



Innovation Article

Innovation relaxation belts to reduce labor pain intensity and increase β -endorphine levels

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ABSTRACT

Background: Labor pain feels tremendous, and only 2-4% of mothers low pain during labor. Heat therapy is a non-pharmacological method. The heat therapy is still conventional, and this study uses a relaxation belt with more stable, dry heat media, and comfortable.

Objective: This study aims to develop and test a relaxation belt for efforts to reduce labor pain intensity and increase β -endorphin levels in the primigravida of the active labor phase.

Method: This study Research and Development (R&D). It consisted of 5 stages; stage I (literature study), stage II (product development), stage III (expert validity and phase I trials), stage IV (product revision and final product), and stage V (phase II trials).

Results: The relaxation belt has been created, it has been validity experts test and field trials. The result that the relaxation belt is more effective in reducing pain and increasing β -endorphin levels than warm water compress (mean different pain labor 2.40; $p < 0.01$; effect size 1.72 and mean different increasing β -endorphin levels 53.34; $p < 0.01$; effect size 2.42).

Conclusion: The relaxation belt is effective in reducing labor pain intensity and increasing β -endorphin levels.

INTRODUCTION

Pain experienced by a woman when entering labor is a physiological or regular process.¹ Labor pain is a response to nerve stimulation caused by uterine contractions and tissue damage during labor.² In the first stage of labor, the increased contraction of the uterine muscles, the cervix is opening by the opening of the birth canal; usually, the pain will also increase.³ Pain in labor is pain with the highest severity compared with pain in cancer patients and toothache pain.⁴

Research conducted in the UK, 93.5% of women experienced severe or unbearable pain during labor. In comparison, in Finland, 80% described labor pain as very severe and intolerable, and only 2-4% of mothers experienced mild pain during labor.⁵ Research results in China were in phase the latent delivery rate of fetal distress in the moderate pain group was 36.6% higher than the mild pain

group of 13.8%. In contrast, in the active phase of labor, the fetal distress rate was 36.5% in the severely ill group, significantly higher than the fetal distress in moderate pain group 18.5%.⁶ Currently obtained from 20% to 50% of deliveries in private hospitals in Indonesia are performed by cesarean section. The high rate of cesarean section is because mothers who want to give birth choose relatively painless operations.⁷

Management reduces labor pain through pharmacological and non-pharmacological methods.^{8,9} Management of pain reduction using pharmacological methods is by analgesic drugs. Analgesic and epidural anesthesia have side effects, such as; sleepiness, nausea, vomiting, breathing problems, hypotension, uteroplacental vascular insufficiency, and fetal bradycardia.^{10,11} Management of pain reduction with non-pharmacological methods that are easily applied is heat therapy. When heat therapy is applied to touch receptors and stimulated temperature will create relaxation and pleasant sensation. The signal from pain will

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compete with the pleasant sensation to access the spinal cord and reduce pain.¹² The point of the meridian acupoint to reduce pain in the first stage of labor is at the point T10-L1.8 At this point in the spine which ultimately receives information from the uterus, birth canal, and perineum.¹⁰

This study is the development of previous studies. In previous studies, therapy to reduce pain labor still manual and conventional such as the hot media used were iron slabs, warm/hot compresses using a towel, a warm shower for bathing/bathing, and hot herbal compress packs. so that innovative heat therapy is needed that can provide comfort and pain reduction during labor.^{13,14} This study aims to develop and test a relaxation belt and compare the effectiveness of the relaxation belt with a warm compress method in reducing labor pain intensity and increasing β -endorphin levels.

METHOD

The method used in this research is the Research and Development (R&D) method by adopting the simplified Borg and Gall model.¹⁵ It consisted of 5 stages; stage I (literature study), stage II (product development), stage III (expert validity and phase I trials), stage IV (product revision and final product), and stage V (phase II trials).

Research Phase I

At this stage are the literature review and preliminary study. This study researchers were gathering information from the literature and interviews with 20 pregnant women—the results from this stage used as a reference for making products.

Research Phase II

This stage is product development. The data obtained from the phase I research used to make the design and development of a relaxation belt following the user's needs.

