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ARAŞTIRMA MAKALESİ / *RESEARCH ARTICLE*

Risk Factors for Early Weight Loss in Breastfed and Term Newborns

Anne Sütü ile Beslenen ve Term Yenidoğanlarda Erken Kilo Kaybı için Risk Faktörleri

Tijen Eren[1], Bahar Kural[2], Gülbin Gökçay[3]

[1]Koç University, Faculty of Medicine, Department of Family Medicine, Istanbul, Turkey
[2]Bakırköy Dr. Sadi Konuk Research and Training Hospital, Department of Pediatrics, Istanbul, Turkey
[3]Istanbul University, Institute of Child Health Department of Social Pediatrics, İstanbul, Turkey

ORCID ID: T.E. 0000-0001-9650-3734; B.K. 0000-0001-9528-1009; G.G. 0000-0003-1042-0407

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ABSTRACT

Objective: Newborns lose some of their birth weight before hospital discharge. This loss is accepted as "physiological" up to 5-7%. Infants with weight loss over this range may receive undue formula supplementation. Formula supplementation disrupts exclusive breastfeeding, does not have the benefits of mother's milk, and may cause low breastfeeding success in the long run. Identification of the risk factors affecting infant weight loss percentage in the few days following the birth will increase exclusive breastfeeding success. The aim of this study is to identify the risk factors that cause early weight loss in newborns before hospital discharge.
Material and Methods: Weight loss in infants born between January 1, 2011, and December 31, 2014, at Vehbi Koç Foundation American Hospital was evaluated retrospectively. The hospital records of 3812 babies who completed the inclusion criteria were included in the study. The variables yielding significant results in binary tables were further evaluated by "Multivariate Logistic Regression".
Results: Delivering via caesarean section, primiparity, early term gestational week, older maternal age and female gender of the infant were statistically significant risk factors for early weight loss in newborns.
Conclusion: To increase the success of breastfeeding in babies who are exclusively breastfed, the mother-infant pair identified with risk factors that contribute to infant weight loss must be closely monitored. Breastfeeding counselling should be repeated, and breastfeeding should be supported. Suggested intervention list is created aligned with the findings to assist mothers in risk management.

Keywords: Early weight loss, new-born, risk factors

ÖZ

Amaç: Yenidoğan bebekler hastane taburculuğu öncesi doğum kilolarının bir kısmını kaybetmektedirler. Belli bir orana kadar bu kayıp (%5-7) 'fizyolojik' olarak kabul edilmektedir. Kilo kaybı bu oranı geçen bebeklerde erken dönemde yersiz takviye başlanabilmektedir. Erken dönemde mama ile takviye sadece anne sütü ile beslenmeyi kesintiye uğratmakta, anne sütünün faydalarına sahip olmadığı gibi ve uzun vadede anne sütü ile beslenme başarısında düşüklüğe sebep olabilmektedir. Yenidoğan bebeklerde doğumu takip eden birkaç günde kilo kaybına etki eden risk faktörlerinin tespiti sadece anne sütü ile beslenme başarısını arttıracaktır. Çalışmanın amacı taburculuk öncesi yenidoğan bebeklerdeki kilo kaybına sebep olan risk faktörlerinin değerlendirilmesidir.
Gereç ve Yöntemler: Vehbi Koç Vakfı Amerikan Hastanesi'nde 1 Ocak 2011- 31 Aralık 2014 arasında doğan bebeklerdeki kilo kaybı retrospektif dosya taraması olarak değerlendirilmiştir. Çalışmaya dahil edilme kriterlerini dolduran 3812 bebek çalışmaya alınmıştır. İkili tablolarda anlamlı sonuç veren değişkenler 'Multivariate Lojistik Regresyon' ile değerlendirilmişlerdir.
Bulgular: Sezaryen doğum, parite, gestasyon haftasına göre erken term olma, ileri anne yaşı ve kız bebek cinsiyeti yenidoğanda erken kilo kaybı için istatiksel olarak anlamlı risk faktörleri olarak tespit edilmiştir.
Sonuç: Sadece anne sütü alan bebeklerde emzirme başarısının artması için, kilo kaybında artışa sebep olan risk faktörlerine sahip olan gruplarda anne- bebek ikilisi yakın takip edilmelidir. Gerekirse emzirme danışmanlığı tekrarlanmalı ve anne sütü ile beslenme desteklenmelidir. Annelere risk yönetiminde yardımcı olmak için bulgulara uyumlu olarak önerilen müdahale listesi oluşturulmuştur.

