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The Effect of Reflexology on the Size of 1-Hour Postpartum Hemorrhage in Nulliparous Women: A Quasi-experimental Clinical Trial

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Abstract

Objectives: Pregnancy and childbirth are physiological and exciting processes in the life of every woman and family. Although the experience of childbirth is inherently unpredictable, it should be a positive event with minimal risk. Postpartum hemorrhage (PPH) is a complication of labor that requires effective preventive interventions, especially in low-income countries. Although maternal mortality has decreased in recent decades in developing and developed countries due to adopting preventive policies, the number of maternal deaths in these countries is still a concerning issue. Reflexology affects physiological and psychological stimuli. Various studies have been performed on the effect of chemical and herbal medicines on reducing PPH. Due to the importance of controlling PPH in the life of mother and child, this study aimed to investigate the effect of reflexology on reducing PPH in comparison with routine hospital care.

Materials and Methods: This was a quasi-experimental clinical trial. A total of 88 research samples, nulliparous women referring to selected hospitals in Isfahan for vaginal delivery, were selected using convenience random sampling method with the inclusion criteria and then were randomly divided into two groups. The instrument of this study was a questionnaire consisting of three parts: 1. Personal characteristics (demographic characteristics and gestational age), 2. Characteristics and consequences of delivery (PPH and vital signs in the first hour after delivery (fourth stage of labor)), 3. Used instrument to measure PPH (ruler).

Results: The results showed no significant difference between the studied subjects regarding demographic characteristics and gestational age. The difference in hemorrhage rate between the two groups was statistically significant. The difference in mean pulse rate (P = 0.003), and systolic and diastolic blood pressure in the first 15 minutes after delivery (P= 0.005, P = 0.003) was significant. However, the difference in the mean of these scales in 16-60 minutes and the criteria of temperature and respiratory rate in 0-60 minutes after delivery was not significant.

Conclusions: According to the results of this study, reflexology not only can have a direct effect on reducing the duration of labor but also indirectly affect the reduction of PPH. The results of reviewing the maternal vital signs are a relative confirmation of this effect. Therefore, considering the safety of the reflexology method, it can be substituted for drug methods that mostly have side effects.

Keywords: Reflexology, Nulliparous women, Postpartum hemorrhage, Vital sign.

Introduction

Postpartum hemorrhage (PPH) is one of the leading causes of maternal death. Approximately 54%-93% of maternal deaths occur because of obstetric hemorrhage, which can be prevented with fast, convenient, and standard management (1,2). In Iran, maternal mortality rate (MMR) was reported at 16 in 2018 and PPH contributed to this rate as the third reason for maternal death in 24 hours after delivery (3).

According to traditional definitions, PPH is defined as blood loss of at least 500 mL in a vaginal birth or 1000 mL in a cesarean section (4). Evaluation of maternal clinical and vital signs is primarily related to the intensity of PPH (5).

Reflexology is an intervention of complex massage in specific areas of the feet (called reflex points) that involve the internal organs (6).

Since PPH is considered as the most important and main cause of maternal death in the first 24 hours after labor and also, few studies have been performed with very precise design on using reflexology, this study aimed to determine the effectiveness of reflexology on the consequences of childbirth (bleeding and vital signs after childbirth) in nulliparous women.

Materials and Methods

This study was a quasi-experimental clinical trial study which was performed in two separate groups (a reflexology group and a control group receiving routine care). Also, the study was multivariate. Reflexology and routine care were considered "independent variables", bleeding volume and vital signs of the mother in the fourth stage (first one hour after delivery) were considered "dependent variables" and demographic characteristics (age, occupation, place

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of residence, level of education) and gestational age (GA) were considered "contextual variables".

The study population consisted of all nulliparous women aged 18-35 years referring to selected hospitals in Isfahan (Asgariyeh (AS) and Shahid Beheshti hospitals) in 2010 for a natural delivery. The convenience sampling method was used in this research and its arrangement was performed randomly. Subjects of the study were selected according to the inclusion criteria and were randomly divided into two groups using envelopes with odd and even numbers. In this study, data collection was conducted through observation, examination, and completion of a questionnaire. The questionnaire consisted of three parts: 1- Personal characteristics (demographic characteristics and GA) 2- Specifications and consequences of childbirth (the amount of bleeding after delivery and vital signs in the first hour after delivery (fourth stage of labor).

The questionnaire was completed with research items before intervention in the dilation of 3-5 cm and the second stage of labor after the second intervention.

Although there is not an ideal measurement for evaluating hemorrhage, we decided to conduct two methods. In the first method, hemorrhage intensity was evaluated by the researcher by using a ruler. Hemorrhage intensity of the studied subjects in case of left blood stain on the sanitary pads with a size of less than 2.5 cm was considered mild hemorrhage, 10-15 cm moderate hemorrhage and if the sanitary pad was filled within one hour (S/60 min), it was considered as severe. Also, if sanitary pad was filled within 15 minutes (S/15 min), hemorrhage was considered very severe. In the second method, we counted the pads number. Using a lot of postpartum sanitary pads in the first hour and 4 hours after delivery was a factor to determine and estimate the amount of blood loss which could help to monitor uterine changes (7). In this method, all pads should be checked while lying on your side (8).