Research Phase III

This stage is expert validity and phase trial I, relaxation belts that have designed then evaluated or validation of worthiness and comfort performed by health technologists, neurologist, and midwives. Health technology experts in this study are experts in health research using technology for research with minimum doctoral education. In this study, the pain pathophysiolgologist is an expert in the field of pain nerves, a neurologist who knows the pain points in labor. Midwives who become assessors are midwives who are responsible for carrying out field programs. The phase trial I; relaxation belts evaluate with a small sample of 12 primigravida first stage mothers in the active phase.

Research Phase IV

This stage is product revision and the final product. Relaxation belts that have been validated by experts are then revised according to the suggestions and input of expert validation after the revised relaxation belt is ready at the final product stage and can use in the phase II trials.

Research Phase V

At this stage is phase II trials, the product test phase uses a type of quasi-experimental research with a pre-post control group design. The population in this study were all primigravida term pregnant women in Tegowanu Puskesmas, Gubug I Puskesmas, Gubug II Puskesmas, Gondong Puskesmas and Grobogan District Nurhikmah Maternity Clinic which were estimated to be born in February, March and April 2020. The total study population in this study was 283 primigravida, pregnant women. The sample in this study totaling 40 primigravida wares divided into two groups. Relaxation belt group (20 respondents) and warm water compress group (20 respondents).

The sample in that inclusion criterion of primigravida pregnancy, the active phase of the opening cervix was 6,7 and 8, aged 20-35 years, at term pregnancy with 37-40 weeks gestation, single pregnancy, and want to be a respondent. In contrast, the exclusion criteria in this study are; multiple pregnancies, high-risk pregnancy, pain medication, and childbirth with excessive anxiety. Data collection techniques used the NRS pain scale and blood collection to check β -endorphin levels. Data regarding reduce pain labor and increasing of β -endorphin levels to analyze the difference in effects after treatment an independent T-test used.

RESULTS

Literature Review and Preliminary Study

Based on literature studies and interviews with 20 term pregnant women regarding painless labor, the researchers found that non-pharmacological management of heat therapy was the first choice for pregnant women in reducing pain during labor. So the researchers took the initiative to develop heat therapy in previous studies in the form of a relaxation belt as a heat therapy tool in reducing the intensity of labor pain and increasing levels of beta-endorphin.

Product Development, Expert Validity, Phase Trial I and Product Revision

The initial product development took the form of assembling tools assisted by a team from Gadjah Mada University Vocational School to adjust the heat of the relaxation belt with labor nerve pain points the heat generated and the safety component of the relaxation belt that accompanies. The belt is modified into a relaxation belt with a temperature and heat sensor according to the acupoint for the

heat that can be adjusted for nerve pain during labor with specifications of length 114 cm width 17 cm, short section length of 33 cm width 10, width 15 cm.

The fabric on this relaxation belt form of polyvinyl chloride cotton can withstand body heat.¹⁶ This relaxation belt has an electric current that is used with a safety standard of 7.9 VDC with a safe limit of 120 VDC.¹⁷ The validation results obtained from all experts based on the validity criteria get a score of 92.5, which means that the validity criteria in the expert validation assessment are valid. Then conducted testing with a small sample of 12 primigravida first stage mothers in the active phase (Table 1).

Table 1. The intensity of labor pain before and after the relaxation belt trial (n = 12)

The Intensity of labor pain	n	Mean Rank	Z	p-value
Negative Rank	11 ^a	6.00	-2.969	0.003
Positive Rank	0 ^b			
Ties	1 ^c			

^a Post < Pre

^b Post > Pre

^c Post = Pre

After giving heat therapy in the form of a relaxation belt, as many as 11 respondents experienced a decrease in labor pain. As much as one respondent did not experience a decrease in labor pain ($p < 0.05$), which means it can be concluded that a relaxation belt can reduce the intensity of labor pain in the maternal active phase.

After the validity and phase I tests, the relaxation belt requires revision, i.e., the heat generated tends to decrease if applied more than 50 minutes. Hence, the researchers work again with the team to correct the deficiencies. The

final results of the relaxation belt products are shown in Figur 1 dan Figur 2.

Phase II Trials

Based on the results of the phase II trials, 40 primigravida respondents in the first phase of the mother in the active phase, most mothers gave birth aged 21-25 years (72.5%). Also, the majority of secondary school graduates were 23 respondents (57.7%). A total of 25 respondents were working mothers (62.5%). Whereas, at the anxiety level, most mothers experienced moderate anxiety, 25 respondents (62.5%) (Table 2).

