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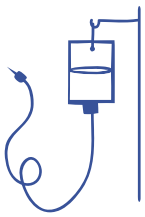


Evidence on: Intravenous (IV) Fluids

Are IV Fluids necessary during labor?

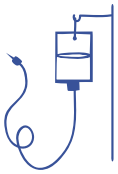
In a recent survey, the majority of mothers in the United States (62%) reported getting continuous "drip" intravenous (IV) fluids during labor (Declercq et al. 2014).

Labor is considered by many to be a demanding exercise, but many people in the United States (and other countries) are not allowed to eat or drink (called "NPO," *nil per os*, or "nothing by mouth") during labor. Because it is necessary to stay hydrated during labor, IV fluids are usually administered to the person giving birth. However, if you read the Evidence Based Birth® Signature Article on Eating and Drinking During Labor, you will see that the practice of forbidding food and drink, while common, is not evidence-based.

This article was originally written on May 24, 2012, and updated on May 31, 2017 by Rebecca Dekker PhD, RN, APRN and Anna Bertone, MPH.

"Nothing by mouth" during labor originated in the 1940s and is based on doctors' fear that a person will inhale (aspirate) stomach contents while under general anesthesia for an emergency Cesarean. However, the increase in the use of epidurals and advances in surgery and anesthesia have made aspiration almost unheard of today. The American College of Nurse Midwives, World Health Organization, National Institute for Health and Care Excellence guidelines in the United Kingdom, and the Society of Obstetricians and Gynecologists guidelines in Canada all recommend that people be able to choose whether or not they want to eat and drink during labor.

If people can choose to eat or drink during labor, then are IV fluids necessary?



Evidence On: Intravenous (IV) Fluids

What Are Intravenous (IV) Fluids?

Many hospitalized patients receive IV fluid therapy to maintain adequate hydration when oral (by mouth) fluids are restricted. The three most common IV solutions for laboring people are normal saline, Ringer's lactate, and dextrose solutions (Dawood et al. 2013). For how common they are, a surprisingly small amount of research has been done to compare the different types of IV fluids used during labor.

When IV fluids are medically necessary, the type of solution and the amount infused should be determined on an individual basis (ACOG, 2017). Normal saline and Ringer's lactate are *isotonic solutions*, meaning that they allow water to flow freely at a cellular level, without causing cells to swell or shrink. Dextrose (sugar) in water is another isotonic solution, but it doesn't act as one. It provides calories that the body can use for energy, but as the sugar is used, the solution becomes *hypotonic* and pulls water into the cells. A trial in 1995 compared dextrose solution and normal saline for oxytocin administration and found that the dextrose solution caused blood sodium (salt) levels to fall too low in mothers and babies (Stratton et al. 1995). Nowadays, dextrose solutions are commonly mixed with normal saline or Ringer's lactate to increase safety.

Fluid volume overload, also known as *hypervolemia*, can happen when there is too much fluid in the blood. With hypervolemia, excess fluid can collect in the lungs and other tissues, and the heart has to work harder to pump the extra fluid around the body (Carvalho and Mathias 1994). Fluid overload is more likely with IV fluids than oral fluids because the fluid goes directly into the bloodstream, instead of traveling through the stomach and intestines first, thereby overriding a healthy body's ability to maintain fluid balance. Overload is less likely to happen in young people with healthy kidneys that can process extra IV fluids by getting rid of them through urine, and healthy hearts that can easily pump the extra blood volume (Floss and Borthwick 2008).

What is the Evidence on IV Fluids During Labor?

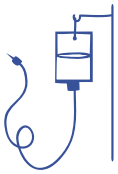
Two studies, called meta-analyses, have combined data from many similar studies on IV fluids during labor. In 2013, Cochrane reviewers combined nine randomized trials and looked at results from 1,617 people (Dawood et al. 2013). The researchers were interested in whether or not routine IV fluids could shorten the length of labor. They also looked at how IV fluids might affect birth outcomes like Cesareans, operative births (assistance with forceps or vacuum during second stage), number of babies admitted to the NICU, or Apgar scores.

