

© 2017 The Author(s)

This is an Open Access article distributed under the terms of the [Creative Commons Attribution 4.0 International License](#) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

ORIGINAL RESEARCH

ISSN: 2477-4073

THE IMPACT OF PINEAPPLE (*ANANAS COMOSUS (L.) MERR.*) JUICE ON FUNDAL HEIGHT IN PRIMIGRAVIDA MOTHERS DURING POSTPARTUM PERIOD

Winda Yunyaty Harianja^{1*}, Onny Setiani², Umaroh³,
Melyana Nurul Widyawati¹, Imam Djamaludin Mashoedi¹, Sri Endang Pujiastuti¹

¹Magister Applied Midwifery, Health Ministry Polytechnic Semarang, Semarang, Indonesia

²Fakultas Kedokteran, Universitas Diponegoro, Semarang, Indonesia

³Prodi DIII Kebidanan, Health Ministry Polytechnic Semarang, Semarang, Indonesia

*Corresponding author:

Winda Yunyaty Harianja, S.ST, M.Tr. Keb

Magister Applied Midwifery, Health Ministry Polytechnic Semarang

Jl. Tirta Agung, Pedalangan, Banyumanik, Kota Semarang, Jawa Tengah, Indonesia (50268)

E-mail: windayunitaharianja@ymail.com

ABSTRACT

Background: Failure in the process of uterine involution can result in bleeding if not treated immediately. Provision of pineapple (*Ananas Commosus (L.) Merr*) juice can be administered as a medicinal plant therapy to prevent sub involution of the uterus and is considered to speed up the recovery process of the uterine involution.

Objective: This study aims to examine the effect of pineapple (*Ananas Commosus (L.) Merr*) juice to decrease fundal height in primigravida mothers during postpartum period.

Design: This was a quasi-experimental study with non-equivalent control group, conducted in the working area of the Health Center (Puskesmas) of Jekulo Kudus Indonesia on 1-30 December 2016. There were 28 respondents selected using consecutive sampling technique, consisted of 14 respondents in the intervention group and 14 respondents in the control group. Data were analyzed using independent t-test and paired t-test.

Results: Findings showed that there was a mean difference of the height of the uterine fundus after given pineapple juice in the intervention group with mean score 13.80 in pretest and 5.80 in posttest, while there was also a decrease in fundal height in the control group with mean score 13.35 in pretest and 7.01 in posttest. The mean of fundal height in the intervention group was 8.15 cm and in the control group was 6.09 cm in 7 days. There was significant difference of the average of the decrease of fundal height between both groups with p-value (0.000).

Conclusions: Pineapple (*Ananas comosus (L.) Merr*) juice had a significant effect in the decrease of fundal height. It is suggested that pineapple juice can be used as herbal or medicinal plants, which can be used during postpartum period that is processed naturally without involving the use of chemical and incorporated into the procedure standard of midwives in postnatal care.

Keywords: pineapple juice, fundal height, primigravida, postpartum

INTRODUCTION

Maternal mortality in Central Java Indonesia in 2014 was 126.55 per 100,000 live births, and deaths occur during postpartum was equal to 57.93%.¹ Postpartum maternal mortality in Kudus in 2015 was 10 people caused by high preeclampsia (4 people), bleeding (3 people), eclampsia (1 person), heart disease (1 person), and pulmonary embolism (1 person),² while the coverage of postpartum mothers in 2015 amounted to 97.27%.²

Postpartum hemorrhage is one of the most important issues, which lead to maternal death. Based on research results of Bateman BT, et al at the hospital of the United States showed that in 2004-2010, of 25,654 deliveries, there were 876,641 cases of bleeding in the postpartum period, which 79% of the causes were main atonic or lack of uterine contractions during postpartum.³ According to Walfish M et al, postpartum hemorrhage was the state of blood loss > 500 ml at 24 hours after birth.⁴ Based of the study of Sher Zaman, Bushra et al indicated that the causes of primary postpartum hemorrhage were retained placenta which amounted to (53.7%), followed by the birth canal laceration (29.3%), atonic (14.6%), and uterine inversion of (2.4%).⁵ According to Ujah IAO et al found that the main cause of primary postpartum hemorrhage was atonic (47.9%) and retained placenta (71.05%).⁶