Anahtar Kelimeler: Erken kilo kaybı, yenidoğan, risk faktörleri

Corresponding Author/Sorumlu Yazar: Bahar Kural **E-mail:** drbsalihoglu@hotmail.com

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INTRODUCTION

As a global public health recommendation, The World Health Organization (WHO) and United Nations International Children's Fund (UNICEF) promote exclusive breastfeeding during the first 6 months of life for infants to achieve optimal growth, development, and health (1). The first few days after the delivery, colostrum is produced which is scarce in amount and low in calories. For exclusively breastfed babies, weight loss following the first three days after birth is accepted as being "physiological" if around 5-7%. Most clinicians are concerned when infant weight loss exceeds 10% of their birth weight (2). Above 10%, weight loss is considered "pathological" and may suggest breastfeeding problems (3). Excessive weight loss after birth may cause maternal anxiety and reduce breastfeeding success, potentially leading to serious problems like hypernatremia and hyperbilirubinemia (4-6). Early onset of breastfeeding problems may lead to supplementing with formula and falling short of exclusive breastfeeding targets (7). Therefore, it is important to identify the risk factors associated with infant weight loss during the first few days following birth. In review of medical literature, problems related to infant weight loss may be breastfeeding related, infant-related, mother-related or any combination of these. Common causes of breastfeeding difficulties may be poor latch, ineffective suckling, nipple problems and mother-infant separation (2). Infant-related problems may be infant size, gestational week, metabolic and neurological disorders (2). Mother-related risk factors may be breast surgery, mammary hypoplasia, retained placenta, hypothyroidism, Sheehan syndrome, polycystic ovarian syndrome, advanced maternal age, and education level (8, 9).

Early term infants, born between 37 0/7 and 38 6/7 weeks of gestation, are also at higher risk compared to term infants, born between 39 0/7 and 41 6/7 weeks of gestation, for reduced breastfeeding initiation rate and duration (10).

The aim of this study is to identify significant risk factors for early weight loss in breastfed, healthy early term and term newborns in a setting where Caesarean section (CS) rates are high. There are few studies about early weight loss in newborns in Turkey (11, 12). In one study, risk factors were evaluated only in a very small number (n=34) of newborns (12). This study is first of its kind of this scale in detecting significant risk factors for early weight loss in breastfed, healthy newborns in Turkey.

MATERIAL AND METHODS

Study design and Subjects

This retrospectively designed cohort study was based on the evaluation of postnatal hospital records of newborns and mothers. Changes in weight for all newborns after delivery during hospital stay were analysed.

Newborns delivered in Vehbi Koç Foundation American Hospital between 1 January 2011 and 31 October 2014 were included in the study. All mothers were offered 'breastfeeding education' between 30-36 weeks of pregnancy. Newborns were evaluated by a paediatrician immediately after birth. Skin to-skin contact and breastfeeding within one hour after delivery were early goals. A family medicine specialist who was also an International Board-Certified Lactation Consultant (IBCLC) evaluated all mother-infant pairs during hospital stay to reduce breastfeeding problems. Rooming in and exclusive breastfeeding were prioritised unless there was direct refusal from the mother, or the presence of a medical complication related to the mother or the baby. As soon as these conditions improved, newborns were placed to the breast.

A total of 3812 babies were included in the study. Babies who were non-breastfed, gestational week of <37 or ≥42 weeks, with presence of any metabolic or congenital disease, NICU admittance or/and APGAR score lower than 7 or born as multiples (twins, triplets) were excluded from the study. Birth weight was not considered as an exclusion criterion. A flowchart of the study is given in Figure 1.

