

The Physiological Changes In The Postpartum Period After Childbirth

Christian Martin Tjiu Ritonga¹, Haleyoan Sofinia², Muhammad viky³, Rokibullah⁴

^{1,2} Fakultas Kedokteran Universitas Palangka Raya, Indonesia

^{3,4} Universitas Islam Bunga Bangsa Cirebon, Indonesia

E-mail: christiansaputra98765@gmail.com, muhhammadviki819@gmail.com,
rokibullah06@gmail.com, haleyoansofinia.16@gmail.com.

* Correspondence: christiansaputra98765@gmail.com

KEYWORDS	ABSTRACT
Physiological Changes, Postpartum, Maternity, Pregnancy,	The physiological changes that occur during the puerperium are very clear, where the process of pregnancy goes in reverse. Physiological changes that occur during pregnancy will return to normal during the postpartum period. Pregnancy and childbirth are physical events, so the concept is that during the puerperium the body will recover. This study aims to provide an explanation of the physiological changes during the puerperium after childbirth and to add insight in describing precisely and training the scientific thinking needed to be able to analyze a problem accurately and quickly. This study used the contrast review method, meaning the journal review method by finding differences between several research journals and then drawing conclusions. The results of this study found that there were several physiological changes during the postpartum period including changes in the reproductive system, changes in the endocrine system, changes in vital signs, changes in the cardiovascular system, changes in the blood circulation system, changes in the hematological system, and changes in the respiratory system.

Attribution-ShareAlike 4.0 International (CC BY-SA 4.0)



Introduction

Pregnancy is an important event in the life of a woman and family in general, although the major changes that will occur greatly affect everyone, especially women. Pregnancy starts from ovulation to partus approximately 280 days (40 weeks). Pregnancy is a series of events that begin with conception and will develop until it becomes an aterm fetus and ends with the process of childbirth.

According to a report by the World Health Organization (WHO) the maternal mortality rate is very high. About 830 women die from complications of pregnancy or childbirth every day. Based on the Indonesian Health Democracy Survey (IHDS) in

2012, it showed a significant increase in MMR, namely to 359 maternal deaths per 100,000 live births. MMR again showed a decrease to 305 maternal deaths per 100,000 live births in 2015. The postpartum period is important to monitor the condition of the mother, especially at 2 hours after giving birth. Post-partum bleeding is one of the causes of MMR, if not handled properly. It will result in shock because a lot of blood comes out.⁵

The postpartum is also called puerperium which comes from Latin, namely from the word "Puer" which means baby and "Parous" means to give birth. Puerperium is blood that comes out of the uterus due to childbirth or after childbirth. The puerperium begins from the moment the placenta is born and ends when the obstetric apparatus returns to what it was before pregnancy. The puerperium lasts approximately 6 weeks. Puerperium lasts for 6 weeks or 42 days, which is the time necessary for the restoration of the obstetric apparatus to a normal state. So the puerperium is the period that starts from the placenta of birth until the obstetrics returns to the way it was before pregnancy and takes approximately 6 weeks.

The postpartum period begins after the placenta is born and ends when the obstetric apparatus returns to what it was before pregnancy, usually lasting 6 weeks or 42 days, but overall it will recover within 3 months. The stages or periods of the puerperium are divided into 3 including early puerperium, intermedial puerperium, and puerperium remote during pregnancy, there are changes in the female body system, including changes. The physiological changes that occur in the postpartum are very obvious, although they are considered normal, where the pregnancy process goes upside down. Physiological changes that occur during pregnancy will return to normal during the postpartum period.

Physiological changes in the postpartum after childbirth include: Changes in the reproductive system, breast changes, changes in the digestive system, changes in the camping system, changes in the musculoskeletal system, changes in the endocrine system, changes in vital signs, changes in the cardiovascular system, changes in the blood circulation system, changes in the hematological system, changes in the respiration system, changes in the integumentum system, changes in the fluid and electrolyte balance system, weight loss, and process of psychological adaptation.

In this postpartum, the mother will notice some changes in the body and emotions. Those who do not know this will certainly be concerned about the changes that occur, which is why it is important for mothers to understand the changes that occur in order to handle and recognize the red flags early.

In this postpartum, anatomical and physiological changes occur in the mother. The physiological changes that occur are very obvious, although they are considered normal, in which the processes in pregnancy go upside down. Many factors, including energy levels, comfort levels, newborn health and the care and encouragement provided by health workers, doctors, midwives and nurses help shape the mother's response to her baby during this postpartum.

To provide favorable care for the mother, baby and her family, a health worker must understand and have a good understanding of the anatomical and physiological changes in the postpartum.

Pregnancy and childbirth are physiological events, so the concept is that in the postpartum period the body will recover. This recovery involves the context of the body as an interrelated organ system, so the physical changes that occur in the mother in the postpartum period are changes in body systems, in an interrelated network. If there is prolonged and unexpected pain, or the mother feels discomfort in the postpartum period,

the presence of risk factors, difficulties, signs of complications or changes leading to pathology, must be able to be detected by health workers as caregivers and can anticipate immediate action within the scope of health management.

Research Methods

This research uses the contrast review method, meaning the journal review method by finding differences between several research journals and then drawing conclusions. The Contrast method is one of the favorite methods of some students and is used as a mass method that must be used in the final project preparation guide. This method is the opposite of the compare method, so it can take several research journals that use the same sample but different research methods, different reagents used or different data applications used.

