



Effect of Oral Carbohydrate Intake on Labor Progress: Randomized Controlled Trial

*R Rahmani¹, Z Khakbazan², *P Yavari^{2,3}, M Granmayeh², L Yavari⁴*

1. Department of Midwifery, Nursing & Midwifery Faculty, Gonabad University of Medical Sciences, Gonabad, Iran
2. Faculty of Nursing and Midwifery, Tebran University of Medical Sciences, Tebran, Iran
3. Dept. of Nutrition and Biochemistry, School of Public Health, Tebran University of Medical Sciences, Tebran, Iran
4. Dept. of Public Health, Umea University, Umea, Sweden

***Corresponding Author:** Tel: +92-21-88954824, Email: parvanyavari@yahoo.com

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Abstract

Background: Lack of information regarding biochemical changes in women during labor and its outcomes on maternal and neonatal health still is an unanswered question. This study aims to explore the effectiveness of oral carbohydrate intake during labor on the duration of the active phase and other maternal and neonatal outcomes.

Methods: A parallel prospective randomized controlled trial, conducted at the University Affiliated Teaching Hospital in Gonabad. Totally, 190 women were randomly assigned to an intervention (N=87) or control (N=90) group. Inclusion criteria were low-risk women with singleton cephalic presentation; and cervical dilatation 3-4 cm. Randomization was used by random number generator on every day. Odd numbers was used for intervention and even numbers for control group. Intervention was based on the preferences between: 3 medium dates plus 110 ml water; 3 dates plus 110 ml light tea without sugar; or 110 ml orange juice. The protocol is only run once but women ate and drank gradually before second stage of labor. Control group were fasted as routine practice. Neither participants nor care givers or staff could be blinded to group allocation. Differences between duration of the active phase of labor were assessed as primary outcome measure.

Results: There was significant difference in the length of second stage of labor ($P < .05$). The effect size for this variable was 0.48. There were no significant differences in other maternal and neonatal outcomes.

Conclusions: Oral intake of carbohydrate was an effective method for shortening the duration of second stage of labor in low-risk women.

Keywords: Labor, Oral carbohydrate intake, Eating behavior, Birth outcomes

Introduction

Restrictive policy of fasting during labor first described in 1946. Aspiration of gastric juice during anesthesia can cause sudden death or may occur later from pulmonary complications (1). American Society of Anesthesiologists (ASA) published its obstetrics guideline in 2007 and, stated that solid foods should be trigger for maternal complications and must be avoided during labor (2). The American College of Nurse-Midwives (ACNM)

clinical guideline for providing oral nutrition to women in labor published in 2008, states that "restricting oral intake during labor may add the stress of labor" and also adds "it should be made clear that it is the anesthesia which is the risk for aspiration, not the oral intake." (ACNM), concluded that "It is important that we do not unnecessarily restrict a women's ability to eat or drink during labor," and that "In addition to

providing hydration, nutrition, and comfort, self-regulating intake decreases a women's stress level and provides her with a feeling of control." (3). The American College of Obstetricians and Gynecologists (ACOG) published in 2009, recent recommendations on liquid intake during labor. According to a new Committee Opinion released from (ACOG), "although the guidelines on prohibiting solid food while in labor or before scheduled cesarean surgery remain the same, ACOG says that women with uncomplicated labor, as well as uncomplicated patients undergoing a planned cesarean, may drink modest amounts of clear liquids during labor if they wish." (4). Restrictive intrapartum oral intake policies are different in countries. There is more recommendations relax on oral intake in European countries than in the United States (Seventy nine percent in the Netherland and 32% among 351 birth units in the United Kingdom) (5, 6). However, the available evidence suggests low risk of aspiration. In the United States, the overall pregnancy-related mortality ratio from 1991-1999 was 11.8 deaths per 100,000 live births (7). The results of surveillance data revealed that embolism and pregnancy-induced hypertension were among the leading causes of death (7).

Few randomized controlled trials have studied the effects of oral intake during labor on neonatal and maternal outcomes (8-14). Five studies reported no significant differences on neonatal and maternal outcomes (8-10,12,14). However, one study reported a higher caesarean section rate, (11) and others longer labors (8,13,15). Power limitation has been suggested by previous writers, except for the recent study (14).

In addition, the energy needs of laboring women and the effect of fasting on labor are not clearly understood (3). Intake of carbohydrates, during exercise has been proved not only to decrease the occurrence of fatigue but also to enhance the performance (16, 17).