Heart rate or pulse was measured by touching the radial pulse along the ulnar bone and counting it in one full minute. Respiratory rate was also measured by counting breaths (the number of times the chest moved up and down) in 1 minute. Blood pressure was measured using a calibrated mercury sphygmomanometer at the beginning of each day. The temperature was measured by personal feverfew by only one person throughout the study. At the end of 4 measurements, we set an average for each criterion of vital signs. The type of delivery was also determined in this part of the questionnaire.

The number of samples in this study with 95% confidence, test power of 80%, and D = 0.6 s (minimum difference in the mean score of each variable between the two groups), for each group was estimated to be 44 individuals. Considering the loss during the study, this number increased to 50 individuals in each group. In the routine care group, 112 patients were included in the study, of which 14 patients were excluded from the study due to undergoing emergency cesarean section due to lack of progress in delivery, 35 individuals due to fetal heart rate drop, and 16 individuals due to thick meconium after the artificial opening of the bladder. In the fourth stage of labor, 1 person was transferred to the operating room because of severe bleeding caused by extensive rupture of the birth canal, and 1 person in the second stage of labor needed to extract the baby with a vacuum, both of whom were excluded from the study. One infant in the routine care group needed resuscitation in the first minute after birth, but its APGAR score did not increase due to respiratory complaints and the use of intercostal muscles and nasal fins. Due to the presence of respiratory grunting and the use of intercostal muscles and nasal fins in breathing, the infant was transferred to the intensive care unit and excluded from the study. In the reflexology group, 45 individuals were included in the study, and only 1 person was discharged from the hospital due to dissatisfaction with the services and was admitted to Saadi hospital.

Inclusion criteria were being nulliparous in the age range of 18 to 35 years, being Iranian Muslim, being a mother at the beginning of the active phase of labor (dilation of 3-5 cm with a finger examination by the researcher), GA of 37 to 41 weeks, an ultrasound confirming an ongoing singleton pregnancy, embryonic cephalic presentation (fetal presentation refers to the part of the fetus that was closest to the pelvic entrance), mothers who expressed their consent to participate in the intervention group (reflexology) (obtaining written consent from the research units was required), with frequent uterine contractions, at least 3 contractions in ten minutes (suitable in terms of intensity, duration, and number of contractions- the duration of contractions was more than 30 seconds and less than 60 seconds). Exclusion criteria were being multiparous, having non-Iranian race, history of infertility, and women living alone (death of spouse, divorced, or not being in speaking terms with spouse. If she had at least one of these criteria, according to the Holmes-Rahe Stress Inventory, she was excluded from the study), imprisonment or history of imprisonment (excluded from the study according to the Holmes-Rahe Stress Inventory), death of a close family member (not included in the study according to the Holmes-Rahe Stress Inventory), being infected with an infectious and febrile illness, pregnant mothers at high risk for having these problems (underlying diseases: diabetes, hypertension, asthma, migraine, kidney disease, psychological disorders, epilepsy or seizures / any pregnancy-related illness: gestational diabetes, pregnancy hypertension, polyhydramnios or oligohydramnios, etc), the existence of severe varicose veins, injuries and wounds, lumps, corns, calluses, fungal diseases of the legs, history of any obstetric problems during pregnancy (placenta previa, threat of miscarriage, etc), existence of any disorder that was contrary to normal delivery (pelvic anatomical disorders, pelvic stenosis, prolongation

of the latent phase of labor, etc). Also, the exclusion criteria included unwillingness to continue reflexology or benefiting from routine hospital care and attending the study, the occurrence of any problems such as fetal distress, bleeding, etc during the study (any problem of this kind would be reported), and the incidence of any undiagnosed dystocia during the study.

Pregnancy control means checking uterine contractions by touching and using the watch, measuring fetal heart rate with a Sony kit in the ward, controlling vital signs by the intern or ward staff according to the ward routine, prescribing fluids by receiving Ringer or physiological serum or according to the routine of the serum section, 1.3/2.3, intravenous infusion at a rate of 6 milliunits per minute and eectal enema were used for both groups. Vaginal examinations in both study groups were measured and recorded by the researcher. (All routine care in the ward was performed in both study groups and only the intervention group had the technique of reflexology pain relief.) Then, we prepared the uterus (intervention group) and the surrounding area for the intervention.

Routine care in this study means that in addition to establishing appropriate emotional and verbal communication with the delivery, all current care, including control of vital signs of the mother, intake of intravenous fluids, administration of 10 units of oxytocin in 1 L of Ringer serum, one-third-two-thirds or 5% dextrose, administration of hyoscine combination and half dose of promethazine ampoule by intramuscular injection, control of uterine contractions, monitoring of fetal heart rate, enema, and other examinations. People in the routine care group like the reflexology group, had all the mental and emotional support by the researcher, including skin-to-skin contact even in the foot area, but not in the form of reflexolog. One of the important points in providing hospital care was the routine use of oxytocin to induce labor and uterine contractions.