Table 2. Characteristics of Respondent (n = 40)

Characteristics	Frequency	Percentage
Age		
21 – 25 Years	29	72.5%
> 25 Tahun	11	27.5%
Education		
Elementary school	3	7.5%
Middle school	9	22.5%
High school	23	57.5%
College	5	12.5%
Profession		
Work	25	62.5%
Does not Work	15	37.5%
Anxiety Level		
Light anxiety	15	37.5%
Worried Medium	25	62.5%

Table 3 shows that relaxation belt therapy is more effective in reducing the intensity of labor pain and increase β -endorphin levels than warm water compress heat therapy (mean different pain labor 2.40; $p < 0.01$; effect size 1.72 and mean different increasing β -endorphin levels 53,34; $p < 0.01$; effect size 2.42).

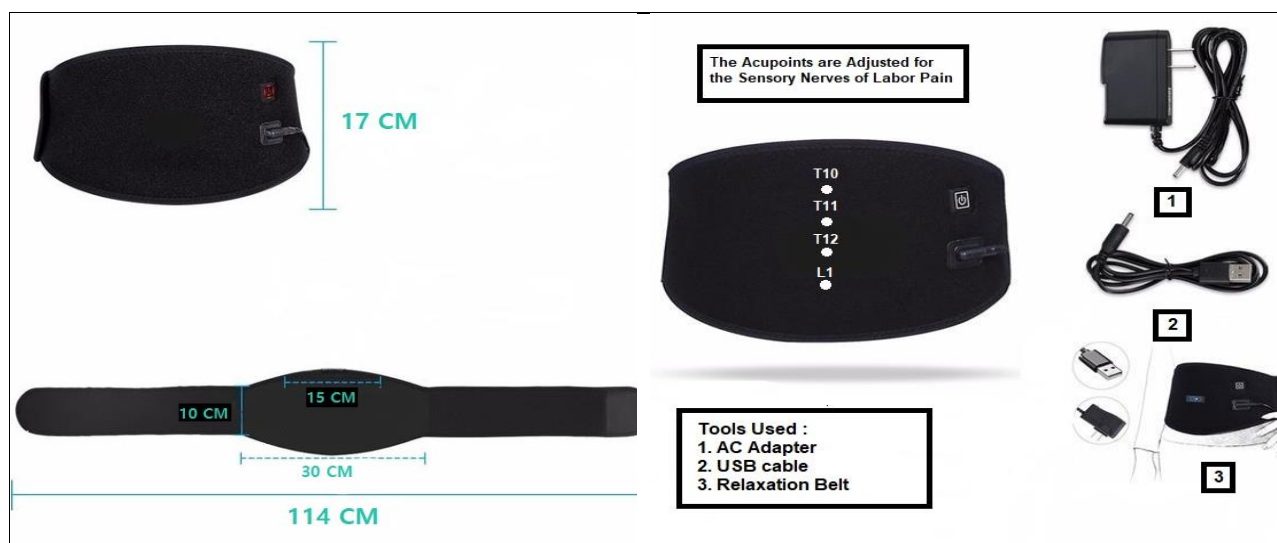


Figure 1. Relaxation belt



Figure 2. A way of using the relaxation belt

Table 3. The effect of heat therapy on intensity of labor pain and β -endorphin levels

Variable	Group			Mean \pm SD	Mean Diff	t	p-value	Effect Size
Pain	Relaxation Belt (n=20)	Water	Compress	Pre	2.40	5.41	0.001	1.72
				Post				
	Warm (n=20)	Water	Compress	Pre				
				Post				
β -Endorphin Levels	Relaxation Belt (n=20)	Water	Compress	Pre	53.34	7.67	0.001	2.42
				Post				
	Warm (n=20)	Water	Compress	Pre				
				Post				

DISCUSSION

Relaxation belts can provide a more stable heat effect. Therefore, during the administration of heat therapy, relaxation belts in labor can maintain the vascular system components in a vasodilatation state so that blood circulation to the pelvic muscles becomes homeostatic, which can reduce anxiety and pain during labor.¹⁸ The provision of heat therapy with a temperature of 45 ° C for 60 minutes in the T10, T11, T12, and L1 regions, will signal the hypothalamus stimulated through the spinal cord. The effector system will emit a signal in peripheral vasodilation. Changes in the size of blood vessels will result in smooth circulation of oxygenation, the occurrence of muscle spasms, the body's muscles become more relaxed because of the heat and cause a decrease in pain intensity.¹⁹