Energy requirements are the highest in the second stage of labor (18). Intravenous glucose could result in high blood level of lactate and acidosis in fetal (19, 20). Whether oral intake or different food choices during labor will affect the

duration of labor, type of delivery and other maternal and neonatal outcomes is not known completely. To the best of our knowledge, the lack of consistency in management strategies due to our limited understanding regarding the effects of fasting on normal biochemistry of laboring women and maternal and neonatal outcomes. Therefore, our hypothesis was that intake of simple carbohydrate would decrease the length of labor and cause desirable outcomes in low-risk women and their neonates.

Our main outcome was to assess the effectiveness of oral carbohydrate intake during labor on the duration of the active phase. Our secondary outcomes were to measure the effect of oral carbohydrate on caesarean rate, the incidence of instrumental deliveries, the frequency and volume of vomiting, and neonatal outcomes.

Materials and Methods

A parallel prospective randomized controlled trial conducted between September 2008 and December 2008, at the University Affiliated Teaching Hospital in Gonabad, Iran. The study protocol was reviewed and approved by the Ethics Committee for Human Experimentation of Tehran University of Medical Sciences. Women were fully informed of the study protocol before active labor. Written informed consents were obtained from all participants. Women were eligible for inclusion if they were over 19 years of age, at or more than 36 weeks' gestation, with a singleton cephalic presentation, and cervical dilatation at 3-4 cm. Exclusion criteria were unplanned cesarean section, oral intake less than 30 kcal, fast labor and fetal compromise. We did not recruit women with a known medical complication that had high risk of cesarean section. There was no limitation on amniotomy procedure in all participants. Epidural analgesia was not used at the medical center. The sample size was estimated 87 subjects in each group, based on the vomiting rate (9) with 80% of statistical power to detect 20% differences at 5% significance level. Based on the aim of the study, which was determination whether giving

permission to women in labor to eat small amount of carbohydrate would influence the outcome of labor and to increase the chance of vomiting and subsequent risk of pulmonary aspiration. The risk of pulmonary aspiration is the main reason for prohibiting of eating before and during labor. Mendelson's syndrome described in 1946 and was about aspiration of gastric juice which can cause sudden death. Based on the search on the published paper, the main investigators and the biostatistics came up together with the best way and practical way of sample size calculation.

Screenings were done on 324 patients to find the pregnant women who had our criteria. Of the women 123 did not meet the criteria and 11 women declined to participate. After randomization, 190 volunteer low-risk pregnant women before active labor were enrolled in this study, 90 women in each group. Totally, 180 women allocated to carbohydrate (N=90) and control (90) group. All participants were followed until the end of the study. Investigators excluded 3 participants from carbohydrate group for *noncompliance with assigned protocol*.

The attended women were randomized before active labor begins based on random number generator on every day. Odd numbers for intervention and even numbers for control group were implemented until complete recruitment in each group was achieved. Women in the carbohydrate group were advised to consume three medium dates with 110 ml water; or three dates with 110 ml light tea without sugar; or 110 ml orange juice drink based on their preferences. The protocol was only run once but women ate and drank gradually before start of active phase. Women in control group were limited to water only. The total energy of commercial orange juice was 49 calories per 100 ml with 11.5 g carbohydrates, so the calories and carbohydrate of our protocol (110 ml) was respectively, 54 calories and 13 gram. The amount of carbohydrate and the calories of three dates were respectively 15 gram and 60 calories. The intake of carbohydrate group was observed and recorded until end of the delivery

phase. The compliance behaviors supervised by the researcher.

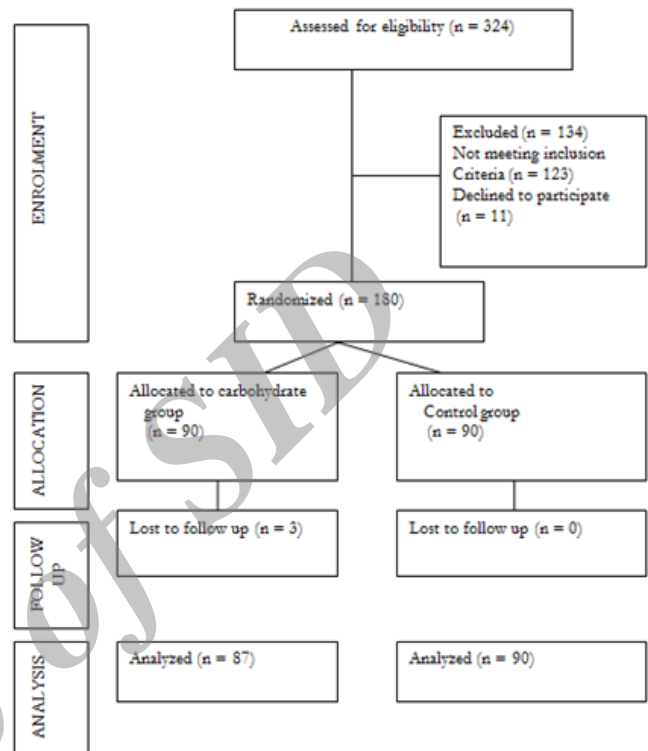


Fig. 1: CONSORT flow diagram of progress through stages of a randomized trial of two parallel groups