Results and Discussions

Reproductive System Changes

At this time the size of the uterus is approximately equal to the size of the uterus at 16 weeks of gestation approximately the size of a grapefruit (sour orange) and weighs approximately 1000 grams. Within 12 hours, the height of the fundus reaches approximately 1 cm above the umbilicus. Within a few days later, the change of involution took place quickly. The fundus drops approximately 1 to 2 cm every 24 hours. On the sixth day of the postpartum the normal fundus will be in the interplay between the umbilicus and the pubic symphysis. The uterus cannot be palpated on the ninth day of postpartum. (Bennet & Brown, 2016)

Elevated levels of estrogen and progesterone are responsible for the passive growth of the uterus during pregnancy. Prenatal uterine growth depends on hyperplasia, an increase in the number of muscle cells, and hypertrophy, enlargement of existing cells. In the postpartum period a decrease in the levels of these hormones leads to the occurrence of autolysis, the direct destruction of excessive hypertrophic tissue. Additional cells formed during pregnancy are sedentary. This is the cause of a slightly larger uterus size after pregnancy. Sub involution is the failure of the uterus to return to its pre-pregnancy state. The most frequent causes of sub involution are retained placental fragments and infections.(Bennet & Brown, 2016)

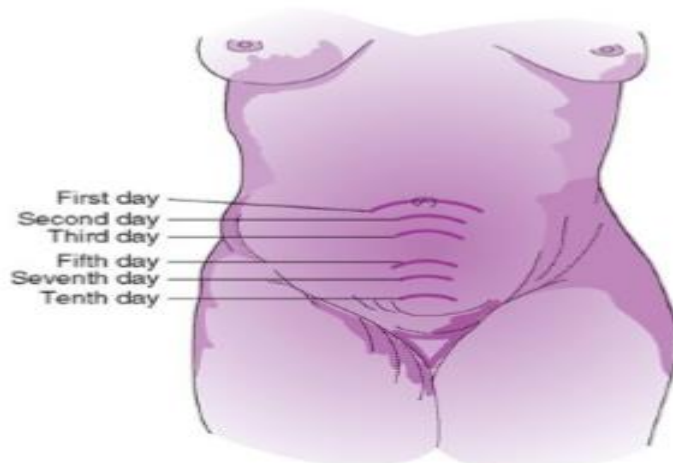


Figure 1. Changes in involution in the height of the fundus and the size of the uterus during the first 10 days postpartum (Caroline Pessel & Ming C. Tsai, 2022)

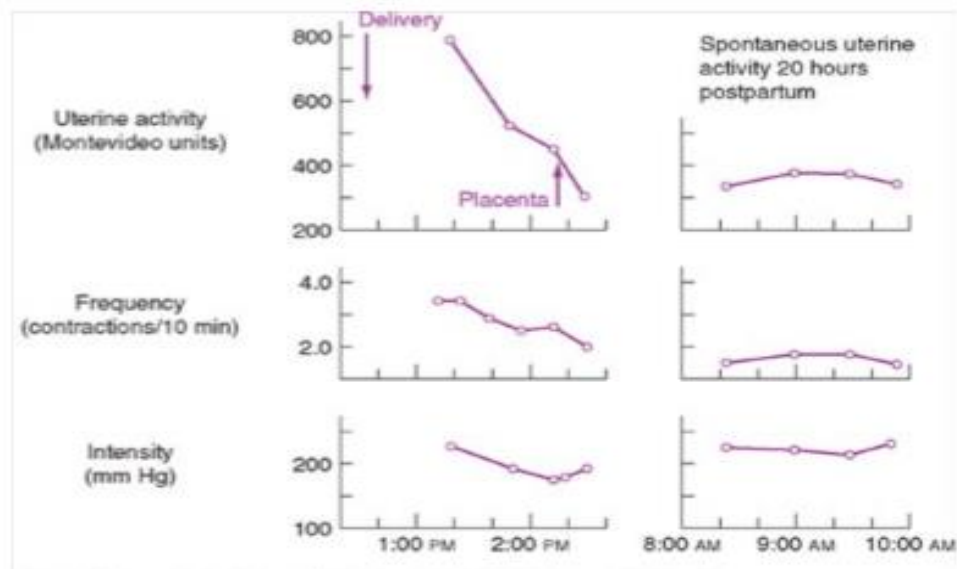


Figure 2. Uterine Activity During Puerperium (Left) and at 20 Hours Postpartum (Right)(Caroline Pessel & Ming C. Tsai, 2022)

Breast Changes

In all women who have given birth the lactation process occurs naturally. The breastfeeding process has two physiological mechanisms, which are as follows: (Sasmita, 2017)

- a) Milk Production
- b) Milk secretion or *let down*

During the nine months of pregnancy, breast tissue grows and prepares its function to provide food for newborns. After giving birth, when the hormones produced by the placenta no longer exist to inhibit it the pituitary gland will secrete prolactin (a lactogenic hormone). Until the third day after delivery, the effect of prolactin on the breast begins to be felt. The blood vessels of the breast become swollen with blood, resulting in a feeling of warmth, swelling, and pain. The acini cells that produce breast milk also begin to function. When the baby sucks the nipple, the nerve reflex stimulates the posterior lobe of the pituitary to secrete the hormone oxytocin. Oxytocin stimulates the *let down* reflex, causing the ejection of breast milk through the active sinuses of the breast to the ducts found in the nipples. When breast milk is flowed due to suction of the baby or by being pumped acini cells to produce more milk. This reflex can continue for quite a long time.(Sasmita, 2017)