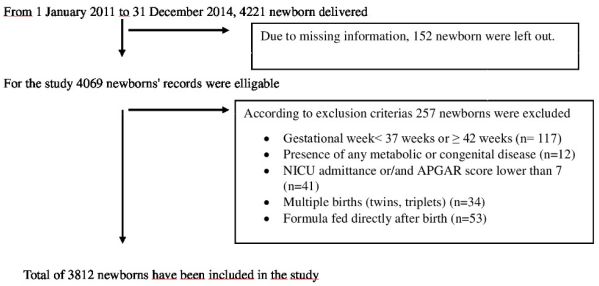


Figure 1: Flowchart of the study

Routine weight measurements were performed until discharge, the first one being immediately in the delivery room and then daily. Every day the babies were visited by a paediatrician and an IBCLC. When weight loss reached 7% of the birth weight, measurements were taken every 12 hours or more frequently. In such cases, re-evaluation of the breastfeeding technique and additional breastfeeding consultancy was provided. If latch was not successful, manually expressed milk was given by cup feeding. In the study, those babies who were given expressed mother's own milk (MOM) are included in the exclusively breastfed baby group. If MOM is inadequate and weight loss reached ≥10%, formula feeding was initiated by order of the paediatrician.

Data were collected by an IBCLC between 1 January 2015 and 1 June 2015 from postnatal hospital records of newborns and mothers. Physiologic weight loss is defined as 5-7% loss of the birth weight (10). In this study, weight loss over 7% was identified as increased weight loss. Risk factors related to neonatal weight loss that were evaluated by the study are listed in Table 1. Early term refers to babies born between 37 0/7– 38 6/7 weeks of gestation (10). The method of anaesthesia during delivery (spinal or general anaesthesia) and the method of conception (spontaneous or In Vitro Fertilisation -IVF) were noted from hospital records. The underlying conditions of the mother were inclusive of Gestational Diabetes Mellitus (GDM), glucose intolerance and hypothyroidism. Maternal

Table 1: Risk factors evaluated in the study

Maternal age
Parity
Gestational week
Delivery Mode
Anesthesia Method
Conception method
Birth weight
Infant gender
Maternal hypothyroidism
Maternal gestational diabetes mellitus
Maternal increased insulin resistance

GDM and hypothyroidism are among the potential risk factors for exclusive breastfeeding (13, 14). All mothers included in the study were screened for GDM during pregnancy with a laboratory-based screening test(s) using blood glucose levels. Maternal hypothyroidism was detected by obtaining TSH levels with free thyroid hormone levels. In the study, maternal metabolic and hormonal diagnosis were based on pregnancy follow-up notes found in the maternal records.

Ethical consideration

Ethics committee approval was received from the local ethics committee for the study with decision number 2105-058-IRB2-024 dated 19.03.2015. Informed consent was not obtained since the study is retrospective. The study was conducted in accordance with the guidelines of the Declaration of Helsinki.

Data analysis

The Number Cruncher Statistical System 2007 (NCSS Kaysville, UT, USA) was used for the statistical analysis. In analysis, descriptive statistical methods such as mean, standard deviation, median, frequency and ratio were used. The Pearson Chi-Square test was employed for the comparison of qualitative data. Multivariate data were assessed byLogistic Regression (Backward Stepwise) analysis. All the results were evaluated in the 95% confidence interval, with $p<0.05$ level of significance.

RESULTS

The hospital records of 3812 healthy, term newborns were evaluated. All newborns were initially exclusively breastfed after delivery. During their stay, 14.9 % (n=565) of the newborns were supplemented by formula.

Most mothers were over 30 years of age (79.5%). The majority of the mothers were primiparous (61.3%). The gestational week was early in nearly half of the study group (51.5%). Babies were predominantly delivered via Caesarean section (71.8%) and mainly under epidural anaesthesia (85.3%). A total of 311 mothers conceived with IVF techniques. Many of the mothers did not have any underlying medical conditions (85%). The male gender comprised of 51.4% of the infants. The characteristics of the mothers and newborns are given in Table 2.