Data were collected through a complete questionnaire in two sections; demographic and information about labor. Content validity was done by 10 expert professionals in the related area. The questionnaires were completed by the main researcher. Data about age, the number of parity, abortion, gestational age, weight, height, cervical dilatation, Oxytocin requirements, the indication for intravenous fluids, use of analgesics, birth weight, episiotomy, duration of labor, type of delivery, instrumental delivery, frequency and volume of vomiting were collect and recorded by the attending midwife. We did not determine the stomach contents of the women. Intravenous infusion of physiologic electrolyte solution was given during labor. Pethedine or meperidine was used by an injection during labor to relieve the

pain. Neonate heart rates in first and second stage were assessed by external electronic fetal heart monitoring. One minute, five minute Apgar scores, and birth weight were recorded at delivery. Cervical dilatation was assessed at hourly intervals by the attending midwife. We defined the duration of active phase from vaginal dilation 3-4 cm until the end of delivery, and the second stage of labor from complete cervical dilatation (10 cm), until the baby is born. The data were recorded by the attending midwife who was one of the research team members. The attending obstetricians made all the decisions regarding caesarean section, oxytocin infusion, intravenous fluid, and use of analgesia.

The main researcher was responsible for all data collection, education, and could not be blinded to trial allocation. All data were analyzed using SPSS 11.5 (SPSS Inc., Chicago, IL). Statistical analysis included student's *t*-test, χ^2 tests, non-parametric testing (Mann-Whitney *U* test), and the effect size were appropriate. The Cohen's *d* and effect size is calculated for significant difference. A value of *P* < .05 was considered to be statistically significant.

Results

A total of 324 women were informed about the study protocol at the hospital. The 134 (41.4%) did not wish to participate. Common concerns of the first time delivery was the most frequent reason for nonparticipation. The women in the two randomized groups were similar with respect to age, parity, abortion, gestational age, body mass index, cervical dilatation, use of oxytocin, intravenous fluids, and analgesia, infant's birth weight, and episiotomy (Table 1). No significant differences in mother's education or income were detected at the baseline (data not shown). The mean level of calorie intake in the carbohydrate group was 44 Kcal/h until delivery. A few number of women had light tea.

We found no significant difference in the duration of active phase and the third stage of labor, type of delivery, frequency and volume of vomiting, neonate heart rate in first and second stage

and Apgar one minute and five minutes score between the two groups (Table 2). The length of second stage of labor was significantly shorter in the carbohydrate group (*P* = .04). The Cohen's *d* and effect size for this variable were respectively, 1.8 and 0.48. The proportion of instrumental vaginal and caesarean section were similar in both groups. No aspiration was observed during the study.

Table 1: Baseline Clinical characteristics for study groups

VARIABLE	Carbohydrates (n=87)	Control (n=90)	<i>P</i> value
Age (yr)			
Mean(SD)	25.4 (4.1)	26.8 (3.6)	0.2
Range	19-33	20-33	
Parity (No)			
Mean (SD)	1.9 (0.8)	2.0 (1)	0.5
Abortion (No)			
Mean (SD)	0.1 (0.3)	0.1 (0.3)	0.3
Gestational age (wk)			
Mean (SD)	38.5 (0.8)	39.0 (1.0)	0.2
Body mass index (kg/m ²)			
Mean (SD)	28.2 (2.4)	28.8 (2.4)	0.1
Cervical dilatation (cm)			
Mean (SD)	2.6 (0.7)	2.7 (0.7)	0.2
Intravenous oxytocin in labor (IU)			
Mean (SD)	2.8 (1.2)	3.1 (1.2)	0.2
Intravenous fluid (ml)			
Mean (SD)	401.5 (129.4)	472.2 (126.6)	0.2
Use of analgesia (%)			
Yes / No	93.1 (6.9)	95.6 (4.4)	0.6
Episiotomy (%)	40.2	39.0	0.2

There were no significant differences between groups by *t*-student, χ^2 tests or Mann-Whitney