The appropriate time to perform the technique was determined in the samples of the reflexology group. This time was when there were at least 3 contractions in ten minutes as entering the active phase of labor (suitable in terms of intensity, duration, and number of contractions and the duration of contractions was more than 30 seconds and less than 60 seconds). The intervention was conducted as follows: Performing reflexology for 30 minutes on each foot (60 minutes in total) as general reflexology including 15 stages: 1. Solar plexus, 2 and 3. Areas related to the digestive viscera, 4. Pelvic area, 5. Pituitary, 6. Sinuses, 7. Upper and lower extremities (external sides of the feet), 8. Spinal cord (inner sides of the feet), 9. Lungs, 10. The shallow chest area, 11 and 12. The sides on the feet, 13. Ovaries, 14. Uterus and 15. Fallopian tubes; and the specific reflexology including the areas related to labor pain such as liver, spleen, kidney, pituitary, solar plexus, and uterus. Specific reflexology was performed during the first period and again for the second time in 9-10 cm dilatation with an emphasis on specific points for at least five minutes (9).

Statistical Analysis

Data analysis was performed using SPSS software version 18 and descriptive statistical methods were used to describe the characteristics of the subjects. "ANOVA" test was used to compare the mean of quantitative variables (discrete and continuous) between the two groups during different stages of labor: GA and age. The Mann-Whitney test was used to compare the status of ranking variables between the two groups (e.g. bleeding) and the chi-square test was used to compare the relative frequency of nominal qualitative variables between the two groups. Fisher's exact test was used to evaluate the homogeneity of status and type of residence between the two groups.

Scientific Trust and Credibility

Heart rate and systolic diastolic blood pressure, temperature, and respiratory rate in a systematic review study showed reliable indicators for estimating the amount of blood loss and its intensity. Blood pressure, pulse, and respiration should be reset to pre-pregnancy levels within the first hour after delivery. Regular monitoring of blood pressure and pulse during this interval was one of the tools for diagnosing shock due to heavy bleeding, and during this stage, the temperature of the mother's body rose slightly but normally remained below 38°C so that, the vital signs were measured at least once during this period until vital signs reach the pre-pregnancy levels and were stable, or it was recognized that special control was needed.

There was no ideal way to measure the amount of blood lost. Visual estimation, which was a good method of estimation, may estimate the amount of bleeding to be less than half the calculated measurement. But ruler was used to describing the amount of hemorrhage: Blood stains left on the sanitary pad measured by ruler. Also, the number of sanitary pads that were completely soaked in blood was measured. One person (researcher) did all of these measurements from the beginning to the end of the study in order to minimize the calculation error.

Results

The mean age of the subjects was 25.22 and 24.02 years in the reflexology group and the routine care group, respectively. The mean GA of the subjects in the reflexology group and routine care group was 39.44 and 39.27 weeks, respectively. Most participants in the reflexology group, i.e., 23 individuals (52.3%), and in the routine care group, i.e., 27 individuals (61.4%) were living in a house under their ownership. Most participants in the reflexology group and the routine care group, i.e., 41 individuals (93.2%), were housewives. Most participants in the experimental group, i.e., 43 (97.7%), and most participants in the control group, i.e., 44 (100%), had a

high school education or less. The difference between the two groups in terms of demographic characteristics and GA was not statistically significant. Analysis of variance showed that the intensity of hemorrhage based on the number of sanitary pads used in the fourth stage (first hour after delivery) in the study subjects of the routine care group was significantly higher than the reflexology group ($P=0.02$ and $t = 2.34$) (Figure 1). Mann-Whitney test showed that the intensity of hemorrhage based on the size of the blood stain left on the sanitary pads in the fourth stage (first hour after delivery) in the routine care group (Figure 2)was significantly higher than the reflexology group (P value = 0.001 and Z = 5.33) (Figure 3).

Analysis of variance showed a statistically significant difference between the two groups in terms of systolic blood pressure ($P=0.005$) and diastolic blood pressure ($P<0.001$) and pulse rate ($P=0.003$) in the studied units at 0-15 minutes; however, this difference at 16-30 minutes was not significant in both groups. Analysis of variance showed no significant difference between the two groups in terms of the maternal respiratory rate at 0-15 minutes ($P=0.06$ and t = 1.88), 16-30 ($P=0.8$ and t = 1.72), 31-45 ($P=0.69$ and t = 1.90) and 46-60 ($P=0.18$ and t = 0.4). Moreover, analysis of variance showed no significant difference between the two groups in terms of maternal temperature at 0-15 minutes with ($P=0.9$ and t = 1.85), 16-30 with ($P=0.11$ and t = 1.75), 31-45 with ($P=0.9$ and t = 0.04) and 46-60 with ($P=0.14$ and t = 1.68).

Table 1 shows that the age of the mother in most of the research units in the experimental group (45.5) and in the control group (43.2) was between 23-27 years old. Analysis variance test showed no significant difference between the two groups ($P=0.14$)

Table 2 shows that mothers' education level in most of the research units in the experimental group (97.7%) and in the control group (100%) was sub-diploma and diploma. Mann–Whitney test showed no significant difference between the two groups ($P=0.54$)

Table 3 shows that most of the research units in the experimental group (95.4%) and in the control group (97.7%) were housewife. The chi-square test showed no significant difference between the two groups ($P=0.23$)

Table 4 shows that the location status in most of the research units in the experimental group (52.3%) and in the control group (61.4%) was private property. Fisher's exact test showed no significant difference between the two groups.