Changes in the digestive system

Usually the mother has obstipation after childbirth. This is because at the time of childbirth the digestive apparatus gets pressure that causes the colon to become empty, excessive discharge of fluids at the time of delivery (dehydration), lack of feeding, haemorrhoid, lacerations of the birth canal. In order to re-defecate regularly, a diet / food containing fiber and giving enough fluids can be given. If this effort is not successful within 2 or 3 days, it can be helped by giving huknah or glycerin syringes or giving other drugs. In addition to constipation, the mother also experiences anorexia due to a decrease in the secretion of the digestive glands and affects changes in secretion, as well as a decrease in caloric needs that cause lack of appetite.(Sweet, 2018)

The gastrointestinal system during pregnancy is influenced by several things, including high levels of progesterone which can disrupt the balance of body fluids, increase blood cholesterol, and slow down the contraction of smooth muscles.

Postpartum, progesterone levels also begin to decline. Nevertheless, the intestinal faal takes 3-4 days to return to normal.(Sasmita, 2017)

Changes in the Camping System

Hormonal changes during pregnancy (high levels of steroids) also cause an increase in kidney function, while a decrease in steroid levels after a woman gives birth partly explains the cause of the decrease in kidney function during the postpartum period. Kidney function returns to normal within a month after the woman gives birth. It takes approximately 2 to 8 weeks for hypotonia in pregnancy and dilatation of the ureters and renal pelvis to return to their pre-pregnancy state. In a small percentage of women, dilatation of the urinary tract can settle for 3 months.

The walls of the bladder expose oedem and hyperemia. Sometimes the oedema of the trigonum, gives rise to abstraction from the urethra resulting in urinary retention. The bladder in the *puerperium* is less sensitive and its capacity increases, so the bladder is full or after urination still lags residual urine (normal + 15 cc). Residual urine and trauma to the bladder during labor facilitate the occurrence of infection.

Normal dilatation of the ureters and pyolum within 2 weeks, Urine is usually excessive (polyurie) between the second and fifth days, this is due to excess fluid as a result of water retention in pregnancy and is now secreted. Sometimes hematuri due to the catalytic process of involution, Acetonurie especially after a difficult and long partus caused the breakdown of numerous carbohydrates, due to the activity of the muscles of the uterus and due to hunger. Proteinurine results from the autolysis of muscle cell.(Cunningham et al., 2015)

Changes in the Musculoskeletal System

The muscles of the uterus contract after the partus. The blood vessels that are between the webbing of the uterine muscles will be pinched. This process will stop bleeding after the placenta is born. The ligaments, fascia and pelvic diaphragm that stretch at the time of delivery, after the baby is born, gradually become shrunken and recover again so that it is not uncommon for the uterus to fall backwards and become retroflexible, as the ligaments of the rotundum become saggy. Stabilization perfectly occurs at 6-8 weeks after delivery.²³

As a result of the breakup of the elastic fibers of the skin and the prolonged distension due to the size of the uterus during pregnancy, the abdominal wall is still soft and sagging for a while. To restore the supporting tissues of the genitalia apparatus, as well as the muscles of the abdominal wall and pelvic floor, it is recommended to perform certain exercises.(Hanifa, 2012)

Changes in Placental Hormones (HCG, HPL, Estrogen, and Progesterone)

Placental hormones decline rapidly after childbirth. *Human Chorionic Gonadotropin* (HCG) decreases rapidly and persists up to 10% in 3 hours until the 7th day postpartum and as an onset of mother fulfillment on day 3 postpartum.(Mochtar, 2018)

Table 1.
Changes in the Endocrine System in the Postpartum
(Mochtar, 2018)

Hormon	Perubahan Yang Terjadi	Keadaan Terendah
Hormon Placental Lactogen	Menurun	24 jam
Estrogen	Menurun	Hari ke-7
Progesteron	Menurun	Hari ke-7
FSH	Menurun	Hari ke 10-12
LH	Menurun	Hari ke 10-12

During the postpartum period, major hormonal changes occur. The removal of the placenta leads to a significant decrease in the hormones produced by the organ. The decrease in the hormones human placental *lactogen* (hPL), estrogen, and cortisol, as well as *placental enzyme insulinase* reverses the diabetogenic effects of pregnancy, so that blood sugar levels decrease meaningfully during the puerperium. Diabetic mothers usually need much smaller amounts of insulin for several days. Because these normal hormonal changes make the puerperium a transitional period for carbohydrate metabolism, the interpretation of glucose tolerance tests is more difficult at this time.

