**Title:** Maternal intrapartum fluids and neonatal weight loss in the breastfed infant

**Abstract:**

**Background** Significant weight-loss (SWL) during early life can be of serious concern. Assessment of weight is key in decisions regarding supplementation to avoid associated complications such as hypernatraemia. Supplementation is a significant risk factor for early breastfeeding cessation 4. Health benefits of breastfeeding are numerous, and protection from unplanned cessation is an important public health issue 18, 23, 24, 28. Distinguishing non-pathological causes of weight-loss supports identification of genuinely unwell infants and targets practices that support exclusive breastfeeding appropriately.

**Aim** Identify whether maternal fluid balance/load is associated with neonatal weight-loss.

**Methods**Databases: CINAHL, MEDLINE, EMBASE, EMCARE**.** Data was extracted using a structured form based upon the Cochrane Handbook.Meta-analysis was not possible due to heterogeneity of all aspects of study design and outcome definitions.

**Findings**Eight studies presented original data: four reported an association between maternal IV fluid intake and neonatal weight-loss, and four did not.

No two studies collected the same outcome data at the same time, using the same comparator or intervention.

**Conclusions**Further research is required to clarify the relationship between maternal fluid intake and neonatal weight-loss in a clinically useful way.

**Keywords:**

Breastfeeding, intravenous fluid, diuresis, intrapartum, newborn, weight-loss

**Key points/major themes:**

* Transplacental passage of fluids administered to the mother intravenously in the intrapartum period may have an association with neonatal birthweight and subsequent loss through diuresis in the early days of life.
* Recognition of such non-pathological causes of weight-loss may support the identification of genuinely unwell infants; thereby targeting practices that better support continuation of exclusive breastfeeding when illness can be excluded.
* The definition of ‘excessive’ or ‘significant’ weight-loss remains a contentious issue, and methods used to report weight-loss remain inconsistent. This prevents clear comparison of data.
* Further research is required in this area to clarify the relationship between maternal fluid intake and neonatal weight-loss in such a way that is clinically useful.
* It is possible that a ‘threshold’ above which maternal fluid load becomes relevant to neonatal weight-loss can be identified for use in clinical practice.

**Reflective questions:**

* Does your clinical area have guidance on intravenous fluid volumes during the intrapartum period?
* What is a significant weight-loss in your clinical area? How does this fit with your opinion/observations in practice?
* What factors might be taken into account when considering significant weight-loss in an otherwise well breastfed infant?
* How might this paper influence your assessment of breastfed infants in future?

**Background:**

Reduction in weight is a physiological process (9) as the infant adjusts from dependence upon maternal circulation for continuous nutrition to managing their own intermittent nutritional intake. Weight nadir usually occurs between days 2-4, recovering to birthweight by the end of the second week (14). Acceptable parameters of loss remain unclear in the literature (19) but 10% loss from birthweight is generally cited as a threshold for intervention. In the context of significant weight-loss in a breastfed infant, efficacy of milk transfer becomes a central concern for clinicians (7).

Administration of intravenous fluids during the intrapartum period is common practice when anaesthesia is required or complications occur. Intrauterine fluid resuscitation is routinely undertaken to support fetal wellbeing when compromise is suspected (11).

Transplacental passage of fluids administered to the mother intravenously in the intrapartum period appears to have an association with neonatal birthweight and subsequent loss through diuresis in the early days of life (4,12).

Significant weight-loss (SWL) in the breastfed infant during the first weeks of life can be a serious health concern, and is a key factor in clinical decision-making regarding the need for supplementation to avoid associated complications, such as hypernatraemia. Supplementation is a significant risk factor for early cessation of breastfeeding 4, and this is an important public health issue globally (23,24,28).

Recognising differential causes of weight-loss may support the identification of genuinely unwell infants; thereby allowing targeted implementation of practices that support the continuation of exclusive breastfeeding towards those for whom illness can be excluded.

**Objective of this review:**

To identify whether maternal fluid balance/load is associated with neonatal weight-loss after birth, searches were conducted of key databases (CINAHL, MEDLINE, EMBASE, EMCARE) using a search strategy developed in collaboration with the local NHS library service (appendix 1). Known researchers in this area were contacted regarding unpublished/ongoing work of relevance, and reference lists of searched papers were examined backwards and forwards for relevant papers. Conference proceedings were also reviewed for relevant unpublished work.

Two authors screened papers by title/abstract, and all study methodologies meeting the following criteria were considered for inclusion:

**Table 1**

|  |  |  |
| --- | --- | --- |
| Participants | Interventions | Outcomes |
| Women expecting to birth healthy, term, singleton infants and expecting to breastfeed | Intravenous fluid administered in the intrapartum period | Neonatal weight/loss as measured by grams or % |
|  | All fluid loads recorded in the intrapartum period | Prevalence of ‘excessive’ or ‘significant’ weight-loss |

Figure 1: PRISMA chart



Data was extracted using a structured form based upon the Cochrane Handbook for Systematic Reviews (appendix 2).

All studies were assessed using the Cochrane Risk of Bias tool and results illustrated in Figure 2. This process was independently reviewed by a supervisor of the Author.

It was expected that studies in this area would be relatively few and approaches to data collection, intervention definition and outcome selection would be heterogenous in nature due to differences in clinical critera across settings. It was therefore not anticipated that meta-analysis would be possible. A descriptive review of included studies follows.

**Findings: Description of studies.**

Population:

All included studies examined outcomes for singleton infants, and all referred to 'healthy' infants. However, 'health' was defined in a variety of ways, from the absence of undefined significant perinatal morbidity (8), to "mother and baby discharged together and able to breastfeed freely" (6,15).

