

# The Effect of Pineapple Juice (*Ananas comosus*) on the Uterine Involution of Postpartum Mothers at Pratama Jannah and Dermawati Maternity Clinics of Deli Serdang Regency in 2019

Ardiana Batubara<sup>1</sup> & Fitriyani Pulungan<sup>1</sup>

<sup>1</sup>Jurusan Kebidanan, Poltekkes Kemenkes Medan, Medan, Indonesia

Correspondence: Rumelia Lubina Sembiring, Comprehensive Emergency Neonatal Obstetrics, RSUD Subulussalam, Aceh, 24782, Indonesia. Tel: +628-139-604-5555. E-mail: rumelia.lubina@gmail.com

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## Abstract

Uterine involution is the enlarged uterus that undergoes a physiological involution of about 6 weeks returning to its nonpregnant condition. Uterine subinvolution occurs due to the uterus cannot contract properly, causing bleeding, leading possibility to death. Various synthetic drugs have been used in accelerating uterine involution by inducing uterine contractions and preventing uterine subinvolution often lead to anaphylactic reactions, short-term arterial hypotension, hot flashes and reflex tachycardia, nausea, vomiting, and heart rhythm disturbances. Concerning the adverse effects of the synthetic drugs in accelerating uterine contractions and preventing uterine subinvolution, many researchers had conducted studies pertaining to the beneficial of natural medicinal plants in accelerating uterine involution by inducing uterine contractions and preventing uterine subinvolution, including pineapple (*Ananas comosus*). The aim of the current study was to determine the effect of pineapple juice on the uterine involution in postpartum mothers at Pratama Jannah and Dermawati Maternity Clinics of Deli Serdang Regency in 2019. The study design was a quasi-experiment with pretest and posttest using independent t-test. The sample numbers were 40 postpartum mothers that consisted of 20 samples in the control group and 20 samples in the intervention group by predetermined criteria. The dependent variable of uterine involution by inducing uterine contractions was fundal height (the distance between the symphysis pubis and the uterine fundus) and the independent variable was pineapple juice. Fundal height was measured using a metric tape. Data collection was carried out by the means of direct interview using questionnaires and observation sheets. The data were analyzed using independent t-test. The statistical test used was t-test. Results of the statistical t-test revealed that  $p\text{-value} = 0.0001 < \alpha = 0.05$ , in which  $H_0$  was rejected, meaning that there was a significant difference in the group control group and the intervention group on the uterine involution in postpartum mothers with  $p\text{-value} = 0.002 (\alpha < 0.05)$ . It was concluded that pineapple juice showed a significant effect in reducing uterine subinvolution and accelerated uterine involution of postpartum mothers at Pratama Jannah and Dermawati Maternity Clinics in Deli Serdang Regency. It is suggested to use pineapple juice as natural therapy in reducing the adverse effects of uterine involution.

**Keywords:** Postpartum mother, uterine involution, pineapple

## 1. Introduction

During uterine involution in the postpartum period, the enlarged uterus undergoes a physiological involution of about 6 weeks returning to its nonpregnant condition (Kristoschek et al., 2017) and its process is primarily due to the hormone oxytocin (Medan & El-Daek, 2015). The involution process includes the degradation and resorption of collagen (Ryvniak et al., 1999) which represent sequential vaginal discharge (lochia) that occurs during the first week after delivery that consists of blood, mucus, uterine tissue and other materials from the uterus (Oppenheimer et al., 1986; Marchant et al., 1999; Sherman, 1999; Chi et al., 2010), the contraction of uterine smooth muscles that manifests as the gradual decrease of symphysis pubis-uterine fundus distance (Cluett et al., 1997), and the repair of endometrium and blood vessels (Weydert & Benda, 2006). Immediately following the delivery, the uterus and the placental site contracts rapidly to prevent further blood loss that can lead to abdominal pain or cramps. At this point, the uterus has an increased tone, feels firm, and weighs 1000 g, and at the end of the first week, it weighs 500 g, and by six weeks, it weighs approximately 50 g (Negishi et al., 1999; Mulic-Lutvica et al., 2001; Sokol et al., 2004).