Based on the data of preliminary study obtained from the Health Center (Puskesmas) of Jekulo Kudus in 2015, indicated that there were 854 postpartum mothers (98.2%).⁷ There were two of postpartum maternal deaths due to bleeding caused by uterine atony and pre-eclampsia.⁷ Based on the report of this health center, of 854 deliveries, 34 mothers were reported making the referral to the hospital caused by uterine atony (11 cases), retained placenta (9 cases),

prolonged labor (5 cases), and pre-eclampsia (9 cases).⁷

On the other hand, inadequate uterine contractions during postpartum period may cause poor involution process.⁸ Uterine involution is the process by which the uterus return to its normal pre-pregnant state, preceded by strong uterine contractions.⁹ If the process is interrupted, then it is called uterine sub involution, which is one of the symptoms in the postnatal pathology that can cause complications during postpartum. The occurrence of sub involution uterus is one symptom of the failures of the uterus to return to the non-pregnant state, characterized by delays of uterine fundus reduction, and accompanied by lengthening the period of expenditure lochea or heavy bleeding and irregular, soft and bigger uterus than normal.¹⁰

Uterine sub involution is one of the causes of bleeding, according to a study conducted by Gita & Saced on normal pattern of uterine involution with Symphysis Method- Fundus Distance (S-FD) in primiparous women in Fatemieh Hospital, Hamedan, Iran, found that 21 women from a total of 180 respondents experienced uterine sub involution due to lack of adequate uterine contractions.¹¹ Therefore, efforts should be made to accelerate the process of uterine involution to increase its contraction.

Postpartum care is one of the efforts that aims to expedite the recovery process, accelerate the process of involution with the aim of preventing the occurrence of complications during childbirth. In addition, medical treatment now has developed a technique of treatment using medicinal plants. One of herbal / medicinal plants that are considered to facilitate healing or recovery process is consuming pineapple.¹² Thus, nonpharmacologic efforts to improve uterine contractions during postpartum is to eat pineapple, which contains

bromelain enzyme. Bromelain is a proteolytic enzyme or protease that is found only in the pineapple plant (*Ananas comosus* (L.) Merr).¹³ The content of bromelain in pineapple (*Ananas comosus* (L.) Merr) is most abundant in stems and fruits, while other parts such as seeds, bark, leaves, roots and its crown contains only small amount of bromelain.¹³ Bromelain has a function as antiedema, fibrinolytic, anti-cancer, anti-inflammatory, antibiotics, anticoagulants and anti-thrombotic and used as a medicine to cure or treatment.^{13,14}

In this regard, bromelain enzyme increases the hydrolytic activity of the connective tissue, especially on collagen.¹³ Collagen is a constituent component walls of arteries, veins and capillaries of the body which provides the strength, structure and flexibility of blood vessels in order to transport blood throughout the body effectively.¹⁵ Extract of pineapple or pieces of pineapple juice given repeatedly lead to the high concentration of the enzyme bromelain in the blood. Collagen is hydrolyzed by the enzyme bromelain make the uterus becomes very pliable. Hydrolysis of collagen by bromelain, especially type III collagen can cause uterine smooth muscle becomes elastic, thus the involution process will be better.¹⁵

According to the research of Muzzamman who conducted laboratory tests on the effects of the extra pineapple on uterine contractions of female marmots, it showed that there was statistically a significant relationship between giving extra pineapple with the activity of uterine contractions in female marmots;¹⁶ thus, based on the results of these studies, it is assumed that consumption of pineapple fruit will also affect uterine contractions during pregnancy and non-pregnancy. Thus, this study aims to prove the effect of pineapple (*Ananas comosus* (L.) Merr) juice in a

reduction of fundal height in primigravida mothers during postpartum period in the health center of Jekulo Kudus, Indonesia.

METHODS

Design

This was a quasi-experimental study with non-equivalent control group.

Setting

This research was conducted in the working area of the Health Center (Puskesmas) of Jekulo Kudus on 1 – 30 December 2016.

Population and sample

The target population in this study was primigravida mothers in the postpartum periods. There were 28 respondents recruited in this study using consecutive sampling technique. The formula of Lemeshow¹⁷ was used to recruit the sample that consisted of 14 respondents in the intervention group and 14 respondents in the control group. The inclusion criteria of the sample were postpartum primipara, had normal deliveries, had early initiation of breastfeeding, no food restriction, normal BMI, no complications, did early mobilization, could communicate cooperatively, able to eat orally in the form of soft or regular, and willing to become respondents by signing the informed consent.