Table 2: Characteristics of mothers and newborns (n=32)

	Min-Max	Mean±SD
Maternal age	19-52	33.83±4.09
Parity	1-5	1.44±0.60
Gravida	1-9	1.93±1.08
Gestation week	37-41.29	38.90±0.84
Birth weight	2050-5190	3378.17±398.86

When analysing the risk factors, the first set of risk factors that were statistically significant after univariate analysis for early weight loss were; maternal age, parity, type of anaesthesia, in-vitro conception, gestational week, Caesarean section, and the gender of the baby (Table 3). Hypothyroidism, insulin resistance and gestational diabetes mellitus were identified as underlying conditions and were evaluated as one group (Table 3).

The number of weight measurements, time intervals and weight changes of newborns are given in Table 4. The babies were separated as one group with a loss less than 7% and a second group with weight loss over 7%. Overall, 58.3% (n=2224) of the newborns experienced weight loss that exceeded 7% of their birth weight. Weight loss above 7%of the birth weight was mostly observed between 24-72 hours after birth (Table 4). The rate of exclusively breastfed newborns during hospital stay was 85.2%. Only 14.8 % (n=565) were supplemented with formula alongside breastfeeding.

Only five of the risk factors revealed by univariate analysis turned out to be statistically significant after logistic regression analysis (Table 5). Namely these factors were caesarean section, lower parity, an early gestational week, an older maternal age and the female gender of the infant.

Caesarean section was the most prominent risk factor that increases the chance of early weight loss by 7.92 times (Table 5).

Lower parity was the second factor that came out statistically significant ($p<0.01$) for higher rates of birth weight loss. Weight loss over 7% for babies born to primiparous women was 61.2% and weight loss and the number of births were inversely correlated; 54.2% for para 2, 52.6% for para 3, 42.9% for para 4 and 40% for para 5 women. (OR:1.918 (%95 CI:1.638-2.245) (Table 5).

The gestational week was the next identified risk factor for early weight loss. Babies born as early term had a higher risk of losing over 7% of their birth weight in comparison with term babies (OR: 1.012 (%95 CI:1.21-1.042) (Table 5).

Older maternal age was the fourth significant risk factor for neonatal weight loss. The weight loss percentages were evaluated for four different groups of mothers and these groups are as follows: younger than 30 years of age, between 31-35 years, between 36-40 years and above 40 years of age. Babies born to older mothers lost significantly more weight in comparison with the babies born to the younger mothers, for

Table 3: Evaluated risk factors of mothers and newborns in univariate analysis (n=3812)

		n	%	Weight loss >7% n(%)	*p*
Maternal Age	**19-30**	780	20.5	399 (51.2)	*0.001**
	31-35	1767	46.4	1004 (56.8)	
	36-40	1069	28.0	684 (64)	
	> 40	196	5.1	137 (66.9)	
Parity	**Primipara**	2338	61.3	1430(61.2)	*0.001**
	Multipara	1474	38.7	794 (53.9)	
Gestational Week Distribution	**Early Term (37-38w)**	1962	51.5	1266(64.5)	*0.001**
	Term (>39w)	1850	48.5	958(51.8)	
Delivery Mode	**Cesarean**	2736	71.8	1961(71.8)	*0.001**
	Vaginal birth	1076	28.2	260 (24.2)	
Anaesthesia	**None**	137	3.6	37 (27.0)	*0.001**
	Used	3675	96.4	2187 (59.5)	
General		422	11.1	311 (73.7%)	*0.001**
Epidural		3253	85.3	1876 (57.7 %)	
Conception	**Spontaneous**	3501	91.8	2010 (57.4)	*0.001**
	IVF	311	9.2	214 (68.8)	
Underlying Conditions	**None**	3249	85.2	1879 (57.8%)	0.126
	Present	563		345 (61.3 %)	
Birth Weight Distribution (g)	**2050-2500**	36	0.9	19 (52.8%)	0.051
	2501-2999	584	15.3	321 (55.0%)	
	3000-3999	2946	77.3	1724 (58.5 %)	
	>=4000	246	6.5	160 (65.0 %)	
Gender	**Boy**	1958	51.4	1093 (55.8 %)	*0.001**
	Girl	1854	48.6	1131 (61.0 %)	