Any failure in the process of degeneration or regeneration leads to subinvolution of the uterus that disturbs the uterus to return to its normal size (Williams, 1882). Abnormal symptoms of uterine subinvolution are abnormal lochial discharge in weeks, irregular or excessive uterine bleeding, irregular cramps, and larger than normal uterus (Sokol et al., 2004; Jamie & Benda, 2006). Secondary postpartum hemorrhage (PPH) that occurs more than 24 hours following delivery and lasts until 6 weeks postpartum is an unusual complication following a vaginal delivery with a reported incidence of 0.5 to 1.3%, but is associated with serious maternal morbidity and mortality (Ben-Ami et al., 2005).

Acute postpartum hemorrhage has several potential causes and can be mainly divided into primary and secondary. Primary causes of postpartum hemorrhage include: uterine atony (lack of effective contraction of the uterus), genital tract lacerations, retained placenta, uterine inversion, abnormal placentation and coagulation disorders. Uterine atony is the most common cause of postpartum hemorrhage. Postpartum hemorrhage in a previous pregnancy is a significant risk factor and providers should make all the effort to establish its severity and cause (Kelly et al., 2022). Secondary causes of postpartum hemorrhage include retained products of conception, infection, subinvolution of the placental site and inherited coagulation deficits (Lin et al., 2019; Changede et al., 2019; Joseph et al., 2018; Gillissen et al., 2018).

Subinvolution treatment depends on the cause. The treatment for uterine subinvolution consists of the removal or prevention of several causes that lead to it. Basically, emptying the uterine cavity by surgery is the main treatment for the retention of the placenta or membranes. For uterine atony, uterotonic agents are the primary drugs for treatment, and the most prescribed one is oxytocin (Vallera et al., 2017). Besides, methylergonovine, carboprost, and misoprostol are also functional medications for uterine contraction and are candidate drugs for the treatment of uterine subinvolution (Lin et al., 2011; Vallera et al., 2017). Endometrial curettage may not be curative, and continued brisk bleeding may require hysterectomy in spite of fluid and coagulation maintenance. Known methods for the prevention of uterine subinvolution after childbirth, including the appointment of common drugs that enhance uterine contractions: oxytocin, tincture of water pepper, quinine (Abramchenko & Bogdashkin, 1988; Mashkovsky, 1988; Vidal, 1995). However, these drugs often lead to anaphylactic reactions, short-term arterial hypotension, hot flashes and reflex tachycardia, nausea, vomiting, and heart rhythm disturbances. Moreover, their usage is limited due to antidiuretic action. With the introduction of oxytocin in large doses for a long time, water intoxication with convulsions may develop. The problem solved by the invention is to eliminate the disadvantages of the prototype, reducing side effects, which leads to an increase in the effectiveness of treatment (Fursova et al., 1999; Chernukha et al., 2000). Regarding the adverse effects of synthetic drugs in accelerating uterine involution by inducing uterine contractions and preventing uterine subinvolution, several studies investigate uterotonic properties of medicinal plants including pineapple (*Ananas comosus*) in inducing uterine involution, monitoring and preventing uterine subinvolution although the concerned studies are still lacking (Monji et al., 2016; Baroroh and Prajayanti, 2016; Rahayu and Sugita, 2015; Katno et al. 2010; Pavan et al. 2012; Harianja et al. 2017; Apsari et al. 2016).

In view of the wide range of beneficial health effects of the pineapple on uterine activity, the authors of the present study intend to investigate the effect of pineapple juice on the uterine involution by inducing uterine contractions. This notion stems from the fact that there is lack of potent, selective and non-toxic natural drug to manage uterine involution and subinvolution after delivery.