25

Estrogen and progesterone levels decreased markedly after the placenta was born, the lowest levels reached approximately one week postpartum. A decrease in estrogen levels is associated with breast swelling and diuresis of excess extracellular fluid accumulated during pregnancy. In women who are not breastfeeding estrogen levels begin to increase in the second week after childbirth and are higher than in women who breastfeed on the 17th day postpartum.(Mochtar, 2018)

During pregnancy normal blood volume increases, it is thought that high levels of the increase in the hormone estrogen enlarge the antidiuretic hormone that increases blood volume. In addition, progesterone affects smooth muscles which reduces excitation and increase in blood vessels which greatly affects the urinary tract, kidneys, intestines, venous walls, pelvic floor, perineum and vulva, as well as the vagina.(Baston & Hall, 2016)

Changes in vital signs

One day (24 hours) in postpartum the body temperature will rise slightly (37.5 – 38°C) due to hard labor during childbirth, fluid loss, and fatigue. Usually on the 3rd day the body temperature rises again due to the formation of breast milk and the breasts become swollen, red in color due to the large amount of breast milk. When the temperature does not drop it indicates the possibility of leading to infection or other abnormal circumstances. The pulse rate is normal in adults 60-80x/min. After childbirth, the pulse will usually be faster. Blood pressure usually does not change. Low blood pressure is likely due to bleeding, while high blood pressure in post partum can signal the occurrence of postpartum preeclampsia. The state of breathing is always related to the state of body temperature and pulse.(Dewi & Susmati, 2017)

Changes in the Cardiovascular System

The three changes in the physiology of the postpartum cardiovascular system that occur in women include the following.(Stables & Rankin, 2020)

- a. Loss of circulation of utero-placenta that reduces the size of maternal blood vessels by 10-15%.
- b. Loss of endocrine function placenta that eliminates the vasodilation stimulus.
- c. The occurrence of extravascular water mobilization stored during pregnancy.

Three postpartum physiological changes that protect women:(Saifuddin, 2017)

1. Loss of uteroplacenta circulation that reduces the size of maternal blood vessels by 10% to 15%.
2. Loss of endocrine function of the placenta that eliminates the vasodilation stimulus.
3. The occurrence of extravascular water mobilization stored during pregnancy. Therefore, hypovolemic shock usually does not occur in normal blood loss.

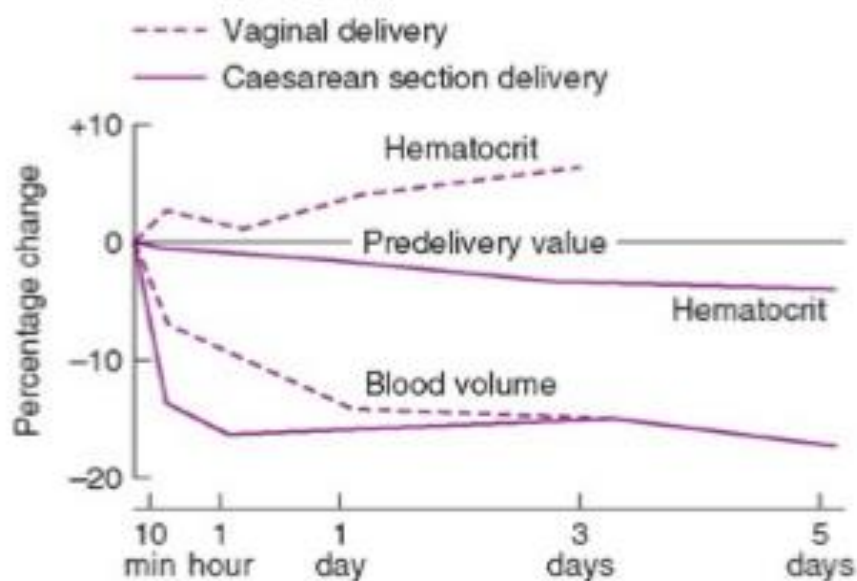


Figure 3. Changes in Hematocrit and Postpartum Blood Volume in Patients Who Gave Birth Pervaginam and By Caesarean Section (Caroline Pessel & Ming C. Tsai, 2022)

Changes in the Blood Circulation System

The presence of a massive increase in uterine blood flow essential to maintain pregnancy is possible by the presence of hypertrophy and significant *remodelling* that occurs in all pelvic blood vessels. After delivery, its diameter is reduced approximately to the size before pregnancy. In the puerperal uterus, the enlarged blood vessels become covered by changes in hyaline, slowly reabsorbed, then replaced by smaller ones. But a few remnants of those larger blood vessels persisted for several years. The mother's body will reabsorb an excessive amount of fluid after delivery. In most mothers, this will result in the production of large amounts of urine, especially on the first day as diuresis increases. (Cunningham, 2012) The mother's body will reabsorb an excessive amount of fluid after delivery. In most mothers, this will result in the production of large amounts of urine, especially on the first day as diuresis increases. Mothers can also develop edema of their ankles and feet. this is possible due to the presence of variations in normal physiological processes due to changes in circulation. This will usually go away on its own in the puerperal range, along with the increase in the mother's activity to care for her baby. Information and advice that can be given to postpartum mothers includes appropriate physical exercise or puerperal gymnastics, avoiding standing for too long, and raising the legs or feet when lying down, avoiding hanging legs when sitting, wearing loose, comfortable and sweat-absorbing clothing, and avoiding wearing footwear with high heels. In physiological conditions, swelling of the ankles or feet is usually bilateral and is not accompanied by pain, and there is no hypertension. Health workers need to study the presence of signs of femoral thrombophlebitis, if the swelling or edema of the leg from unilateral is sometimes accompanied by redness, accompanied by pain, especially in palpation of palpable limbs / calves such as hard rope threads (*phlegmasia alba dolens*). This indicates a sign of inflammation or infection, due to poor blood circulation, thrombus blockage, inflammation to infection in the limb area, in advanced states femoral thrombophlebitis can extend to the pelvis, this condition is called thrombophlebitis pelvica.