Intervention

The intervention was given to the respondents in the intervention group was the ripe pineapple juice with dose 250 grams. The juice was made using a juicer with a concentration level of 100% to make 200 cc of a pure juice without added water and sugar, given 1x daily for 7 days. The juice was provided by the investigators and taken directly by the respondents, then recorded on the observation sheet. Meanwhile, in the control group, in accordance with the code

of conduct standard postnatal care, the respondents were given only the health education about the nutritional needs in the postpartum period, and then recorded on the observation sheet of health education administration. Monitoring of both groups was done every day as a following up step to measure the height of uterine fundus.

Instruments

Instruments used in this study were *ultrasonography* (USG) and metlin to measure the height of uterine fundus of the respondents, and the observation sheet to write the height of uterine fundus of the respondents and giving juice.

Ethical consideration

Ethical clearance in this study was obtained from the Health Research Ethics Committee (K.E.P.K) of Health Polytechnic of Ministry of health (Poltekkes) of Semarang and was approved with the ethics code number: 043 / KEPK / polytechnic-SMG / EC / 2017. Data were collected after obtained research permission from the Chairman of the Study Program of Master of Applied Science of Ministry of Poltekkes Semarang and addressed to the Institution of national unity and politic (Kesbangpol) and forwarded to the Health department of Kudus district and the Health Center of Jekulo. In addition, prior to data collection, participants were asked to write and sign an informed consent, which contained information about the research objectives, benefits or risks and the procedure. The consent form was voluntary, which the respondent might at any time withdraw or cancel their participations in this study. The consent form also stated clearly the name and phone number of the researchers if there were further questions regarding the research.

Data collection

In this study, the researchers were assisted by enumerators, namely experienced midwives for the research field or had expertise in accordance with the purpose of research. Enumerators helped to collect the necessary data and provided the intervention in the administration of pineapple juice which had been prepared by the researchers. They also noted the data in the observation sheet, and assisted checking the decrease of the height of uterine fundus everyday day by using pitameter or metlin. There were 6 enumerators in this study. The measurement of the height of uterine fundus was performed after 4-6 hours of the intervention.

Data analysis

A descriptive statistic was performed in this study to describe the characteristic of the respondents, and independent t-test and paired t-test were also performed to see the significant mean difference between the two groups before and after treatment as well as to determine the fundal height difference between treatment groups.

RESULTS

Table 1 shows that the age of respondents both in the intervention and the control group ranged between 22-27 years old. The mean of age was 25 years old with $p=0.411$, which indicated that these both groups were homogenous. In the level of education, both groups were also homogenous with $p=0.445$. The breastfeeding frequency in the intervention group was 7.36 times per day and in the control group was 7 times per day, which was also homogenous with $p=0.370$.

Table 1 Characteristic of respondents based on mothers' age, education, and breastfeeding frequency

Variable	Group	Mean	Median	Min	Max	SD ²	<i>P value (homogeneity)</i>
Age (year)	Intervention	24.64	25	22	27	1.39	0.411
	Control	24.7	25	23	27	1.13	
Breastfeeding frequency	Intervention	7.36	7	6	8	0.633	0.370
	Control	7.00	7	5	8	0.961	
Education	Intervention	1.64 ^{``}	2	1	2	0.497	0.445
	Control	1.71	2	1	2	0.469	

Table 2 Measurement of fundal height in pretest and posttest using USG

Intervention group	Mean	Minimum	Maximum	SD
Pretest	13.70	13.0	14.3	0.50
Posttest	5.80	5.1	7.7	0.61
Control Group	Mean	Minimum	Maximum	SD
Pretest	13.35	12.4	14.2	0.56
Posttest	7.01	5.1	7.8	0.78

Table 2 shows that in the intervention group, there was a decrease of the height of the uterine fundus after given pineapple juice with mean score 13.80 in pretest and

5.80 in posttest. There was also a decrease in fundal height in the control group with mean score 13.35 in pretest and 7.01 in posttest.

Table 3 Mean difference of fundal height between the intervention and control group using USG

Groups	Mean	Minimum	Maximum	SD
Intervention	8.15	7.3	8.6	0.43
Group	6.09	5.4	6.7	0.58

As shown in table 3, the mean of fundal height in the intervention group was 8.15 cm in 7 days, while in the control group

was 6.09 cm. It can be seen the difference of the average of the decrease of fundal height between the two groups.