Table 5 shows that GA in most of the research units in the experimental group (45.5%) and in the control group (34.2%) was in the category of 39.1d-40wk. Analysis Variance test showed no significant difference between the two groups.

Table 6 shows that most of the studied units in the experimental group (100%) and the control group (88.6%) used 2 sanitary pads, which was a statistically significant difference between the two groups ($P=0.02$).

Table 7 shows that the amount of hemorrhage in most individuals (56.2%) in the experimental group was mild (15-10 cm) and in the majority of subjects (84.1%) in the control group hemorrhage was severe (S/min 60). Mann-Whitney test showed that the hemorrhage intensity in the routine care group was significantly higher than in the reflexology group ($P<0.001$).

Analysis of variance showed no significant difference between the number of pulses in the fourth stage of labor (first one hour after delivery) in the two groups and only the difference between the number of pulses in the first 15 minutes was statistically significant ($P=0.003$) (Table 8).

Analysis of variance showed a significant difference only in terms of systolic blood pressure in the first 15 minutes in the fourth stage of labor in the two groups. There was no significant difference in terms of systolic blood pressure 16 to 60 minutes after delivery in the fourth stage of labor (Table 9).

Analysis of variance showed a significant difference in terms of diastolic blood pressure in the first 15 minutes in the fourth stage of labor in the two groups. There was no significant difference in terms of diastolic blood pressure

Table 1. Comparison of the Frequency Distribution and Age (year) Means in Two Groups

Age (y)	Groups			
	Reflexology		Routine care	
	No.	%	No.	%
18-22	10	22.7	15	34.1
23-27	20	45.5	19	43.2
28-32	14	31.8	10	22.7
Total	44	100	44	100
Mean	25.22		24.02	
SD	3.86		3.79	

P value = 0.14, t=1.47, df=1.

Table 2. Comparison of the Frequency Distribution of Education Level in Two Groups

Education Level	Group			
	Reflexology		Routine Care	
	No.	%	No.	%
High school diploma and sub-diploma	43	97.7	44	100
Post-diploma and bachelor's degree	1	2.3	0	0
Total	44	100	44	100

P value=0.317, df=1.

Table 3. Comparison of the Frequency Distribution of Employment Status in Two Groups

Employment Status	Group			
	Reflexology		Routine Care	
	No.	%	No.	%
Housewife	42	95.4	43	97.7
Employee	1	2.3	1	2.3
Freelance	1	2.3	0	0
Total	44	100	44	100

P value=0.23, χ^2= 1.33, df=1.

16 to 60 minutes after delivery in the fourth stage of labor in the two groups (Table 10).

Analysis of variance showed no significant difference between the number of maternal respirations in 0-60 minutes in the fourth stage of labor (first hour after delivery) in the two groups (Table 11).

Analysis of variance showed no significant difference between the temperatures in the fourth stage of labor (first hour after delivery) in the two groups (Table 12).

Discussion

Explaining the results of the present study, it should be stated that anxiety initiates the vicious circle of pain, fear, and muscle stiffness and results in increased levels of adrenaline and epinephrine, which have anti-oxytocin properties and can impair uterine muscle activities and cause prolonged labor. Reflexology increases muscle activity and uterine contractions by decreasing adrenaline and noradrenaline and increasing endorphins and oxytocin release which can affect the duration of labor. According to the results of the present study and studies on the factors affecting PPH, reflexology brings about relaxation and comfort in the individual through physiological changes and the release of endorphins and anesthesia can create comfort. Hence, when labor interventions such as the use of oxytocin are less, the risk of uterine atony and PPH will also be low. Meanwhile, the risk of PPH is higher in prolonged and stimulated deliveries (8). Therefore, according to the mechanism of the effect of reflexology in calming and relieving pain and stress and physiological delivery without using routine pharmacological and invasive interventions, the pregnant mother will benefit from a reduction in pain and the duration of labor. As a result, the amount of PPH and its obvious effect on vital signs will be reduced.

Risk factors for hemorrhage include the type of delivery, placenta remaining in the uterus, lack of progress in the second stage, placental abruption, rupture of the birth canal, delivery with assistive technology, large fetus, induction of labor, and prolongation of the first or second stage of labor, each acting independently (10).

Nyfløt et al found in their study that women who had prolonged labor had severe PPH (11) which confirms the results of the present study. Another study showed that the duration of the third phase of labor, i.e., placental delivery, is also associated with the incidence of PPH (12). In a study conducted in 2019 by Chandrababu et al, the results showed that reflexology had a significant effect on reducing the stress scale with the Spielberger index (13).

Heart rate and systolic diastolic blood pressure, temperature, and respiratory rate in a systematic review study showed reliable indicators for estimating the amount of blood loss and its intensity. Blood pressure, pulse, and respiration should be reset to pre-pregnancy levels within the first hour after delivery. Regular monitoring of blood pressure and pulse during this interval is one of the tools for diagnosing shock due to heavy bleeding, and during this stage, the temperature of the mother's body rose slightly but normally remained below 38°C so that, the vital signs were measured at least once during this period until vital signs reached the pre-pregnancy levels and

Table 4. Comparison of the Frequency Distribution of Residential Status in Two Groups

Residential Status	Group			
	Reflexology		Routine Care	
	No.	%	No.	%
Rent	21	47.7	17	38.6
Private property	23	52.3	27	61.4
Total	44	100	44	100

P value=0.25, df=1.