The second, a more recent meta-analysis that we will refer to as the 2017 meta-analysis, included seven randomized trials with a total of 1,215 people (Ehsanipoor et al. 2017). These researchers also studied the relationship between IV fluids and birth outcomes but they were mostly interested in whether or not an increased rate of IV fluids could safely reduce the Cesarean rate.

All of the study participants were low-risk, in spontaneous labor, and giving birth for the first time. None of the trials in either review looked at the birthing person's satisfaction or dehydration level, nor did they measure breastfeeding rates or the effect of the IV fluids on the newborn's early weight loss.

IV Fluids + Oral Fluids vs. Oral Fluids Alone

Only two trials have ever compared IV fluids versus oral fluids alone. This in itself is very revealing! IV fluids have become so common during labor that when they are studied, it's usually to compare one type or rate of fluid to another. Only two times in history have researchers ever compared IV fluids to oral fluids, and in both cases, people in the IV fluids groups were also permitted to drink oral fluids.



Evidence On: Intravenous (IV) Fluids

In the first trial, 293 people in labor were randomly assigned to one of three groups: oral fluids alone (plain water and coconut water), oral fluids plus IV fluids of Ringer's lactate at 125 mL/hr, or oral fluids plus IV fluids at 250 mL/hr (Kavitha et al. 2012). There were no differences between the groups in regards to length of labor (first stage, second stage, or total length), Cesareans, augmentations, or any other complications. There was a lower chance of vomiting with more IV fluids (6% vomiting in the 250 mL group, 11% in the 125 mL group, and 24% in the oral fluid group). There were no cases of fluid overload in the lungs, also known as *pulmonary edema*.

This was one of several studies in the recent meta-analyses that measured pulmonary edema; however, other signs and symptoms of fluid overload were not measured. For example, researchers did not measure whether or not people experienced swelling in the arms, legs, and breasts. This swelling, called *peripheral edema*, can be painful and is a sign of fluid volume overload.

In the second study, 120 people were randomly assigned to either oral fluids alone (water or soda), or to oral fluids plus IV fluids of Ringer's lactate at 60 mL/hr, 120 mL/hr, or 240 mL/hr (Direkvand-Moghadam and Rezaeian 2012). The researchers found longer first and second stages of labors in the people who had not received IV fluids. Also, Pitocin augmentation was used more frequently in the group with no IV fluids. They found no differences between groups with rates of Cesarean, vomiting, or low Apgar scores in the newborn. The authors didn't report on any markers of fluid overload.

When these two studies were combined, the Cochrane researchers found that people who had received IV fluids plus access to oral fluids had shorter labors (by about 30 minutes) compared to those who took oral fluids alone (Dawood et al. 2013). There was no difference in Cesareans or Apgar scores. Neither of the two meta-analyses reported on vomiting.

It's important to note that in both trials, the people receiving IV fluids were also permitted to take in oral fluids. In the first trial, they reported the average amount of total fluid intake received by group: 896 mL for those taking oral fluids alone, 727 mL for those receiving IV fluids of 125 mL/hr, and 1,326 mL for those receiving IV fluids of 250 mL/hr. The oral fluids alone group experienced the greatest fluid loss due to vomiting. We contacted the authors for more information and found out that the oral intake among the people in the IV fluids groups was not documented because it was negligible, so the IV fluids group totals refer to IV fluid intake alone (Personal Communication, Dr. Jiji Mathews, 2016). The second trial didn't report the total amount of fluid received in each group, but, interestingly, they did determine that the IV fluids groups drank just as much fluid orally as the oral fluids only group.

So, the people who took in more fluids had shorter labors by about 30 minutes when the studies were combined. This suggests that mild dehydration could contribute to slightly longer labors. That people receiving IV fluids in the second trial also chose to take in oral fluids in the same amounts as the oral fluids only group suggests that people without IV fluids may benefit from additional support and encouragement to drink enough to stay hydrated during their labors. It might not be enough to rely on feelings of thirst, when the laboring person is distracted by the work of labor.