Table 4 Fundal height before and after intervention in the intervention and control group (Paired t-test)

Fundal height	Paired Differences					T	Df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
<i>Intervention Group</i>								
Pretest-Posttest	7.9071	.7498	.2004	7.4742	8.3401	39	13	.000*
<i>Control Group</i>								
Pretest-posttest	7.121	1.02	.1930	6.73	7.52	37	27	.000*

*) < .05

Paired t-test in table 4 shows that the mean of fundal height in pretest-posttest in the intervention group and control group was statistically different, referred to the p-value of sig. (2 tailed) was < .05.

It could be said that fundal height for those who got pineapple juice in the intervention group, and standard care in the control group were significantly decreased.

Table 5 The difference of fundal height in the intervention and control group (*independent t-test*)

	<i>Intervention Group</i>	<i>Control Group</i>	<i>p-value</i>
<i>Pretest</i>	13.70	13.35	0.089
<i>Posttest</i>	5.80	7.01	0.000*

* (<0.05)

Table 5 shows that there was no significant difference of fundal height between intervention and control group during pretest with p -value = 0.089. In posttest, there was a significant difference of fundal height in both groups with p -value = 0.000.

DISCUSSION

Findings of this study showed that there was a significant difference in the effect of pineapple juice on fundal height between the intervention and control group. It could be said that consuming pineapple juice in 7 days could lower the fundal height quickly. This effect however was related to the contents of the pineapple, which was mentioned by a previous study that bromelain enzyme in the pineapple could stimulate prostaglandin and affect to the uterine contraction.¹⁸ Bromelain enzyme is a proteolytic exogenous enzyme in the cysteine proteinase group that is widely used for the tenderness of meat largely due to the degradation of connective tissue.¹⁵ This enzyme also showed hydrolytic activity in the connective tissue, especially against collagen, collagenase activity of bromelain by hydrolyzing collagen accumulation hidroksiprolin.¹⁵ Collagen is an abundant protein found throughout the body of animals and humans. About 30 percent of the total protein in the body is collagen, found in all connective tissues, such as dermal bones, tendons and ligaments, which provide structural integrity to all internal organs and normal tissue.¹⁹

In this study, collagen is an important component in the connective

tissue in the body to compose artery walls, veins, capillaries of the body which provides the strength, structure and flexibility of the blood vessels that transport blood throughout the body.¹⁹ Thus, having pineapple juice that contains bromelain will make an effective uterine involution because collagen in the body that has been hydrolyzed by bromelain will make uterine muscle become elastic.

Bromelain is absorbed from the gastrointestinal tract functionally in the form intact; approximately 40% of bromelain is absorbed from the intestine in the form of large molecules.²⁰ Bromelain can retain proteolytic activity in plasma and is also found to bind to the alpha 2-macroglobulin, alpha1-anti-chymotrypsin, and two anti-proteinases in the blood.²⁰ In a study conducted by P. Rajendra showed that 3.66 mg / ml of bromelain to be stable in artificial stomach juice after 4 hours of reaction, and 2.44 mg / ml bromelain remain in the blood after 4 hours reaksi.¹³

Pineapple (*Ananas comosus (L.) Merr*) juice can be used as a safe and effective herbal therapy for accelerating the process of uterine involution in the postpartum period in order to avoid complications. Findings of this study showed that the decrease of fundal height in the intervention group was 8.15 cm while control group only was 6.09 cm. However, the decrease of fundal height was processed gradually, not all at once. Study said that the height of fundus will decrease 1 cm per day.²¹ In this study, from the result of 8.15 cm of fundal height in 7 day, it can be said that the average of

the decrease of fundal height per day was 1.16 cm.

Limitation of the study

The researchers in this study did not perform the test of the content of pineapple more specifically, such as bromelain enzyme levels to determine how much of the content in 100 grams of pineapple, which each pineapple might have different level of the enzyme.

CONCLUSION

It can be concluded that pineapple (*Ananas comosus (L.) Merr*) juice had a significant effect in the decrease of fundal height. The finding of this study can be used as herbal or medicinal plants which can be used during postpartum period that is processed naturally without involving the use of chemical. This intervention also can be incorporated into the procedure standard of midwives in postnatal care beside giving health education to mothers to consume food or beverage source of antioxidants, rich in vitamin c and bromelin.

Declaration of Conflict of Interest

None declared.

Funding

This study was supported by Health Ministry Polytechnic Semarang, Semarang, Indonesia.

Authorship Contribution

The authors equally contributed in this study.