Table 5. Comparison of the Frequency Distribution and Mean of Gestational Age in Two Groups

Gestational Age	Group			
	Reflexology		Routine Care	
	No.	%	No.	%
37-38 wk	3	6.8	6	13.6
38.1d-39 wk	10	22.7	13	29.5
39.1d-40 wk	20	45.5	15	34.2
40.1d-41 wk	6	13.6	10	22.7
41.1d-42 wk	5	11.4	0	0
Total	44	100	44	100
Mean	39.44		39.27	
SD	1.13		1.02	

P value = 0.44, t= 0.76, df=1.

Table 6. Comparison of The Frequency Distribution and Hemorrhage Mean (Based on the Number of Sanitary Pads Used) in the Fourth Stage (First 1-Hour After Delivery) in Two Groups

Number of Sanitary Pads	Group			
	Reflexology		Routine Care	
	No.	%	No.	%
2	44	100	39	88.6
3	0	0	5	11.4
Total	44	100	44	100
Mean	2		2.11	
SD	0		0.32	

P value = 0.02, t= 2.34, df=1.

Table 7. Comparison of the Frequency Distribution of Hemorrhage Intensity (Based on the Size of the Blood Stain Left on the Sanitary Pads) in the Two Groups

Hemorrhage Intensity	Group			
	Reflexology		Routine Care	
	No.	%	No.	%
Mild (10-2.5 cm)	1	2.3	0	0
Medium (15-10 cm)	25	56.8	3	6.8
Severe (S/ 60 min)	18	40.9	37	14.1
Very severe (S/15 min)	0	0	4	9.1
Total	44	100	44	100

P value < 0.001, Z= 5.17, df=1.

Table 8. Comparison of the Frequency Distribution of Pulse Rate in the Fourth Stage (First 1 Hour After Delivery) in Two Groups

Pulse (min)	Group								Result of Analysis of Variance	
	Reflexology				Routine Care					
	Mean	SD	Minimum	Maximum	Mean	SD	Minimum	Maximum	*P*	T
0-15	79.68	5.83	64	88	35.80	4.60	72	100	0.003	3.008
16-30	79.40	5.98	64	88	76.81	4.74	70	92	0.08	1.73
31-45	77.90	6.88	64	88	64.80	4.02	70	92	0.12	1.06
46-60	76.31	6.83	64	88	41.80	5.12	64	9	0.058	1.92

Table 9. Comparison of the Mean Systolic Blood Pressure in the Fourth Stage (First 1 Hour After Delivery) in Two Groups

Systolic Blood Pressure	Group								Result of Analysis of Variance	
	Reflexology				Routine Care					
	Mean	SD	Min.	Max.	Mean	SD	Min.	Max.	*P*	T
First 15 min (0-15)	107.27	12.64	90	120	114.09	8.97	90	120	0.005	2.91
Second 15 min (16-30)	107.05	10.47	90	120	110.91	8.30	90	120	0.058	1.91
Third 15 min (31-45)	104.77	11.09	90	120	108.64	8.23	90	120	0.67	1.85
Fourth 15 min (46-60)	108.64	7.95	90	120	111.36	6.67	90	120	0.08	1.74

Table 10. Comparison of the Mean Diastolic Blood Pressure in the Fourth Stage (First 1 Hour After Delivery) in Two Groups

Diastolic Blood Pressure	Group								Result of Analysis of Variance	
	Reflexology				Routine Care					
	Mean	SD	Min.	Max.	Mean	SD	Min.	Max.	*P*	T
First 15 min (0-15)	67.72	8.03	60	80	74.09	6.58	60	80	0.001	4.06
Second 15 min (16-30)	65.45	6.97	60	80	67.04	5.93	60	80	0.25	1.15
Third 15 min (31-45)	104.77	11.09	60	80	108.64	8.23	60	80	0.67	1.85
Fourth 15 min (46-60)	64.09	5.42	60	80	66.13	6.18	60	80	0.1	1.65

Table 11. Comparison of the Frequency Distribution of Respiratory Rate in the Fourth Stage (First 1 Hour After Delivery) in Two Groups

Respiratory Rate	Group								Result of Analysis of Variance	
	Reflexology				Routine Care					
	Mean	SD	Min.	Max.	Mean	SD	Min.	Max.	*P*	T
First 15 min (0-15)	17.59	1.64	14	20	18.22	1.5	16	20	0.06	1.88
Second 15 min (16-30)	16.15	1.32	16	20	17.47	1.38	16	20	0.8	1.72
Third 15 min (31-45)	16.45	0.95	16	20	16.54	1.17	16	20	0.69	1.90
Fourth 15 min (46-60)	16.45	0.95	16	20	16.72	0.97	16	20	0.18	0.4

Table 12. Comparison of the Frequency Distribution of Temperature in the Fourth Stage (First 1 Hour After Delivery) in Two Groups

Temperature	Group								Result of Analysis of Variance	
	Reflexology				Routine Care					
	Mean	SD	Min.	Max.	Mean	SD	Min.	Max.	*P*	T
First 15 min (0-15)	36.55	0.19	36.2	37.1	36.60	0.22	36.2	37.1	0.9	1.58
Second 15 min (16-30)	36.68	0.25	36.2	37.2	36.77	0.24	36.3	37.2	0.11	1.57
Third 15 min (31-45)	36.72	0.23	36.4	37.6	36.72	0.21	36.5	37.6	0.9	0.04
Fourth 15 min (46-60)	36.75	0.25	36.4	37.6	36.84	0.28	36.5	37.6	0.14	1.68

were stable, or it was recognized that special control was needed.