## 2. Method of the Study

The current study was a quasi-experimental research design. This study was conducted in the health service area of Pratama Jannah and Dermawati Maternity Clinics of Deli Serdang on 1 June to 1 August 2017.

### 2.1 Sampling

The target populations in the present study were postpartum mothers. There were 40 respondents recruited in this study using consecutive sampling technique. The formula of Lemeshow was used to recruit the sample that consisted of 20 respondents in the intervention group and 20 respondents in the control group.

### 2.2 Inclusion and Exclusion Criteria

The inclusion criteria of the sample were postpartum mothers, had normal deliveries, had early initiation of breastfeeding, no food restriction, normal BMI, no complications, did early mobilization, capable of communicate cooperatively, able to eat orally in regular time, and willing to become respondents by signing the informed consent, good physical and mental health, a normal delivery history. The exclusion criteria include postpartum mothers with a history of digestive disease (maag), and parity of < 4.

### 2.3 Research Design

#### 2.3.1 Two Groups with Pretest-Posttest Using Independent T-Test

20 respondents in the control group were not treated with ripe pineapple juice from day 1- Day 56 or 8 weeks (pretest) and their fundal heights were daily measured using a metric tape during 3 days of hospitalization at the maternity clinics and their respective homes. Subsequently those in the intervention group were treated with the ripe pineapple juice on day 8 to day14 (posttest).

#### 2.3.2 Preparation of Pineapple Juice Extract

respondents in the intervention group were orally treated with the ripe pineapple juice in the dose of 200 g after lunch. 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. The pineapple juice was given 1x daily for (8 weeks). The juice was provided by the authors and enumerators (experienced midwives) and taken orally by the respondents, then it was recorded on the observation sheet. Meanwhile, those in the control group, in accordance with the code of conduct standard postnatal care, they were given only health counseling about the nutritional needs of the postpartum period, and then were recorded on the observation sheet of health counseling. Monitoring of both groups was done every day as a following up step to measure fundal height (distance between the symphysis pubis and the uterine fundus). The instruments used in this study were a metric tape to measure fundal heights of the respondents and the observation sheet to write the length of postpartum uterine involution of the respondents.

#### 2.3.3 Procedure of the Measurement of Postpartum Uterine Involution

Postpartum uterine involution was immediately measured after 4-6 hours of delivery for two groups of respondents using a metric tape of non-elastic material by placing the zero marker at the top of the uterus. Fundal height was immediately measured by the distance between the symphysis pubis and the uterine fundus using a metric tape (Othman et al., 2022).

The following steps of measurement of uterine involution (White et al., 2012):

- Emptying bladder before measuring fundal height
- Lying on non-elastic mattress in the semi-recumbent position.
- Still lying and breathe normally as the authors or enumerators palpate the uterus.
- Using a metric tape by placing the zero marker at the top of the uterus. Moving the metric tape vertically down the stomach and placing the other end at the top of the pubic bone.

Six 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 reduction of postpartum uterine involution everyday by using a metric tape.

### 2.4 Data Analysis

The Saphiro-Wilk statistical test was selected to determine normality of data distribution for 9-50 samples (Razali & Wah, 2011). If  $p\text{-value} \leq 0.05$ , then the variable is not normally distributed, whereas if  $p\text{-value} > 0.05$ , the variable may be normally distributed (Mishra et al., 2019). Independent t-test and dependent t-test were used to determine mean difference of the postpartum uterine involution between the control group and the intervention group of postpartum mothers. The  $p\text{-value} < 0.05$  of the tests were considered statistically significant. All data were processed using SPSS software package, version 22; SPSS, Inc., Chicago, Illinois, USA.

### 2.5 Research Ethics

Ethical clearance was obtained from the Health Research Ethics Committee of Health Polytechnic of Ministry of Health (Poltekkes) of Medan and was approved with the ethics code. Data were collected after obtained research permission from the Chairman of the Study Program of Applied Science of Ministry of Health Polytechnic of Ministry of Health (Poltekkes) of Medan and were then submitted to the Health Department of Deli Serdang Regency and the Health Center. 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 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 were assisted by enumerators (experienced midwives).