Comparing IV Fluids at Different Rates

Next, the Cochrane review looked at people receiving 125 mL/hr fluids vs. 250 mL/hr fluids, in addition to being able to drink freely.

This category includes the previous two studies and adds one more. In the additional study, researchers randomly assigned 80 people in labor to receive Ringer's lactate at 250 mL/hr or "usual care" (Coco et al. 2010). "Usual care" meant that the person would receive IV fluids if the provider thought they were

needed for medical reasons. The people in the IV fluids group received an average of 2,660 ml of IV fluids. Those in the "usual care" group ended up receiving an average of 1,627 mL of IV fluids over the course of their labor, which worked out to approximately 125 mL/hr. People in both groups were allowed to drink as much as they desired (water, juice, soda), and both groups drank similar amounts. There were no differences between groups with regard to total labor length, length of each stage of labor, Cesareans, augmentations, or any other outcome measured. The authors did not mention anything about measuring markers of fluid volume overload in the mothers or babies, so we contacted the primary author, who confirmed that markers of fluid volume overload were not measured.

When these three trials were combined, the Cochrane researchers found shorter labors (by 24 minutes) in people receiving IV fluids at 250 mL/hr and drinking freely than those receiving IV fluids at 125 mL/hr and drinking freely. They found no difference in Cesareans or any other outcome measured. This is more evidence that people without IV fluids or receiving fluids at a rate of less than 250 mL/hr may benefit from active encouragement to drink enough fluids for adequate hydration or face a slight increase in the length of labor.

The 2017 meta-analysis included one trial that was too recent to be included in the Cochrane review (Edwards et al. 2014; Ehsanipoor et al. 2017). They did not find any benefits from increased IV or oral hydration. The authors randomly assigned people to receive Ringer's lactate with 5% dextrose at 25 mL/hr (101 people), 125 mL/hr (105 people), or 250 mL/hr (105 people). The 25 mL/hr group could drink freely, but the other two groups were only allowed to have ice chips. They found no differences as far as labor duration, augmentation, Cesareans, Apgar scores, or any other outcome assessed. There were no cases of pulmonary edema.

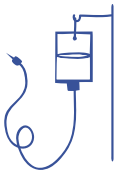
Nothing by Mouth and IV Fluids at Different Rates

(Is a "nothing by mouth" policy and IV fluids at 125 mL/hr a recipe for dehydration? YES)

Four trials compared different rates of IV fluids (125 mL/hr versus 250 mL/hr) in people who either had zero oral intake, or ice chips only, or occasional sips of water (Garite et al. 2000) (Alavi et al. 2005) (Eslamian et al. 2006) (Maderia et al. 2007). This means that none of the women in these studies were allowed to drink freely—similar to many hospital environments today.

When the results from these trials were combined, the Cochrane reviewers found longer labors (by about 1½ hours) in the people who received 125 mL/hr IV fluids versus 250 mL/hr. They also found a higher risk of Cesarean for any indication in the group that received IV fluids at 125 mL/hr. There were no differences detected in operative vaginal birth and not enough information to draw conclusions about fluid overload.

The findings of the 2017 meta-analysis of seven trials were consistent with the four trials pooled in the Cochrane review. The 2017 meta-analysis found that people who received IV fluids at 125 mL/hr versus 250 mL/hr had longer labors by about one hour and a 30% higher risk of Cesarean for any indication. The effects observed in the Cochrane review were larger than those in the 2017 meta-analysis, perhaps because the Cochrane estimate only describes the trials with restrictions on oral intake, while the 2017 meta-analysis estimate also includes some trials with unrestricted oral intake. The authors of the 2017 meta-analysis estimate that treating 18 women with IV fluids at a rate of 250 mL/hr instead of 125 mL/hr could actually prevent one Cesarean (Ehsanipoor et al. 2017). However, this finding cannot be generalized to women who are allowed to drink freely, since the vast majority of people included in their review were under strict oral intake restrictions.



Evidence On: Intravenous (IV) Fluids

What is the Evidence on Dextrose Solution?

Two trials in the Cochrane review compared normal saline and 5% dextrose solutions at a rate of 125 mL/hour (Shrivastava et al. 2009) (Stratton et al. 1995).