The first hour after childbirth is the most important and dangerous time for the mother. During postpartum care, it is important to control the mother's PPH and vital signs (blood pressure, body temperature, pulse, and respiration). In the present study, the vital signs of the studied units were measured and recorded. Analysis of variance showed a statistically significant difference in terms of mean pulse rate and systolic and diastolic blood pressure in the first 15 minutes after labor. However, the difference in temperature and respiratory rate was not statistically significant. The results of the study showed that although the amount of systolic and diastolic blood pressure and pulse rate was insignificant during 16-60 minutes, the mean systolic and diastolic blood pressure and pulse rate

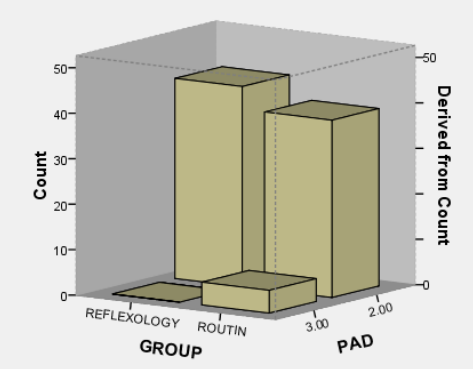

Figure 1. Frequency distribution of hemorrhage (based on the number of sanitary pads used) in the fourth stage of labor in both groups of reflexology and routine care.

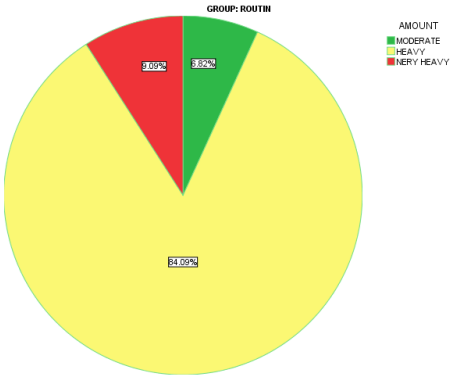

Figure 2. Frequency distribution of hemorrhage (based on the size of the blood stain left on the pad) in the fourth stage of labor in the routine care group.

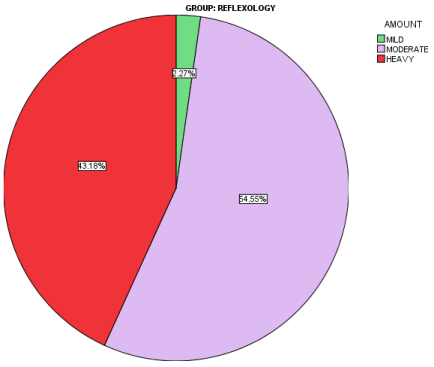

Figure 3. Frequency distribution of hemorrhage (based on the size of the blood stain left on the pad) in the fourth stage of labor in the reflexology group.

in the studied units in the reflexology group were lower than the studied units in the routine care group.

The results showed that the mean number of breaths in the reflexology group was lower than the study units in the routine care group and this was because of relieving stress and anxiety and creating relaxation in the body due to reflexology and skin contact between the therapist and the individual. It is worth mentioning that this effect has remained stable over time. The number of breaths decreased as maternal relaxation in the reflexology group increased. However, if we worked specifically on the reflex points of respiration, it would also be statistically significant. In addition, although there was a statistically significant difference between the two groups in terms of temperature, the average temperature in the research units in the reflexology group was slightly lower than the research units in the routine care group. When the reflex points were stimulated, general relaxation was created in the body. Following this relaxation, stress messages were stopped, and sympathetic nervous system activity decreases. As a result, blood pressure, heart rate, and respiration rate decrease.

Therefore, there is an assumption that patients who receive reflexology have lower blood pressure, heart rate, and respiratory rate than those who do not receive this treatment due to a reduction in their anxiety and stress levels (14). Regarding the effect of reflexology on vital signs and other organs of the body, according to a 2007 study by McVicar et al, reflexology reduced the stress of the participants. By measuring cardiovascular parameters (pulse and blood pressure), McVicar et al showed that reflexology had been effective in reducing these parameters. In this study, the reduction of volunteers' anxiety was not statistically significant in the control group (15). In McCullough and colleagues' study, blood pressure and heart rates were quite different between the two receiving reflexology and control groups. In other words, reflexology has been effective in improving these parameters (16).