Table 4: Weight changes of newborns in the early postnatal period

		n	Min- Max	Mean	SD	Weight loss >7% n(%)
Weight (gr)	**Birth weight**	3812	2050-5190	3378,17	398,86	--
	0-24 hours	3784	1995-4990	3248,88	388,59	19 (52.8%)
	24-48 hours	3521	1920-4780	3146,89	374,17	321 (55.0%)
	48-72 hours	2738	1890-4660	3129,76	378,12	1724 (58.5%)
	≥73 hours	259	2090-4555	3136,54	408,34	160 (65.0%)
Weight loss (%)	**0-24 hours**	3784	0-10,29	3,86	1,76	124 (3.3%)
	24-48 hours	3521	0-13,45	6,92	1,70	1791 (47.0%)
	48-72 hours	2738	0,27-13,89	7,57	2,13	1704 (44.7%)
	≥73 hours	259	-1,18-12,33	6,91	2,54	139 (3.6%)

Table 5: Significant risk factors for higher than 7 % weight loss

	p	Odds Ratio	%95 CI	
			Lower	Upper
Maternal Age				
<30yrs	0,001			
31-35 yrs	0,014	1,275	1,051	1,547
36-40 yrs	0,001	1,665	1,335	2,076
>40 yrs	0,002	1,780	1,226	2,584
Parity (primiparous)	0,001	1,918	1,638	2,245
Gestational Week (37 and 38 wk)	0,012	1,210	1,042	1,405
Mode of Delivery (Cesarean Section)	0,001	7,923	6,686	9,390
Gender (female)	0.001	1,330	1,150	1,538

every group and for every measurement (p<0.01 for all groups). Maternal age over 35 years was found to increase the risk of early weight loss nearly 2 times (Table 5).

Finally, the female gender of the infant was found to be significant after logistic regression analysis (OR: 1.330 (%95 CI:1.150-1.538) (Table 5).

DISCUSSION

The identification of significant risk factors for excessive weight loss in newborns before hospital discharge is crucial for developing prevention strategies. Further benefits would reflect on exclusive breastfeeding rates. These risk factors may change from country to country (15). To the best of our knowledge, this is the most extensive study in Turkey that has investigated risk factors for early weight loss in breastfed, early term and term newborns. Caesarean section, primiparity, gestational week, maternal age, and female gender were the significant risk factors found in the study. By using the same cohort presented here, early weight loss percentile charts in exclusively breastfed infants according to the mode of delivery were also plotted (16).

WHO has stated that no robust evidence existed for ideal Caesarean section rate (15). The rate in our study was quite high (71.8%). In Turkey, the CS rate increased five Fold between 1993 and 2013 (17). The most recent CS rate reported in the Turkey Demographic and Health Survey of 2018 (2019) was 52% (18). There are studies of small-scale stating CS delivery as a barrier for breastfeeding (19, 20). However, its effects are not separately pinpointed from other risk factors due to the study size. This study evidently defines the effect of CS, clear of the effects of other risk factors like maternal age or parity, due to its large cohort size. Contributing factors like late skin to skin, post-operative pain and IV fluid administration were associated with lower success rates in exclusive breastfeeding following CS (21,22). As a progressive method of lactation support for women who deliver via CS, skin to skin may be expedited, post-op pain may be managed more effectively and the use of IV fluids may be done sensibly (Table 6).

Being primiparous was another noticeable risk factor of the study. This finding is similar to the study mentioned above where the maternal age and parity were evaluated jointly (23). In this study, increased weight loss above 7% was high (61.3%) among babies born as the first child of the family and primiparity was identified as an independent risk factor. Research suggests that maternal inexperience and anxiety may be related (4, 24). Such anxieties may have a detrimental effect on successful breastfeeding (25). Multiparas show an earlier start of breastfeeding which may be associated with a previous experience (26). An intervention for successful breastfeeding may be providing early lactation consultancy to primiparous women (Table 6).

It was found that 64.5% of the early term babies lost over 7% of their birth weight, whereas the percentage of excess weight loss for term babies was 51.5% (Table 3). This notable difference may be due to increased morbidities and prolonged hospital stays for early term babies (27). Difficulty in regulating blood glucose, undesired respiratory conditions and neonatal intensive care admissions may contribute (27, 28). The sleepiness and reduced ability to effectively latch on is a major problem of early term babies (10). Even if some early term infants may seem to latch on properly, they may not be able to transfer an adequate amount of breastmilk. A modified approach may be to give additional attention in breastfeeding support to this group and showing their mothers how to stimulate these babies to feed effectively and how to use supportive equipment like nipple shields (Table 6).