When the results were combined, there were no differences in the length of labor, Cesareans, or forceps or vacuum use between groups (Dawood et al. 2013). However, the Stratton et al. trial measured blood sodium levels and found low levels in mothers and babies when the mothers had received dextrose solution infused with oxytocin. The Cochrane reviewers concluded that the low sodium levels are a safety concern and that oxytocin infused with 5% dextrose solution should be avoided until we have more evidence on safety.

Another trial that was not included in the Cochrane review randomly assigned 250 low-risk, first time mothers who were three to five cm dilated, to normal saline with and without alternating 5% dextrose fluid at a rate of 175 mL/hr (Sharma et al. 2012). Both groups were restricted to ice chips. They found that the people who had received 5% dextrose solution alternating with normal saline had shorter labors by nearly three hours and less need for Pitocin augmenation. There were no differences in blood sodium levels, Cesareans, or Apgar scores.

A second additional trial randomly assigned 274 low-risk, first-time mothers who were three to five cm dilated, to 250 mL/hr of normal saline, 125 mL/hr of 5% dextrose in normal saline, or 250 mL/hr of 2.5% dextrose in normal saline (Fong et al. 2017). They did not find any differences in labor outcomes when comparing the groups receiving different rates of IV fluids and different amounts of dextrose. Labor duration, Cesareans, postpartum hemorrhage, Apgar scores, and NICU admissions were all similar as well.

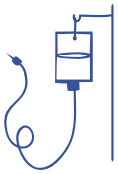
IV Fluids and Breastfeeding

The studies that we've looked at have focused mainly on the risks of dehydration and its potential to slow labor and increase the Cesarean rate. But on the other end of the spectrum, fluid overload can cause painful swelling in the mother and excess fluid in the newborn at birth, potentially leading to breastfeeding complications when the newborn's weight at birth is artificially inflated.

Newborns are often weighed within minutes of birth, and that measurement becomes the baseline for assessing weight loss in the first days of life. Clinical guidelines caution that newborn weight loss greater than 7% from birth at three to five days of age is a sign of ineffective breastfeeding that could mean supplementation with formula is necessary (AAP, 2012).

A randomized controlled trial in 2012 was the first of its kind to examine the effect of IV fluids on newborn weight loss (Watson et al. 2012). The people in the study were all low-risk, not allowed to eat or drink, and planning to have epidurals and to breastfeed. Half of the study group (100 people) were randomly assigned to lower amounts of IV fluids which consisted of <500 mLs of fluid before receiving the epidural and an hourly rate of 75 to 100 mL/hr. Another 100 people received higher amounts of IV fluids, meaning ≥500 mLs and an hourly rate of >125 mL/hr. The average volume infused was 1,430 mLs in the lower amount group, and 2,477 mLs in the higher amount group.

In contrast to other studies that found that higher amounts of IV fluids shorten labor, this trial did not find a difference in the length of labor between the two groups. There was no difference in Cesareans or augmentation, but there were more operative vaginal births in the group receiving less IV fluids.



In this study, the authors defined excess weight loss as >7% from birth at 48 hours. When comparing the two groups, they did not find a difference in the number of breastfed newborns who experienced excess weight loss. However, they found greater weight loss in the infants born to the people who received >2,500 mLs of IV fluids. They also found a higher volume of IV fluids in the mothers of the infants who had lost >10% of their weight. This suggests that once a mother receives around 2,500 mLs or higher of IV fluids, newborn weight loss is affected (Watson et al. 2012). The authors recommend replacing 7% weight loss with a higher percentage since almost half of the breastfed infants lost 7% of their birth weight (Watson et al. 2012).

The randomized trial above built on two previous observational studies that had also looked at the relationship between IV fluids and newborn weight loss.