In a study conducted by Mirzaei et al in 2009 to investigate the effect of reflexology on anxiety in primiparous women at Afzalipour hospital in Kerman, before the intervention, there was no statistically significant difference between both experimental and control groups regarding the mean scores of anxiety, pulse, systolic and diastolic blood pressure in mothers. After the intervention, the mean anxiety score of the experimental group decreased significantly, while this means had increased in the control group; however, no significant difference was found between the pulse and blood pressure variables of the two groups at this stage. The reason for the difference in these results with the results of this study is in method of performing the technique. In another study on healthy men and healthy postmenopausal women, by massaging the upper and the cushioned structure of the left foot, they concluded that the cardiac index was significantly reduced in the intervention group (17).

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It is not bad to mention the duration of labor and the risk of severe PPH. Pirhadi et al conducted a study in 2015, and the results confirmed the role of prolonged labor in increasing the incidence of PPH (18). Thus, due to the mechanism of the effect of reflexology on the nervous system (sympathetic and parasympathetic) and its effect on creating and maintaining relaxation of internal organs, not only does reflexology result in (indirectly) a reduction of the duration of labor (which, if it is prolonged, it can increase the risk of PPH), but also its direct effect on maintaining uterine tonicity and preventing uterine loosening and uterine contractions (which consequently increases the speed of labor and reduces the duration of the active stage of labor) will reduce the amount of PPH in women receiving the intervention (19).

Another interesting point is that in studies on the initial management of primary PPH, vital signs were checked in 38% of patients. Only one-fifth of them underwent routine blood tests and coagulation tests, arterial blood gases, or urinary catheters. Few needed treatments for hypothermia, administration of oxygen, or blood transfusion. Therefore, emergency management of PPH should be provided to all relevant personnel to help improve its treatment and outcomes (20).

Conclusions

Studies in other complementary and alternative medicine methods such as herbal medicines including dates (21) and grape seed powder have been conducted on PPH. As the effect of reflexology on the duration of labor is confirmed and its direct and indirect effect on labor outcomes such as PPH is proved, this non-invasive and inexpensive method can be thought to all midwives in the maternal health care system, new techniques, or complementary medicine. Thus, an effective step can be taken to improve the quality of services and ultimately women's health as an important part of society (22).

Today, complementary medicine is widely accepted in various physical and mental fields, especially among women. If midwives have the knowledge and skills to offer reflexology, they can benefit from these benefits in midwifery services. Reflexology skills may be useful for midwives and nurses in providing comprehensive care. Moreover, the management and role of midwives in applying for complementary medicine in maternal care services create a positive outlook and reduce medical interventions (23).

Thus, the role of midwives in providing services related to the natural process of childbirth has become more prominent. Therefore, using the results of the research, we can avoid using this method during pregnancy, which faces limitations, and also benefit from its effects. Although there is no statistically significant difference in all scales of maternal vital signs in the first hour after delivery, because it does not cause destructive effects on the hemodynamic system of the mother's body and does not have harmful changes on vital signs, it can be used as one of the non-drug, cheap and non-invasive methods during childbirth, without feeling threatened.

Limitations of the Study

For the limitation of the study, we should mention the number of samples which could be more to determine the accuracy of this method. We did not have access to many hospitals due to ethical and political reasons. Also, lack of public awareness about complementary medicine (like reflexology) contributed to accessibility to fewer samples.

Moreover, performing the general reflexology can be considered another limitation of this study. We touched and pressured general points without considering the special reflex point affecting hemorrhage or mothers' vital sign. Furthermore, lack of specific or ideal method to measure hemorrhage should not be ignored.

Other limitations include the use of oxytocin, which can lead to biased research findings. Therefore, the actual volume of bleeding could not be measured.

Recommendation for Future Study

We suggest other researchers conduct specific methods of reflexology on the main parts of the feet for several times during and after delivery to determine the productivity of reflexology on PPH. For example, reflexology on hand or feet can be carried out during neonate delivery (in this condition the reflexologist should be another person for all stages) and even during the first hour after delivery.

Using other exact criteria to measure blood loss such as counting blood hematocrit and blood cells would be recommended. Meanwhile, the combination of these methods to evaluate blood loss after delivery would be ideal (for instance, counting the pads number, blood test, and evaluating the amount of each pad impregnated with blood)

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Conflict of Interests

Authors have no conflict of interest.

Ethical Issues

For the ethical considerations of the research, the official permission of the Research Ethics Committee was obtained from the University Vice Chancellor for Research in terms of not being inconsistent with the research ethics. The researcher started his research by presenting a written letter of introduction (from the School of Nursing and Midwifery of Isfahan University of Medical Sciences) to the hospital officials. Official permission was obtained from the maternity hospital in order to conduct the investigation. The full description of the study objectives was provided to the officials of the centers and units under study in written and oral formats. Written agreements were obtained from all research units. The research units were free to refuse or accept participation in the study, continuous presence, or attempt to leave it. All samples were assured that their personal information was confidential and that conducting the above research would not interfere with their care plans. The final report or the results of the study were made available to the officials of the hospitals and units under study.