According to the gate control theory proposed by Melzack and Wall that the pain impulses that run on the cerebral cortex can be modified, regulated, and inhibited so that the pain sensation can be reduced. One mechanism that can inhibit pain impulses in the cerebral cortex is by giving heat therapy. Heat therapy that is given stably can close the gate of pain messages delivered to the spinal cord and brain. In addition to the administration of heat therapy, activation of β -endorphin compounds in synapses of spinal nerve cells and brains so that the transmission of pain messages can inhibit and cause a decrease in pain sensation.²⁰ The use of relaxation belts in labor can stimulate relaxed pelvic muscles and stimulate pelvic receptors to respond to pain. It then secretes β -endorphins to block the

transmission of pain stimulus and reduce pain levels and increase maternal satisfaction and well-being²¹.

The β -endorphin hormone is a pain suppression system that can be activated by stimulating the β -endorphin receptor region in gray matter periaqueductal in the midbrain. The provision of heat therapy stimulation in the thoracic region 10 to 12 and lumbar one, which is a source of nerve supply in the uterus and cervix, can stimulate ascending nerve receptors. Where the stimulation will be sent to the hypothalamus the spinal cord, passed to the pons followed by gray areas in the brain of the brain middle (periaqueductal). The stimulation received by this periaqueductal is conveyed to the hypothalamus. From the hypothalamus, it is through the descending nerve pathway of the β -endorphin hormone that is delivered to the blood vessels. Relaxation belt itself has a relaxing effect that can reduce the secretion of norepinephrine and ADH and increase the secretion of β -endorphin.²² The effect size value based on literature indicates that the administration of heat therapy carried out at pain intensity and β -endorphin levels have a range of > 1.60, concluded that the magnitude of the effect of heat therapy in reducing the intensity of labor pain and increasing β -endorphin levels included in the high category.²³

The results of this study that heat therapy was proven to reduce labor pain and increase levels of β -endorphin. The previous studies conducted by Turlina concluded that hot compresses are more effective in reducing labor pain when the active phase. Effects of heat that cause vasodilation of blood vessels and a relaxing effect increase blood flow to painful or injured organs. The mechanism of action

of a hot compress is causing a mild effect and skin stimulation that can cause the release of the hormone β -endorphin.²⁴ The previous research on the effectiveness of applying heat therapy to reduce pain and anxiety in maternity found that heat therapy can reduce labor pain, reduce anxiety levels, and be more relaxed to increase β -endorphin levels.¹³ However, this study is not in line with research conducted by Dahlen et al. Which states that warm packaged heat therapy in second stage mothers does not reduce pain during labor.²⁵

Everyone's β -endorphin levels differ from one person to another; this explains that pain is different for each individual. Individuals with high β -endorphin levels will experience less pain. The intensity of the mother exercising also influences increased levels of β -endorphin during labor during pregnancy; this is because mothers who exercise can manage to breathe well and flex muscle rigidity before delivery compared to mothers who are not accustomed to exercise. An increase in β -endorphin levels can be influenced by the intensity of the mother exercising during pregnancy rather than purely the administration of heat therapy during labor. The previous research conducted by Siswanto concluded an increase in β -endorphin levels after 45 minutes of physical exercise.²⁶ However, this study did not analyze the intensity of mothers exercising during pregnancy.

Product test results illustrate that respondents feel comfortable and can gradually reduce contraction pain. However, 2 out of 20 respondents feel uncomfortable when using a relaxation belt because the size is too small (mothers with obesity) and because the heat generated is less than the maximum.

CONCLUSIONS AND RECOMMENDATION

The effect of giving 45° C heat therapy for 60 minutes using a relaxation belt proved to be more effective in reducing the intensity of pain and increasing levels of the hormone β -endorphin during the active phase of labor during the first phase of activity compared to the administration of heat therapy using a boiled warm water compress. Therefore, the mother gave birth is recommended to use a relaxation belt. Midwives can advise mothers in labor pain management by giving heat therapy in the form of a relaxation belt to reduce pain intensity.

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