The neonatal weight loss rate was statistically significant for a maternal age above 35 years. This is comparable to previous findings from various studies (20, 23). However, many studies analyse the combined effect of maternal age and parity (29, 30).

Table 6: Suggested interventions to identified risks

Risks	Suggested Interventions		
	Prenatal	**Perinatal**	**Postnatal**
CS	Perinatal courses	Perioperative sensible IV fluid administration	· Early skin-to skin contact · Repeated lactation consultancy · Postoperative pain management
Primipar	Perinatal courses	Encouraging normal birth	· Postpartum anxiety management · Lactation consultancy
Advanced maternal age	Perinatal courses	Encouraging normal birth	Closer breastfeeding follow-up · Galactagogue use
Gestational week	Perinatal courses · Managing sleepy baby · Explaning physiology of lactation (stimulus leads to production)	Encouraging normal birth	Closer breastfeeding follow-up · Assisted breastfeeding techniques · Hand expression · Cup feeding · Possible mechanical expression
Gender	Routine follow-up	Routine follow-up	Closer breastfeeding follow-up in light of new research

The large data pool of this study made it possible to identify maternal age as an independent risk factor from parity. A lactation intervention for delayed childbearing and following breastfeeding problems could be galactagogue use (31) (Table 6).

Findings about gender as a risk factor for early weight loss are controversial. In one study where risk factors for early lactation problems among primiparous mothers were investigated, the male gender of the infant was observed as a risk factor (24). Another study listed reasons for sex-specific differences in infant suckling as maturation, gender-based differential behaviours in mothers or the subjective observer association (30). In another study, where 414 newborns were evaluated for the risk factors over 8% weight loss, a gender difference was not found to be significant (20). In this study, being a girl was found to be a risk for early weight loss. In "Child Growth Standards" publication, WHO states that "weight losses between birth and day 7 were slightly attenuated in girls compared to boys" (32). Obviously, there are physiological differences between genders in terms of early weight loss. Further prospective studies that investigate the effect of gender on infant weight loss after birth are needed before suggesting gender-based lactation support interventions.

Limitations

Maternal gestational diabetes mellitus, maternal increased insulin resistance and maternal hypothyroidism were evaluated under the heading of "underlying conditions". Future research is essential for individual analysis of these morbidities in relation to breastfeeding success. The study group consisted mainly of women who were administered anaesthesia, general or epidural. This may have limited the expression of the group of mothers that received no anaesthesia.

CONCLUSIONS

Delivery by Caesarean section, parity, gestational week, older maternal age and being primiparous are the identified risk factors determined for early weight loss. Perinatal courses may inform mothers about how they can overcome breastfeeding problems (33). Attentive breastfeeding support immediately after delivery for those mother-infant pairs with identified risk factors may decrease early weight loss (33).By helping mothers making informed decisions about the mode of delivery and the use of anaesthesia is beneficial on many levels: awake mothers who do not miss out the on the 'Golden Hour' and babies with lower anaesthetics in their bloodstream (34). Assisted breastfeeding techniques can be used and close follow-ups for early term babies will likely ensure a prolonged successful exclusive breastfeeding period (10).

Etik Komite Onayı: Etik komite onayı bu çalışma için, Koç Üniversitesi Etik Kurulu'ndan alınmıştır (19.03.2015/ No: 2105-058-IRB2-0242).

Bilgilendirilmiş Onam: Retrospektif bir çalışma olduğu için bilgilendirilmiş onam alınmadı.

Yazar Katkıları: Çalışma Konsepti/Tasarım- G.G., T.E; Veri Toplama- T.E., B.K.; Veri Analizi/Yorumlama- G.G., T.E; Yazı Taslağı- T.E., B.K., G.G.; İçeriğin Eleştirel İncelemesi- G.G., B.K.; Son Onay ve Sorumluluk- G.G., T.E., B.K.

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Informed Consent: Informed consent was not obtained as it was a retrospective study.

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