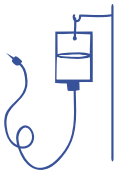
Chantry et al. (2010) followed 448 people through pregnancy and after birth to determine risk factors for excess weight loss in newborns (Chantry et al. 2011). This study defined excess weight loss as >10% loss of birth weight at three days old. Of the breastfed newborns, 16-19% experienced excess weight loss. The authors looked at the predictors of excess weight loss in those babies. The only two things that independently predicted excess weight loss in newborns were increased IV fluids given to the mother during labor and delayed milk production. If mothers received more than 200 mL/hr of fluids during their labor, their babies were 3.2 times more likely to experience excess weight loss at three days compared to mothers who received less than 100 mL/hr of fluids. The infants whose mothers had taken in more fluids were also found to urinate more during the first four hours of life. More than half (58%) of the infants in this study (whose parents intended to breastfeed) were supplemented with formula. Reasons for supplementation were excess weight loss, along with concerns about a delay in mature milk coming in.

Other researchers have shown that reports of excess weight loss trigger a new parent's anxiety about their milk supply, which is then associated with discontinuing breastfeeding (Flaherman et al. 2016). Additionally, supplementing formula in the hospital independently predicts a shorter duration of exclusive breastfeeding after hospital discharge (Semenic et al. 2008).

Figure 1 (Page 7) shows the possible unintended consequence of receiving IV fluids during labor.

In a smaller study, a different group of researchers also found that higher amounts of fluids during labor were associated with excess weight loss in newborns (Noel-Weiss et al. 2011). The authors suggested that clinicians use the 24-hour weight—not the birth weight—as the baseline to track infant weight over time. This gives the newborn time to urinate off the excess fluid weight from the IV fluids, and get closer to what would have been their real birth weight.

In another study, researchers in Canada observed that 87% of women initiated breastfeeding, but 21% of them had stopped by one month. When asked about early weaning, the breastfeeding parents frequently cited sore breasts and painful nipples. So the researchers conducted a small observational study to figure out if IV fluids during labor could contribute to postpartum breast swelling (Kujawa-Myles et al. 2015). Thirteen of the 17 first-time mothers included in the study had IV fluids during birth. Participants received an average amount of 2,787 mLs of total IV fluids. Oral fluid intake was not reported. The researchers found that people who had received more IV fluids during labor reported more post-partum breast tenderness on a self-assessment scale and had more breast firmness when palpated (touched) by the researcher. However, this study had a small sample size, and neither the women nor the researcher conducting the breast exams were blinded to each participant's IV fluid status—which could lead to a biased result. More research is needed on this topic, and we will update this article as soon as results come in from further studies.

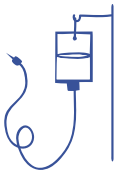


Evidence On: Intravenous (IV) Fluids

The bottom line is that large amounts of IV fluids during labor can potentially harm breastfeeding by contributing to excess newborn weight loss concerns and by possibly leading to painful breast swelling in the postpartum parent.

Figure 1: The possible unintended consequence of receiving IV fluids during labor

* *Conceptual framework developed by Rebecca Dekker, PhD, RN, APRN*



Evidence On: Intravenous (IV) Fluids

Conclusion

There are mixed findings, but evidence is building that dehydration is related to longer labors. People drinking freely without IV fluids or who are receiving IV fluids at a rate less than 250 mL/hr may require additional encouragement to drink enough to stay hydrated. Being adequately hydrated may help people to experience a shorter labor by around 30 minutes, on average.

People not allowed to drink freely in labor and receiving IV fluids at the lower rate of 125 mL/hr are at increased risk of longer labors by about 1½ hours and are more likely to give birth by Cesarean. Neither the American College of Obstetricians and Gynecologists (ACOG) nor the American Society of Anesthesiologists (ASA) recommends restricting low-risk women to ice chips or sips of water, so hospitals with policies forbidding oral fluids (including among people with epidurals) are out of line with both current evidence and professional guidelines.