## 3. Results

Distribution normality of the data of fundal heights of postpartum mothers from normality test using the

Shapiro-Wilk test at Pratama Jannah and Dermawati Maternity Clinics in Deli Serdang Regency is shown in Table 1. The Shapiro-Wilk normality test was used to determine normality distribution of the data ( $p>0.05$ ).

Tabel 1. Normality test of the control group and the intervention group of postpartum mothers from the Saphiro-Wilk test

No	Data	p-value	$\alpha$	Results
1	Pretest of Intervention Group	0.16	0.05	Normal
2	Pretest of Intervention Group	0.14	0.05	Normal
3	Pretest of Control Group	0.16	0.05	Normal
4	Pretest of Control Group	0.16	0.05	Normal

In Table 1, p-value of data of pretest in the intervention group is 0.16, then data of fundal height in the intervention are normally distributed ( $0.16>0.05$ ). P-value of data of posttest in the intervention group is 0.14, and therefore data of fundal height in the intervention are normally distributed ( $0.14>0.05$ ). P-value of data of pretest in the control group is 0.16, thus data of fundal height in the control groups are normally distributed ( $0.16>0.05$ ). P-value of data of posttest in the control group is 0.16, then data of fundal height in the control are also normally distributed ( $0.16>0.05$ ) respectively.

### 3.1 Univariate Analysis

Table 2. Uterine involution by fundal heights of postpartum mothers between the control group and the intervention group.

Uterine Involution	Mean	Fundal Height		SD
		Min.	Max.	
Control	12.5	12.5	13.0	0.36
Intervention	5.45	2.0	11.0	1.79

Table 2 shows comparison of uterine involution by fundal height (distance between the symphysis pubis and the uterine fundus) between the control group without treatment of ripe pineapple juice from day 1-day 56 and the intervention group with treatment of ripe pineapple juice from day 8-day 14 (posttest) of postpartum mothers at Pratama Jannah and Dermawati Maternity Clinics in Deli Serdang Regency. Uterine involution of the intervention group (Min. = 2.0; Max. = 11.0; Mean = 5.45; SD = 1.79) was significantly reduced compared to the control group (Min. = 12.0; Max. = 13.0; Mean = 12.5; SD = 0.36). The fundal heights of postpartum mothers in the intervention group were 12.0 cm to 2.0 cm, whereas those of the control group were 12.5 cm to 5.45 cm.

### 3.2 Bivariate Analysis

Tabel 3. Fundal heights of the intervention group of postpartum mothers

No	Fundal Height	Min.	Max.	Mean
1	Pretest	12.0	13.0	12.5
2	Posttest	2.0	11.0	5.45

Table 3 indicates comparison of uterine involution by fundal height (distance between the symphysis pubis and the uterine fundus) the intervention group with treatment of ripe pineapple juice from day 1 (pretest) until day 56 (posttest) of postpartum mothers at Pratama Jannah and Dermawati Maternity Clinics in Deli Serdang Regency. Uterine involution of the intervention group before intervention (Min. = 12.0; Max. = 13.0; Mean = 12.5) and after intervention (Min. = 2.0; Max. = 11.0; Mean = 5.45).

Tabel 4. Fundal heights of the control group of postpartum mothers

No	Fundal Height	Min.	Max.	Mean
1	Pretest	9.0	15.2	13.09
2	Posttest	2.5	8.0	4.11

Table 4 indicates comparison of uterine involution by fundal height (distance between the symphysis pubis and the uterine fundus) the control group without treatment of ripe pineapple juice from day 1 (pretest) until day 56 (posttest) of postpartum mothers at Pratama Jannah and Dermawati Maternity Clinics in Deli Serdang Regency. Pretest uterine involution of the control group (Min. = 9.0; Max. = 15.2; Mean = 13.09) and post test the control group (Min. = 2.5; Max. = 8.0; Mean = 4.11).