All studies excluded infants born before 37 weeks of pregnancy, and Thulier (22) excluded any born before 38 full weeks’ gestation. Most studies reported on the basic demographic characteristics of their sample. The majority of participants were white, English-speaking, and educated to basic secondary standard. All studies took place in western healthcare settings. Total number of participants included: 1665.

Intervention:

The focus of all studies was the administration of intravenous fluids given during the intrapartum period. However, each study defined this intervention slightly differently. For instance, some studies included fluids administered from admission in labour/pre-caesarean until birth, whilst Chantry et al (2) attempted to create a sub-group to examine the effect of fluids given during the two hours immediately prior to birth. This was a change to the original protocol, implemented after recruitment had commenced, when electronic records made such data collection possible; and consequently only included 63.8% of the study population.

Comparison:

Comparison groups also differed across studies in this review. Groups were categorised by total IV fluid administered in six studies, and according to mls/h in the others. Differing thresholds were used for comparison, reflecting heterogeneity in exposure. Chantry et al (2 )compared IV loads of <100ml/h, with 100-200ml/h and >200ml/h, whilst others dichotomised using thresholds of 1200mls total (15), 1500mls (6), and even 3000mls (22). In Watson's RCT (25), a 'conservative' regime of IV fluid administration was compared against usual care. These both considered the effects of bolus loading and ongoing ml/h infusions. Minimal reference was made to oral intake of fluids.

Outcomes:

All studies included outcomes related to infant weight-loss in either percentage terms or absolute loss in grams.

Definition of 'excessive' weight-loss was variable across studies, and ranged from 7% loss (25) to 10% (2). These studies, along with Thulier (22) compared prevalence of 'excessive' weight-loss according to IV administration, whilst others compared mean weight-loss (1, 6, 15). Lampe & Macke (10) used regression modelling to examine the relationship between weight loss (g) to other variables of interest, including maternal fluids. Weight-loss was examined at various times, with all studies including measurements at specified time-points during the first four days of life. Thulier's study (22) recorded weights on certain days, and did not take into account the age in hours of the infant, a limitation identified by the author. Lampe & Macke (10) recorded weight at 24 and 48 hours exactly. John et al (8) collected weight data 12-hourly until 72 hours of age, and then again on "day 10" of life.

No two studies in this review collected the same outcome data at the same time, using the same comparator or intervention.

Of the eight studies presenting original data from 1665 participants, four reported an association between maternal IV fluid intake and neonatal weight-loss, and four did not. See table 2 for summary of study characteristics.

**Quality of the evidence**

The majority of studies were observational which resulted in bias on a number of levels. Poor reporting prevented full assessment of methodological rigour, however, use of maternally-reported outcome data was noted to introduce measurement bias; and attrition bias was an issue for at least one study. Narrative papers reviewed did not take systematic approaches to literature review. The one RCT in this review was conducted using robust methods with a low level of bias. It did not observe an effect of restricted IV administration on neonatal weight-loss. However, the authors pose the question of whether investigation of total maternal volumes in excess of 2500mls may be of value in future research.

In a systematic review of physiological newborn weight loss research in 2008, Noel-Weiss et al found that methods used to report weight loss were inconsistent, and that this was a barrier to clear investigation of the relationship between weight loss and morbidity (16). The current review notes that this problem persists today, precluding observation of the nature of a potential relationship between maternal fluid status and neonatal weight loss.

All studies reflected predominantly white, western population and healthcare settings, restricting the extent to which their findings can be generalised to more diverse settings.

Every effort was made to minimise bias during the review process. Support was obtained from NHS library services to ensure access to a wide range of sources; and standardised approaches to data extraction and reporting were employed. Screening and data extraction were completed by two team members in order to minimise bias in this process, and conclusions were discussed throughout the review team before publication.

Despite efforts to ensure comprehensive searching of the literature, relevant papers were noted after this review was completed. A prospective observational study conducted in Jerusalem (20) found that intravenous fluid contributed to the multifactorial process of newborn weight loss among 375 women-baby pairs in this setting; and the extensive work by Mulder in this area (12, 13) also suggests an influential relationship between maternal fluid status and newborn weight-loss.

**Implications for practice**

Despite conflicting conclusions among studies in this review, all authors suggest that attention should be paid to maternal fluid intake when assessing significant weight-loss in the breastfed infant. Whilst it remains impossible to apply specific thresholds for concern due to limitations in the collection of research evidence, it is generally accepted that a relationship of some nature exists; and it is possible that mothers and babies could benefit from clinicians considering this aspect of clinical history in postnatal assessments.

**Implications for research**

Further research is required in this area to clarify the relationship between maternal fluid intake and neonatal weight-loss in such a way that is clinically useful.

Measuring total IV fluid volume received during the intrapartum period would allow comparison to existing studies,and may help to confirm the observations of other authors around a potential ‘threshold’ above which maternal fluid load becomes relevant to neonatal weight-loss. Since the definition of ‘excessive’ or ‘significant’ weight-loss in the newborn remains a contentious issue, it may be more helpful to examine neonatal weight-loss as a continuous measure in grams or percentage terms in preference to varying categories of excessive weight-loss; as this limits the extent to which comparisons can be made.

This review demonstrates that attention must be paid to selection of outcome and method of measurement to allow for comparison with existing evidence that can lead to a meaningful body of data to inform clinical practice. Given the importance and urgency of the public health issues associated with the premature cessation of breastfeeding, it is imperative this area of study remains in the spotlight.

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‌Ongoing trial:

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