Changes in the Hematological System

During the last weeks of pregnancy, fibrinogen and plasma levels as well as blood clotting factors increase. On the first day of postpartum, fibrinogen and plasma levels will decrease slightly but the blood thickens more with an increase in viscosity thus increasing blood clotting factors. Increased leukocytosis where the number of white blood cells can reach 15,000 during labor will remain high in the first few days of the postpartum period. The number of white blood cells can still rise again to 25,000 or 30,000 in the absence of a pathological condition if the woman has a long delivery.

The amount of hemoglobin, hematocrit and erythrocytes will vary greatly in the early postpartum period as a result of blood volume, placental volume and varying blood volume levels. All of these levels will be affected by the woman's nutritional status and hydration. Approximately during birth and the postpartum period there is a blood loss of about 200-500 ml. A decrease in volume and an increase in blood cells in pregnancy is associated with an increase in hematocrit and hemoglobine on day 3-7 postpartum and will return to normal in 4-5 weeks postpartum.(Varney, 2017)

During pregnancy, physiologically there is an increase in the capacity of blood vessels used to accommodate increased blood flow, which is required by placenta and uterine blood vessels. The recall of estrogens causes diuresis to occur rapidly, reducing plasma volumes back to normal proportions. This flow occurs in the first 2-4 hours after the birth of the baby. During this time, the mother secretes a huge amount of urine. The decrease to the disappearance of the hormone progesterone helps reduce fluid retention attached to the vascular increase in those tissues during pregnancy together with the trauma of childbirth. After childbirth, the shunt will disappear abruptly. The relative blood volume of the mother will increase. This situation will cause the load on the heart to increase. This situation can be overcome by a compensatory mechanism with haemoconcentration so that the blood volume returns to normal. Generally, this will happen on 3-7 days postpartum. In most mothers, blood volume almost returns to its original state before 1 week postpartum pregnancy.(McCandlish et al., 2018)

The production of prostacyclins (prostaglandin I₂ [PGI₂]), platelet aggregation inhibitors, and thromboxane A₂, platelet aggregation inducers and vasoconstrictors, increases during pregnancy and during *puerperium*. Likely, the balance between thromboxane A₂ and PGI₂ shifted to the side of dominance of thromboxane A₂ during the *puerperium* as platelet reactivity increases at this point. Rapid and dramatic changes in the coagulation and fibrinolytic systems occur after birth (Table 2.5). A decrease in fibrinogen concentration begins during labor and reaches its lowest point on the first day of postpartum. After that, the increased level of plasma fibrinogen reaches its prenatal value on the third or fifth day of the *puerperium*. This secondary peak in fibrinogen activity is maintained until the second week of postpartum, after which the activity level slowly returns to normal levels while not pregnant for the next 7-10 days. A similar pattern occurs with respect to factor VIII and plasminogen. The level of circulation of antithrombin III decreases in the third trimester of pregnancy. Patients with congenital antithrombin III deficiency (endogenous inhibitor of factor X) have recurrent venous thromboembolic disease, and low levels of this factor have been associated with a state of hypercoagulation.

The mother's plasma fibrinolytic activity is greatly reduced during the last months of pregnancy but increases rapidly after childbirth. In the first few hours of postpartum, an increase in the activity of tissue plasminogen activators (tPA) develops, along with a slight prolongation of thrombin time, a decrease in plasminogen activator inhibitors, and a significant increase. Protein C is an important coagulation inhibitor that requires the nonenzymatic cofactor protein S (which exists as a free protein and as a

complex) for its activity. The level of S protein, both total and free, increases on the first day after calving and gradually returns to normal levels after the first week of postpartum.

The increased concentration of clotting factors that are usually seen during pregnancy can be seen as an important reserve to compensate for the rapid consumption of these factors during childbirth and in increasing hemostasis after childbirth. Despite this, extensive activation of clotting factors, along with immobility, sepsis, or trauma during labor, can establish a stage for thromboembolic complications later in life. A secondary increase in fibrinogen, factor VIII, or platelets (which remain well above the value of not conceiving in the first week of postpartum) is also a predisposition to thrombosis during the puerperium. The sudden return of fibrinolytic activity after calving may be a protective mechanism to combat this danger. A small percentage of puerperal women who show a decreased ability to activate the fibrinolytic system appear to be at high risk for the development of postpartum thromboembolic complications. (Caroline Pessel & Ming C. Tsai, 2022)

Table 2.