References

1. World Health Organization (WHO). WHO Recommendations for the Prevention and Treatment of Postpartum Haemorrhage. Geneva: WHO; 2012.
2. Shields LE, Wiesner S, Fulton J, Pelletreau B. Comprehensive maternal hemorrhage protocols reduce the use of blood products and improve patient safety. Am J Obstet Gynecol. 2015;212(3):272-280. doi:10.1016/j.ajog.2014.07.012
3. Report on the performance and achievements of the national system of maternal death care. Health office of population, family and school, maternal health department. 2017-2018
4. Postpartum Bleeding (Lochia). https://www.whattoexpect.com/pregnancy/symptoms-and-solutions/postpartum-bleeding.aspx.
5. Izadpanah A, Alahyari E, Torshizi M, Khazaie Z, Sharifzadeh G, Hosseini M. Effect of grape seed powder on postpartum hemorrhage in vaginal delivery: a randomized controlled clinical trial. Iran J Obstet Gynecol Infertil. 2018;21(10):30-37. doi:10.22038/ijogi.2018.12242
6. Song HJ, Son H, Seo HJ, Lee H, Choi SM, Lee S. Effect of self-administered foot reflexology for symptom management in healthy persons: a systematic review and meta-analysis. Complement Ther Med. 2015;23(1):79-89. doi:10.1016/j.ctim.2014.11.005
7. Pillitteri A, Silbert-Flagg JA. Maternal & Child Health Nursing: Care of the Childbearing & Childrearing Family. 13th ed. Lippincott Williams & Wilkins; 2018. p. 657.
8. Cunningham F, Leveno K, Bloom S, Spong C, Dashe J, Hoffman B, et al. Williams Obstetrics. 25th ed. New York: McGraw Hill; 2018.
9. Abdollahi Fard S, Dolatian M, Heshmat R, Alavi Majd H. Effect of foot reflexology on physical and psychological symptoms of premenstrual syndrome. Pajoohandeh Journal. 2013;18(1):8-15. [Persian].
10. Lisonkova S, Mehrabadi A, Allen VM, et al. Atonic postpartum hemorrhage: blood loss, risk factors, and third stage management. J Obstet Gynaecol Can. 2016;38(12):1081-1090.e2. doi10.1016/j.jogc.2016.06.014
11. Nyfløt LT, Stray-Pedersen B, Forsén L, Vangen S. Duration of labor and the risk of severe postpartum hemorrhage: A case-control study. PLoS One. 2017;12(4):e0175306. doi:10.1371/journal.pone.0175306
12. van Ast M, Goedhart MM, Luttmer R, Orelio C, Deurloo KL, Veerbeek J. The duration of the third stage in relation to postpartum hemorrhage. Birth. 2019;46(4):602-607. doi:10.1111/birt.12441
13. Chandrababu R, Rathinasamy EL, Suresh C, Ramesh J. Effectiveness of reflexology on anxiety of patients undergoing cardiovascular interventional procedures: a systematic review and meta-analysis of randomized controlled trials. J Adv Nurs. 2019;75(1):43-53. doi:10.1111/jan.13822
14. Gunnarsdottir TJ, Jonsdottir H. Does the experimental design capture the effects of complementary therapy? A study using reflexology for patients undergoing coronary artery bypass graft surgery. J Clin Nurs. 2007;16(4):777-785. doi:10.1111/j.1365-2702.2006.01634.x
15. McVicar AJ, Greenwood CR, Fewell F, D'Arcy V, Chandrasekharan S, Alldridge LC. Evaluation of anxiety, salivary cortisol and melatonin secretion following reflexology treatment: a pilot study in healthy individuals. Complement Ther Clin Pract. 2007;13(3):137-145. doi:10.1016/j.ctcp.2006.11.001
16. McCullough JE, Liddle SD, Sinclair M, Close C, Hughes CM. The physiological and biochemical outcomes associated with a reflexology treatment: a systematic review. Evid Based Complement Alternat Med. 2014;2014:502123. doi:10.1155/2014/502123
17. Mirzaei F, Kaviani M, Jafari P. Effect of foot reflexology on duration of labor and severity of first-stage labor pain. Iran J Obstet Gynecol Infertil. 2010;13(1):27-32.
18. Pirhadi M, Valiani M, Azimi M. Effect of auriculotherapy on neonatal apgar score and maternal postpartum hemorrhage and vital signs. Iran J Obstet Gynecol Infertil. 2018;21(6):27-33. doi:10.22038/ijogi.2018.11630
19. Yılar Erkek Z, Aktas S. The effect of foot reflexology on the anxiety levels of women in labor. J Altern Complement Med. 2018;24(4):352-360. doi:10.1089/acm.2017.0263
20. Zea-Prado F, Hernández-Pacheco J, Ortiz-Ramírez M, et al. Initial management of primary postpartum hemorrhage: a survey. J Matern Fetal Neonatal Med. 2021;34(17):2841-2847. doi:10.1080/14767058.2019.1671342
21. Mojahed S, Aflatunian A, Khadem N, Dehghani Firouzabadi R, Karimi Zarchi M. an investigation into effectiveness of date (Rutab) on postpartum hemorrhage. J Shahid Sadoughi Univ Med Sci. 2012;20(2):159-166. [Persian].
22. Della Torre M, Kilpatrick SJ, Hibbard JU, et al. Assessing preventability for obstetric hemorrhage. Am J Perinatol. 2011;28(10):753-760. doi:10.1055/s-0031-1280856
23. Hall HG, McKenna LG, Griffiths DL. Midwives' support for complementary and alternative medicine: a literature review. Women Birth. 2012;25(1):4-12. doi:10.1016/j.wombi.2010.12.005