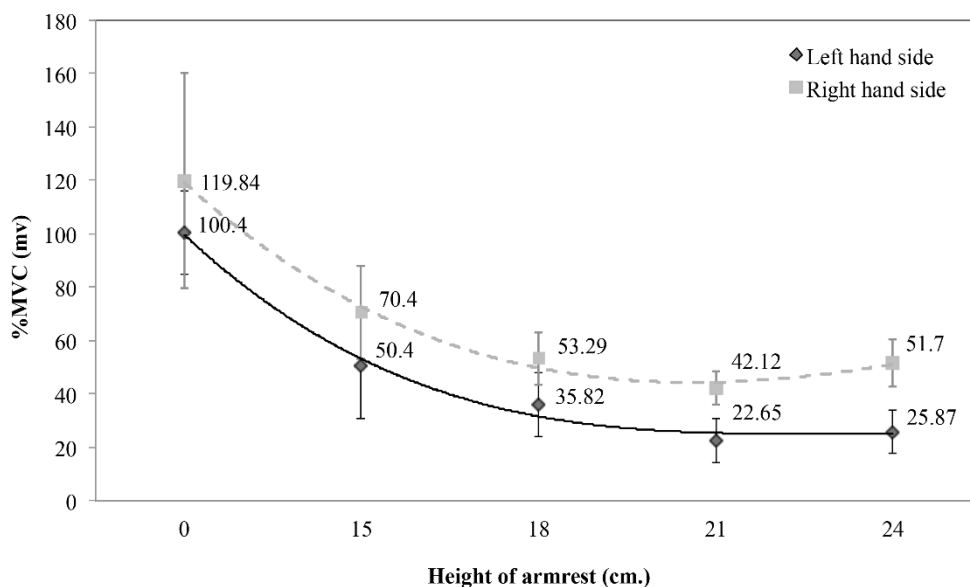


Figure 4 Effect of armrest height on MVC

## Discussion

The results showed that back pain resulting from sitting in breastfeeding posture is dependent on the parameters of the chair such as backrest angle, lumbar support thickness, and armrest height. Regarding backrest angle, increasing backrest angle of the chair from 90 to 110 degrees resulted in decrease in MVC values. This is thought to be due to greater transfer of body weight to the backrest. Effective body weight (and the weight of the baby doll) decreases with increasing backrest angle resulting in lower MVC values. When the backrest angle was increased too much (120 degrees), the MVC values started to increase because of too much strain in the body. The results are in general agreement with the work of other investigators studying low back pain of office workers (O'keeffe et al,2013).The effect of armrest height is even more dramatic than that of the backrest angle, particularly when compared with the chair without armrest. This again can be explained in terms of body weight transfer. Without the armrest, all the weight is borne by the bottom part of the body resulting in high MVC values. With the armrest, part of the body weight (and the weight of the baby doll) is transferred to the armrest. Effective body weight is lower hence lower MVC values. The optimal armrest height of about 21 cm. corresponds to the position for the best weight transfer. The results are also in generally agreement with the work of other investigator (LiesbethGroenesteijn et al, 2009).

Increasing lumbar support thickness resulted in decreasing MVC values. This is because the support reduced the bending of the spine thus reducing the strain in the low back region. And the greater the thickness of the support, the greater the 'reduction' effect. MVC values lowered comparatively rapidly when support thickness was increased from zero (no support) to 3 and 5 cm. This means that even a small support thickness is beneficial. The leveling off of MVC values at 9 cm support thickness suggested that this thickness is the most suitable for breastfeeding. The results are different from those of Steven and colleagues in their study of computer workstation and found that the optimum support was 3 cm (Andrew Claus et al, 2008).

This research demonstrated that the characteristics of the chair used during breastfeeding could play an important role in the comfort or discomfort and back pain of breastfeeding mothers. As these would influence the effectiveness of breastfeeding and the wellbeing of the mother and the child, selection and/or modification of the chairs that are to be used during breastfeeding are important. The results can serve as guidelines for chair selection or modification so that breastfeeding mothers suffer minimum back pain. There are many other features of chairs, however, that could influence back pain which need to be further researched in the future. Interview results indicated that characteristics of breastfeeding mothers, such as their ages and vital statistics, are also important and need to be considered in selecting or modifying chairs.

It must be mentioned at this point that the present study has a number of limitations. Firstly, the subjects in this study are Thai women who had breastfed their children some years earlier. The results might not be generalizable for women from other countries or women who do not have the same experience as the subjects. Support thickness of the chair might be different for different groups of breastfeeding mothers. The optimum values of backrest angle, armrest height, and lumbar Secondly, there may be other variables such as age, socioeconomic background, weight, height, emotional state that play important role regarding back pain in addition to sitting postures and chair design. Finally, the subjects in this study are not actually breastfeeding babies during the tests. The results are bound to be different from the results obtained from testing the mothers who are actually breastfeeding (i.e. actual breastfeeding mothers). Nonetheless the results from this study did indicate that sitting postures and chair designs could strongly influence back pain.

## Conclusion

The following conclusions can be drawn from this study;

1. Back pain of women sitting in breastfeeding posture is influenced by chair design. Backrest angle, armrest height, and the use of lumbar support and lumbar support thickness are found to have profound effects on back pain as measured by MVC values.

2. Increasing backrest angle of the chair from 90 to 110 degrees results in lower MVC values which represent lower back pain. Further increase in backrest angle leads to an increase in MVC values. The optimum backrest angle of the chair to be used for breastfeeding is between 100-110 degrees

3. Armrests have dramatic effect on MVC values. Chairs with armrests can reduce the MVC values as much as 80% compared with chairs without armrests. Armrest height of about 21 cm. was found to be optimal when sitting in breastfeeding posture.

4. The use of lumbar support was found to reduce back pain significantly compared with that when using the chair without lumbar support. The MVC values decreased with increasing lumbar support thickness. The optimum value of lumbar support thickness was around 10 cm.

### Suggestion

Further research is required to identify other key factors that could affect back pain and general well-being of breastfeeding mothers. Chairs for breastfeeding mothers should be properly selected, modified, or designed so that the back pain of the mothers is minimal. This would result in better mothers and health increased breastfeeding effectiveness.

### Acknowledgements

The study is financially by the Commission on Higher Education and Rajamangala University of Technology Krungthep, Thailand for financial support for this research.

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