Changes in Blood Coagulation and Fibrinolysis during *Puerperium* (Caroline Pessel & Ming C. Tsai, 2022)

	Time Postpartum				
	1 Hour	1 Day	3-5 Days	1st Week	2nd Week
Platelet count	↓	↑	↑↑	↑↑	↑
Platelet adhesiveness	↑	↑↑	↑↑↑	↑	0
Fibrinogen	↓	↓	↑	0	↓
Factor V		↑	↑↑	↑	0
Factor VIII	↓	↓	↑	↑	↓
Factors II, VII, X		↓	↓	↓↓	↓↓
Plasminogen	↓	↓↓	0	↓	↓
Plasminogen activator	↑↑↑	↑↑	0		
Fibrinolytic activity	↑	↑↑	↑↑	↑	
Fibrin split products	↑	↑↑	↑↑		

Changes in the Respiration System

The most rapidly changing lung functions are those affected by changes in the entrails and thoracic cage capacity. The volume of the lungs changes in the puerperium and gradually returns to a state of non-pregnancy. The total capacity of the lungs increases after childbirth due to a decrease in intraabdominal pressure on the diaphragm. Increased ventilation at rest and oxygen consumption as well as a less efficient response to exercise can persist during the early weeks of postpartum. Comparison of aerobic capacities before pregnancy and postpartum shows that lack of activity and weight gain contribute to the effect of general termination of 4-8 weeks postpartum. ¹⁵

Changes in acid-base status generally parallel to changes in respiratory function. The state of pregnancy is characterized by respiratory alkalosis and compensated metabolic acidosis, while childbirth is a transitional period. Significant hypocapnia (<30

mm Hg), increased blood lactate, and metabolic acidosis are compensated, while childbirth indicates a transitional period. Significant hypocapnia (<30 mm Hg), an increase in blood lactate, and a decrease in pH are first noted at the end of the first stage of labor and extend to the puerperium. Within a few days, there was an increase towards normal values of PCO₂ when not pregnant (35–40 mm Hg). Progesterone affects the speed of ventilation through a central effect, and a rapid decrease in levels of this hormone is responsible for the increase in PCO₂ seen in the first week of postpartum. An increase in excess of bases and plasma bicarbonates accompanies relative postpartum hypercapnia. A gradual increase in pH and excess of bases occurs until normal levels are reached around 3 weeks postpartum.¹⁵

Arterial PO₂ at rest and oxygen saturation during pregnancy is higher than in non-pregnant women. During labor, oxygen saturation can be suppressed, especially in the supine position, possibly as a result of a decrease in cardiac output and a relative increase in the number of intrapulmonary pyre. However, an increase in arterial oxygen saturation of up to 95% was noted during the first day of postpartum. The apparent oxygen debt that occurs during labor extends to the immediate puerperium and seems to depend on the length and severity of the second stage of labor. Many researchers have commented on the continuous increase of the basal metabolic rate during the period of 7-14 days after childbirth. Increased oxygen consumption at rest at the beginning of the puerperium has been linked to mild, lactation, and psychological factors of anemia.(Caroline Pessel & Ming C. Tsai, 2022)

Integumentum System Changes

The cloasma that appears during pregnancy usually disappears when the pregnancy ends. Hyperpigmentation in the areola and linea nigra does not disappear completely after the baby is born. In some women, hyperpigmentation of the area will persist. The stretched skin on the breasts, abdomen, thighs and pelvis may fade, but not disappear entirely.

Abdominal striae cannot be completely removed, but can turn into a smooth silvery-white line after a period of several months. Vascular abnormalities such as spiderangioma (nevi), palmar erythema, and epulis are usually reduced in response to a decrease in estrogen levels after pregnancy ends. In some females spidernevi settle. Fine hair that grows densely during pregnancy will usually disappear after the woman gives birth, but the coarse hair that arises during pregnancy will usually settle down. The consistency and strength of the nails will return to the state they were in before pregnancy. Diaphoresis is the most obvious change in the integumentary system. (Wiknjosastro, 2017)

Changes in Fluid and Electrolyte Balance Systems

The average loss of maternal weight by 10–13 lb occurs intrapartum and immediately after delivery due to loss of amniotic fluid and blood as well as the birth of the baby and placenta. The average patient can lose an additional 4 kg (9 lb) during the puerperium and over the next 6 months as a result of excretion of fluid and electrolytes accumulated during pregnancy. Contrary to widespread belief, breastfeeding has minimal effect in accelerating postpartum weight loss. The amount of weight gain during pregnancy has an impact on postpartum weight retention. Women who gain more weight than the recommended range during pregnancy tend to be heavier at 3 years postpartum than women who gain weight within the recommended range during pregnancy, and this applies to patients who are not obese and not obese.

There was an average net fluid loss of at least 2 L during the first week postpartum and an additional loss of about 1.5 L over the next 5 weeks. Water loss in

the first week of postpartum indicates a loss of extracellular fluid. The negative balance should be expected to be a little more than 100 mEq chloride per kilogram of body weight lost in the early puerperium. This negative balance may be due to the discharge of the mother's extracellular fluid. Loss of salt and puerperal water is generally greater in women with preeclampsia or eclampsia.