Table 5. The effect of pineapple juice (*Ananas Comosus*) on the uteral involution by fundal height between the control group (n = 20) and the intervention group (n = 20)

No	Uteral Involution	Mean	SD	df	p
1	Fundal height of pretest and posttest	8.012	2.086	39	0.0001

Table 5 presents the significant effect difference of pineapple juice on the uteral involution by fundal height with  $p$ -value = 0.0001 <  $\alpha$  = 0.05 derived from statistical t-test between the control group of 20 respondents within 8 weeks (pretest) and the intervention group of 20 respondents (posttest) for 8 weeks. Hence, there was a significant difference of pineapple juice treatment between the control group and the intervention group of postpartum mothers at Pratama Jannah and Dermawati Maternity Clinics in Deli Serdang Regency.

Reduction of uterine involution of postpartum mothers before and after the treatment of pineapple juice (*Ananas comosus*) at the intervention group at kelompok Pratama Jannah Maternity Clinic at Deli Serdang Regency was 8.975 cm (pretest of 13.090 cm and posttest of 4.115 cm). Meanwhile reduction of uterine involution of postpartum mothers before and after the treatment of pineapple juice (*Ananas comosus*) for the control group at Dermawati Maternity Clinic of Deli Serdang Regency was 7.05 cm (pretest of 12.5 cm and posttest of 5.45 cm) that the mean difference of reduction of uterine involution of postpartum mothers was 1.925 cm (8.975 cm – 7.05 cm), meaning that reduction of uterine involution of postpartum mothers after the treatment of pineapple juice (*Ananas comosus*) for the intervention group at Pratama Jannah and Dermawati Maternity Clinics at Deli Serdang regency was more significant lebih signifikan at 1.925 compared to the control group of postpartum mothers.

The effect of pineapple juice (*Ananas Comosus*) on the uteral involution by fundal height between the control group (n=20) and the intervention group (n=20) for 8 weeks from results of t-test of uterine involution of postpartum mothers was  $p$ -value = 0.0001 <  $\alpha$  = 0.05, meaning that  $H_0$  was rejected that there was a significant different of pineapple juice treatment (*Ananas comosus*) between the control group and the intervention group of postpartum mothers at Pratama Jannah and Dermawati Maternity Clinics at Deli Serdang regency.

## 5. Discussion

Our study is in line with other related studies. The study of Harianja et al. (2017) proved reduction of the average height of the uterine fundus by 8.15 cm for seven days after the treatment of 250 grams of ripe pineapple juice once a day for seven days. The study of Baroroh (2016) showed that pineapple juice reduced fundal heights of postpartum mothers in Pekalongan with t-value of 6.589 (sig.>0.05) and showed the significant different of fundal height reduction between the control group and the intervention group with the mean value of fundal height reduction was 9.4 cm higher than those in the control group with the mean value of fundal height reduction was 7 cm. The study of Muzzaman (2009) also attested a significant effect of pineapple in inducing uterine contraction with the value of 85.9 %, as well as the significant effect rates of ripe pineapple extract of 87.6 % and 79.9 % of old pineapple extract. Our study is also associated with the study of Rahayu and Sugita (2015) that the reduction rate of uterine fundus of the treatment group was 9.55 cm which higher than that of the control group of 4.90 cm.

The fruit juice of ripe pineapple shows the ability in treating uterine fibroids and menorrhagia (Ososki et al., 2002), discontinuing uterine hemorrhage and vaginal infection (Coe, 2008) and also treating uterine cancer (Siew et al., 2014), having diverse antioxidants such as bromelain, melatonin, polyphenols, vitamin C and  $\beta$ -carotene (Taussig & Batkin, 1988; Hale et al., 2005; Kongsuwan et al., 2009; Chuffa et al., 2020). Pineapple contains bromelain that can stimulate prostaglandin secretion to induce the uterus contracts adequately (Mugisha & Origa, 2006) and

bromealin in pineapple juice helps break down collagen that softens muscle fibers (Manohar et al., 2020).