References

1. Department of Health of Central Java Province. *Health Profile of Central Java Province*. Central Java: Department of Health of Central Java Province; 2014.
2. Department of Health of Kudus. *Health profile of Kudus Regency*. Kudus: Department of Health of Kudus, Indonesia; 2015.
3. Bateman BT, Berman MF, Riley LE, Leffert LR. The epidemiology of postpartum hemorrhage in a large, nationwide sample of deliveries. *Anesthesia & Analgesia*. 2010;110(5): 1368-1373.
4. Walfish M, Neuman A, Wlody D. Maternal haemorrhage. *British Journal of Anaesthesia*. 2009;103(suppl 1):i47-i56.
5. Zaman BS, Badar S, Sher Uz Zaman M, Tariq M. Risk factors for primary postpartum hemorrhage. *Professional Medical Journal-Quarterly [The]*. 2007:378-381.
6. Ujah IAO, Aisien OA, Mutihir JT, Vanderjagt DJ, Glew RH, Uguru VE. Maternal mortality among adolescent women in Jos, North-Central, Nigeria. *Journal of Obstetrics and Gynaecology*. 2005;25(1):3-6.
7. Health Center of Jukelo. *Profile of the Health Center of Jukelo*. Jukelo: Health Center of Jukelo, Kudus Regency, Central Java, Indonesia; 2015.
8. Zagami SE, Golmakani N, Saadatjoo SA-R, Ghomian N, Baghbani B. The shape of uterine contractions and labor progress in the spontaneous active labor. *Iranian Journal of Medical Sciences*. 2015;40(2):98.
9. Medan MS, El-Daek T. Uterine involution and progesterone level during the postpartum period in Barbary ewes in north Libya. *Open Veterinary Journal*. 2015;5(1):18-22.
10. Weydert JA, Benda JA. Subinvolution of the placental site as an anatomic cause of postpartum uterine bleeding: A review. *Archives of Pathology & Laboratory Medicine*. 2006;130(10): 1538-1542.
11. Gita S, Saeed B. A Normal Pattern of Uterine Involution Using S-FD in Primiparous women and the prevalence of uterine subinvolution. *Journal of Medical Sciences*. 2006;6(6):1011-1014.
12. Ho M, Li T-C, Su S-Y. The association between traditional Chinese dietary and herbal therapies and uterine involution in postpartum women. *Evidence-Based Complementary and Alternative Medicine*. 2011;2011: 918291.

13. Pavan R, Jain S, Kumar A. Properties and therapeutic application of bromelain: A review. *Biotechnology Research International*. 2012;2012.
14. Manzoor Z, Nawaz A, Mukhtar H, Haq I. Bromelain: Methods of Extraction, purification and therapeutic applications. *Brazilian Archives of Biology and Technology*. 2016;59.
15. Ionescu A, Aprodu I, Pascaru G. Effect of papain and bromelin on muscle and collagen proteins in beef meat. *The Annals of the University Dunarea de Jos of Galati. Fascicle VI—Food Technology, New Series*. 2008:9-16.
16. Abu Khairi Muzzaman M. *Pengaruh ekstrak nanas muda (Ananas comosus L. Merr) terhadap kontraktibilitas otot polos uterus terpisah dari marmut betina (Cavia porcellus) [Effect of Ananas comosus L. Merr on contraction of smooth muscles in Cavia porcellus]*. Malang: University of Muhammadiyah Malang; 2009.
17. Lemeshow S, Hosmer DW, Klar J, Lwanga SK. *Adequacy of sample size in health studies*. Geneva: World Health Organization; 1990.
18. Mathai V. Immobilization and kinetic studies of bromelain: A plant cysteine protease from pineapple (Ananas comosus) plant parts. *International Journal of Medical and Health Sciences*. 2012;1(1):10-16.
19. Beckman MJ, Shields KJ, Diegelmann RF. Collagen. *Encyclopedia of Biomaterials and biomedical engineering, Second edition (Online version)*. Florida: CRC Press; 2008.
20. Bhattacharyya BK. Bromelain: an overview. *Natural Product Radiance*. 2008; 7(4): 359-363.
21. Leifer G. *Maternity nursing: An introductory text*. Philadelphia: Elsevier /Saunders; 2005.

Cite this article as: Harianja WY, Setiani O, Umaroh, Widyawati MN, Mashoedi ID, Pujiastuti SE. The impact of pineapple (*Ananas Comosus (L.) Merr.*) juice on fundal height in primigravida mothers during postpartum period. *Belitung Nursing Journal*. 2017;3(2):134-141. <https://doi.org/10.33546/bnj.76>