Changes in serum electrolytes during the puerperium showed a general increase in the number of cations and anions compared to antepartum values. Although the total exchangeable sodium decreases during the puerperium, the relative decrease in body water exceeds the loss of sodium. The reduction of aldosterone antagonism due to a decrease in plasma progesterone concentrations may partially explain the rapid increase in serum sodium. Cell damage due to tissue involution can contribute to an increase in plasma potassium concentrations recorded postpartum. The average increase in cations, especially sodium, was 4.7 mEq/L, with the same increase in anions. As a result, plasma osmolality increases by 7 mOsm/L by the end of the first week of postpartum. In accordance with the chloride shift, there is a tendency for serum chloride concentrations to decrease slightly postpartum along with an increase in serum bicarbonate concentrations. (Vesco et al., 2019)

Weight Loss

After giving birth, the mother will lose 5-6 kg of her body weight coming from the baby, placenta and amniotic water and blood discharge during labor, another 2-3 kg through urine as an effort by the body to remove fluid deposits during pregnancy. The average mother returns to her ideal weight after 6 months, although most have a tendency to still be heavier than the previous average of 1.4 kg. (WHO, 2019)

The Process of Psychological Adaptation in the Puerperium

Psychological Adaptation of Puerperal Mothers

The experience of parenthood, especially being a mother, is not always a pleasant thing for every woman or married couple. The realization of responsibility as a mother is a triggering factor for the emergence of emotional, intellectual, and behavioral disorders in a woman. Some adjustments are needed by women in the face of their new activities and roles as a mother. Some women manage to adjust well, but others do not manage to adjust and experience psychological disorders with a variety of symptoms or syndromes that researchers and clinicians call *post-partum blues*.³⁵

Many factors are thought to play a role in *post-partum blues* syndrome, one of the important ones is the adequacy of social support from its environment (especially the husband). The lack of social support from family and friends, especially the support of the husband during the post-saline (puerperal) period is strongly suspected to be an important factor in the occurrence of post-pastum blues. There are many changes that have occurred in the 9-month period of pregnancy, and it can be even more that occurs in the puerperium, maybe even feeling a little abandoned or separated from the environment.³⁵

Many things can add weight to make a woman feel down. There are also many women who feel depressed after giving birth, in fact, this is normal. The change in the role of a mother is even greater with the birth of a newborn. Positive support and attention from all other family members is something that mothers need. (Azizah & Rosyidah, 2019)

In undergoing puerperal adaptation, some mothers can experience the following phases: (Azizah & Rosyidah, 2019)

1. Phase of Taking in

Taking in Phase is the period of dependence lasting on the first day to the second day after delivery. The new mother is generally passive and dependent, her attention is drawn to the worry about her body. The experience during the labor process was repeatedly told about it. This makes the mother tend to be passive towards her environment. *Listening skills* and providing sufficient time are invaluable supports for mothers. The presence of a husband and family is indispensable in this phase. Health officials can encourage husbands and families to provide moral support and make time to listen to everything the mother has to say so she can get through this phase well.³⁵

The psychological disorders that the mother may feel in this phase are the following:³⁵

- a. Disappointment of not getting what he wants about the baby for example: a certain gender, skin color, and so on
- b. Discomfort as a result of changes in physical changes experienced by the mother for example the feeling of mules due to uterine contractions, swollen breasts, due to suture wounds, and so on
- c. Guilt for not being able to breastfeed the baby
- d. Husbands or families who criticize the mother about how to take care of her baby and tend to just look at it without helping. Mom will feel uncomfortable because it is actually not only the mother's responsibility, but the shared responsibility.

At this time uninterrupted sleep is essential to reduce the physical and psychological disorders that can result from lack of rest, besides that an increase in nutrients is needed to accelerate the recovery and healing of wounds, as well as the preparation of active lactation processes. (Azizah & Rosyidah, 2019)

2. Phase of *taking hold*

The *taking hold* phase is a phase/period that lasts between 3-10 days after delivery. In this phase, the mother is worried about her inability and her sense of responsibility in caring for the baby. Mothers have very sensitive feelings so they are irritable and easy to get angry so we need to be careful in communicating with mothers. In this phase, mothers need support because now is a good opportunity to receive various inputs in caring for themselves and their babies so that confidence arises. The duties as a health worker are teaching how to take care of babies, how to breastfeed properly, how to treat suture wounds, teaching puerperal gymnastics, providing health education needed by mothers such as nutrition, rest, personal hygiene, and others.(Azizah & Rosyidah, 2019)

3. Phase of *letting go*

The letting go phase is the phase of accepting responsibility for her new role which takes place ten days after giving birth. Mom has been able to adjust, take care of herself and her baby, and her confidence has increased. The health education that we provide in the previous phase will be very useful for mothers to be more independent in meeting the needs of themselves and their babies. The support of the husband and family is still indispensable for the mother. Husbands and families can help take care of the baby, work on household affairs so that the mother is not too tired and burdened. Mothers need adequate rest so that they get good physical condition to be able to take care of their babies. In this period the mother takes responsibility for the care of the baby and has to adapt to all the needs of the baby is very dependent on the mother, this leads to a reduction in the mother's rights, freedom and social relationships. If this cannot be passed properly, it can lead to postpartum blues and postpartum depression.(Azizah & Rosyidah, 2019)

Factors influencing the success of the transition period to parenthood at the time of post partum, among others:(Azizah & Rosyidah, 2019)

1) Response and support of family and friends. For post-partum mothers, especially for mothers who give birth for the first time, they will really need the support of those closest to them because they are not yet fully in a stable condition, both physically and psychologically. She is still very unfamiliar with the fantastic change in her new role that happened in such a fast time, namely the role of "mother" With a positive response from the environment, it will speed up the process of adapting to this role so that it will make it easier for health workers to provide health care.