Analysis of the phenolic composition revealed the presence of tyrosine, dimethyl hydroxyl furanone, glutathione, p-coumaric acid, syringic aldehyde, ferulic acid, caffeic acid and sinapic acid (Javier et al., 1992; Wen & Wrolstad, 2002). 5-Hydroxytryptamine (5HT) or serotonin as a phenolic bioactive compound also had been reported to be present in pineapple fruit (Wen & Wrolstad, 2002). Previous studies have documented the role of the serotonin in uterine contractility in vitro in rat (Minosyan et al., 2007), human myometrium (Cordeaux et al., 2009), contraction of uterus of pregnant female guinea pig (Muzaamman, 2009) and uterine contractions through interaction of uterine with serotonin or 5-Hydroxytryptamine (5HT) that directly affects smooth muscles of the uterus (Ramayulis, 2016).

Postpartum period is a critical period associated with 60% of maternal deaths and 40% of maternal deaths within first 24 hours after delivery due to obstetrics hemorrhage, epigastric pain, infection, headache, hypertensive disorder, blurred vision, face swelling, lack of care, and personal factors (poor knowledge of obstetrics complications (Nunung et al., 2013).

By six weeks, the uterus weighs approximately 50 g (Negishi et al., 1999), and any failure in the process of degeneration or regeneration of the uterus leads to subinvolution that delay the uterus to return to its normal size (Williams, 1882). Uterine cavity might enlarged to any further extent, although it could reach a significant size reduction. It is the reason to conduct strict monitoring and observation of uterine fundal height (Baroroh dan Prajayanti, 2016). Symphysis fundal height (SFH) measurement in postpartum period is commonly practiced primarily to monitor uterine involution. Currently, knowing the normal behavior of the uterus in the early postpartum period is essential, especially when the postnatal services differ among countries, this study will be conducted to screen the pattern of uterine involution in terms of uterine fundal height measurements as a simple screening tool in a local society with low resource settings.

According to Indonesia's national health program policy, at least 4 postnatal visits for all mothers and babies, on 6 to 8 hours postpartum, between days 7 to 14, 2 weeks after delivery and 6 weeks after birth to monitor and evaluate their health conditions (Walyani, 2015). Up to now, many scientists have been developing medication techniques using natural pharmacological drugs derived from plant species, including pineapple fruit for recovery of illness. Some studies proved a significant effect of pineapple juice in reducing uterine fundal height, as also attested in our present study. Therefore, further studies are needed to extract pineapple fruit in the form of gel, syrup, capsule or jam that can provide health benefits for postpartum mothers.

In this present study, fundal height was selected as a parameter of uterine involution although other factors also attributable to the process of uterine involution such as age, parity, early initiation of breastfeeding, and early mobilization (Ambarwati et al., 2010).

As proven in our present study, pineapple juice (*Ananas comosus (L.) Merr*) showed a significant effect in inducing uterine involution for the intervention group of postpartum mothers compared to those in the control group with no treatment of pineapple juice. Studies pertaining to pineapple juice are considered necessary to search for an alternative pharmacological medication by natural processing without synthetic chemical processing in inducing uterine involution for preventing complications.

## 6. Conclusions and Suggestion

There was a significant different of pineapple juice treatment (*Ananas comosus*) between the control group and the intervention group of postpartum mothers at Pratama Jannah and Dermawati Maternity Clinics at Deli Serdang regency. It is hoped that the present study can give valuable information to postpartum mothers that pineapple juice is a potential natural therapy in inducing process of uterine involution during postpartum recovery.

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## Competing Interests Statement

The authors declare that there are no competing or potential conflicts of interest.

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