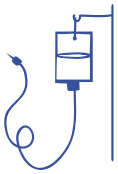
It is important to note that no research has been done to compare birth outcomes in people receiving oral fluids alone versus IV fluids alone, and only a few studies have compared oral fluids alone versus IV fluids plus access to oral fluids. We need more research to show if it is possible for a laboring person to drink enough fluids orally and still achieve the shorter labor duration and lower Cesarean rates seen with IV fluids at a rate of 250 mL/hr. However, low-risk people who give birth out-of-hospital with free access to oral fluids and food (instead of routine IV fluids) experience very low rates of Cesarean (5.2% to 6%) and Failure to Progress (0.2% to 4%) (Cheyney et al. 2014; Stapleton et al. 2013). It may be that the Cochrane review and 2017 meta-analysis found a benefit to higher rates of IV fluids because the studies they included took place in hospital settings—places where one in five women are diagnosed with Failure to Progress and overall Cesarean rates are high (Zhu et al. 2006). So, by using higher amounts of IV fluids to shorten labor, one might reduce the rate of Failure to Progress in the hospital population, leading to an overall decrease in the Cesarean rate.

There is increasing evidence that although large volumes of IV fluids during labor (250 mL/hr) may shorten labor by 30-60 minutes and possibly reduce the Cesarean rate in hospital birth populations, a higher amount of IV fluids (more than 2,500 mL) can lead to an artificial drop in the newborn's weight and possible painful breast swelling, both of which can harm breastfeeding. The studies we reviewed recommend using the newborn's 24-hour weight as baseline (instead of birth weight) and replacing the 7% weight loss threshold (as defined by the American Academy of Pediatrics) with a higher percentage, such as 10%.

The body requires a delicate fluid balance. Dehydration can occur when a person is not drinking enough or not receiving enough IV fluids, and fluid overload occurs when a person receives too great a volume of IV fluids. Laboring people should be encouraged to drink enough to stay hydrated, and the use of IV fluids can be guided by the individual's unique situation, needs, and preferences. Examples of medical reasons for IV fluid therapy include nausea or frequent vomiting and/or diarrhea, maternal exhaustion, prolonged labor, blood volume loss, and as a means of delivering and managing medications. *

* These examples are based on our literature review. We were not able to find a published list of guidelines describing the medical reasons for IV fluids in labor and post-partum.

If a care provider wants to have IV access or access in the event of an emergency, and the laboring person does not wish to receive continuous IV fluids, a saline lock is a possible compromise.



Evidence On: Intravenous (IV) Fluids

Resources:

- The World Health Organization urges against the use of routine IV fluids during normal labor and birth (WHO, 1997). They caution that restricting oral intake can lead to dehydration and exhaustion, and propose instead that people at low risk of requiring general anesthesia be offered drinks and light meals during labor. Click here (http://bit.ly/2rCX6ai).
- The ACOG Committee on Obstetric Practice affirms that low-risk people should be allowed clear liquids (water, sports drinks, juices, sodas, teas, black coffee) during labor (ACOG, 2009). Click here (http://bit.ly/2r0dnpd). In a recent statement, they point out that routine continuous infusion of IV fluids may offer no benefit to people in spontaneously progressing labor and may harm freedom of movement (ACOG, 2017). Click here (http://bit.ly/2kkfVeU).
- The United Kingdom's National Institute for Health Care Excellence (NICE) commissioned a clinical guideline, "Intravenous fluid therapy in adults in hospital." The scope of the recommendations is not meant to include pregnant people, however, the report contains some good information on the different types of IV fluids. Click here (http://bit.ly/2rCZnSQ).
- For the first time, researchers have created early weight loss nomograms (calculators) for exclusively breastfed infants (Flaherman et al. 2015). This tool allows parents and providers to enter information and see how the newborn compares to a population of over 161,000 exclusively breastfed newborns. In the comparison population, weight loss ≥10% of birth weight is common and occurs earlier than previously thought. This tool provides valuable information about what amount of weight loss is "normal" in the overall population versus what amount of weight loss puts the newborn at special risk for health problems. Click here (https://www.newbornweight.org/).
- To learn more about "Failure to Progress," visit our article at ebbirth.com/failuretoprogress.
- To learn more about the "Evidence on Eating and Drinking during Labor", visit our article at ebbirth.com/eating.

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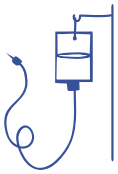

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