2) The relationship of the experience of childbirth to expectations and aspirations the thing experienced by the mother when giving birth will greatly color the nature of her feelings towards her role as a mother. She eventually became aware that so hard she had to struggle to deliver her baby and that it would work her life experience to be more mature. Many cases occur, after the mother gave birth to her first child, she was determined to further improve the quality of her relationship with her mother.

3) The experience of giving birth to and raising a child ago. Although not the birth of the next child is not the first experience, the need for positive support from the environment is no different from the mother who gives birth to the first child. The only difference is that the technique of delivering support is given more to the support and appreciation of her success in getting through the difficult moments of childbirth in the past.

4) Cultural influences the existence of customs adopted by the environment and family will slightly more affect the success of the mother in getting through this transition period, especially if there is something out of sync between the direction of the health worker and the culture adopted in the mother's environment.

Conclusion

The puerperium begins from the moment the placenta is born and ends when the obstetric apparatus returns to what it was before pregnancy. The puerperium lasts approximately 6 weeks. The puerperium experienced by the mother is divided into 3 stages, namely: Immediate Puerperium / early puerperium, early puerperium, and late puerperium. Changes in the reproductive system in the puerperium after childbirth include: Uterine involution, contractions, afterpains, placental sites, lokia, cervix, vagina and perineum, pelvic muscle fractures, and vulva. Changes in the endocrine system in the puerperium after childbirth include: Placental Hormones (HCG, HPL, Estrogen, and progesterone), Pituitary hormones, and pituitary hypotalamic ovaries. Changes in vital signs in the puerperium after childbirth include: Body temperature, pulse, blood pressure, and breathing. Changes in the cardiovascular system in the puerperium after childbirth include: Blood volume and cardiac output. Changes in the blood circulation system in the puerperium after childbirth include: There is a massive increase in uterine blood flow that is important for maintaining pregnancy, made possible by the presence of hypertrophy and significant remodeling that occurs in all pelvic blood vessels. Changes in the hematological system in the puerperium after childbirth include: Fibrinogen and plasma levels, blood clotting factors, hemoglobin count, hematocrit and erythrocytes. Change in the respiration system in the puerperium after child birth include: lung volume, total lung capacity, and acid-base status.

References

- Azizah, Nurul, & Rosyidah, Rafhani. (2019). *Buku Ajar Mata Kuliah Asuhan Kebidanan Nifas dan Menyusui* (1st ed.; Septi Budi Sartika, Ed.). Sidoarjo: UMSIDA Press.
- Baston, H., & Hall, J. (2016). *Midwifery Essential Postnatal* (4th ed.). United Kingdom: Elsevier Inc.
- Bennet, V. ..., & Brown. (2016). *Myles Text Book for Midwives* (12th ed.). London: Churchill Livingstone.
- Caroline Pessel, MD, & Ming C. Tsai, MD. (2022). Anatomic & Physiologic Changes during the Puerperium. In *Current Health Sciences Journal Diagnosis & Treatment: Obstetrics & Gynecology* (1st ed., pp. 1–13). United State Of America: McGraw Hill.
- Cunningham. (2012). *Obstetri Williams* (15th ed.). New York: McGraw Hill Education (Asia) and EGC Medical Publisher.
- Cunningham, MacDonald, & Gant. (2015). *Obstetri Williams* (15th ed.). Jakarta: EGC.
- Dewi, & Susmati. (2017). Fisiologi Persalinan Post Partum. *Jurnal FK Universitas Muhammadiyah Malang*, 1(1), 12–69.
- Hanifa. (2012). *Ilmu Kebidanan*. Jakarta: Yayasan Bina Pustaka Sarwono Prawirohardjo.
- McCandlish, R., Bowler, U., Van, A. H., Berridge, G., Winter, C., Sames, L., Garcia, J., & Elbourne, D. (2018). A randomised controlled trial of care of the perineum during second stage of normal labour. *British Journal of Obstetrics and Gynaecology*, 105(12), 1262–1275.
- Mochtar, R. (2018). *Sinopsis Obstetri* (1st ed.). Jakarta: EGC.
- Pusdiknakes. (2013). *Asuhan Kebidanan Postpartum* (1st ed.). Jakarta: Kementerian Kesehatan RI.
- Saifuddin, BA. (2017). *Acuan Nasional Pelayanan Kesehatan Maternal & Neonatal*. Jakarta: YBP–SP.
- Sasmita, Indriyani. (2017). *Asuhan Kebidanan pada ibu nifas* (1st ed.). Blora: Poltekkes Blora.
- Stables, D., & Rankin, J. (2020). *Physiology in Childbearing* (3rd ed.). Edinberg: Elsevier.
- Sweet, Betty P. (2018). *Mayes Midwifery A Text Book for Midwives* (8th ed.). London: English League Book Society / Bailire Tindal.
- Varney, B. (2017). *Varney's Midwifery* (3rd ed.). New York.: Jones and Bartlett.
- Vesco, KK, Dietz, PM, & Rizzo, J. (2019). Excessive gestational weight gain and postpartum weight retention among obese women. *Obstetric and Gynecology*, 114(1), 1069.
- WHO. (2019). *Postpartum care of the mother and newborn: A practical guide: report of a technical working group*. (1st ed.). Geneva: Stationery Office Books.
- Wiknjosastro, H. (2017). *Ilmu Kebidanan*. Jakarta: YBP – SP.