Table 2: Maternal and neonatal outcomes for study groups

VARIABLE	Carbohydrates (n = 87)	Control (n = 90)	P value
Duration of active phase of labor (hour)			
Mean (SD)	3.3 (1.2)	3.4 (1.3)	0.3
Duration of second stage of labor (min)			
Mean (SD)	12.6 (5.7)	19.7 (7.3)	0.04*
Duration of third stage of labor (min)			
Mean (SD)	4.3 (3)	5 (4.5)	0.1
Type of delivery (%)			
Spontaneous vaginal	97.7	96.7	
Instrumental vaginal	2.3	2.2	0.9
Caesarean section	0	1.1	
Frequency of vomiting (%)			
1 time	70	80	0.7
2 times	30	20	
Volume of vomiting (ml)			
Mean (SD)	188 (51.0)	178 (72.5)	0.7
Infant's Birth Weight (g)			
Mean (SD)	3119.5 (262.6)	3183.5 (350.5)	0.2
N Neonate Heart Rate in 1 st stage			
120- 160 beat/min	137.9 (3.4)	137.1 (4.2)	0.1
N Neonate Heart Rate in 2 nd stage			
100- 140 BPM	117.9 (6.7)	116.3 (8.9)	0.2
Apgar scores 1 min			
Mean (SD)	8.9 (0.3)	8.9 (0.3)	0.5
Apgar scores 5 min			
Mean (SD)	10 (0.6)	9.53 (0.7)	0.8

There were no significant differences between groups by Mann-Whitney

*Statistically significant differences with control group (Mann-Whitney)

Discussion

The purpose of this study was to determine if oral carbohydrate intake during labor decreased the duration of labor and type of delivery, maternal and neonatal outcomes. We found significant difference in the duration of the second stage between the two groups. Intake of carbohydrates before the second stage did not change type of delivery, and other maternal and neonatal outcomes. The baseline characteristics were similar between groups. Therefore, intervention was responsible for the differences between groups.

In previous studies, a significantly increased rate of caesarean section was shown in women in the carbohydrate group in comparison with the placebo (11) but in another study from this scientific group, the intake of carbohydrates just before the second stage did not reduce instrumental delivery rate with no significant difference in caesarean rate (20). The intake of isotonic drinks with 47 kcal/h could prevent the development of ketosis and increased the plasma glucose with no any significant difference on maternal and neonatal outcomes (10). The mean calorie intake in our study was similar to above study (44 kcal/h). Early eating and drinking did not show any effect on the incidence of dystocia

and on delivery outcomes in low-risk nulliparous women between 30 and 40 weeks gestation (12). Offering a light, and low fat diet did not effect on duration of labor (8,15). In a prospective study with a naturalistic passive approach eating during the early phase of first stage of labor in subgroup of women with cervical dilatation between 0-3 cm was associated with 2.16 hours longer labors (13). Consumption of a light diet during labor did not influence obstetric or neonatal outcomes (14). Women in intervention group consumed a variety of food intake during labor. In our study, we used dates and orange juice as a source of simple carbohydrates that are easily absorbable by the body. There was no significant difference between both groups from the aspect of the frequency and volume of vomiting. Cervical dilation, total consumption of energy, fat, the texture of the food, fluids, or solid might be important factors that could affect on maternal and neonatal outcomes. Eating during labor could prevent ketosis (21) but no differences in plasma lactate (9). Based on the recent intervention review about the effects of intravenous fluids or oral intake on maternal, fetal and neonatal outcomes, there is not enough information about ketosis during labor and its association with pregnancy outcome (22). Gastric emptying delay and vomiting and its relationship with opioids drugs has been reported in some previous studies (23). In the present study, pethidine or meperidine is used to relieve pain. Nausea and vomiting are one of the most frequent side effects of this group that might affect the frequency of vomiting. Local anesthetic-opioid solutions were not injected. Other factors such as pain, labor, emotional disturbances, stress, could decrease gastric emptying (24). The effects of hungry on catecholamine release, was shown (25). Fasting can stimulate acid secretion and may increase gastric volume (26). Despite a lack of evidence that fasting can decrease the maternal aspiration morbidity, but still fasting during labor is a common practice in many countries (26). The possibility of aspiration of gastric contents is the main reason for oral intake limitation (27).

Error of judgment and fault of technique are reported as the main factors in aspiration during anesthesia and ensuring the security airway suggested as an important point for prevention (28). The prohibition of solid foods as well as improvements in obstetric anesthesia has contributed to the decrease in incidence of aspiration (4).

Our knowledge about the nutritional needs of laboring women is limited. The American Society of Anesthesiologists currently recommended intake of modest amounts of clear liquids may be allowed for uncomplicated laboring patients, but patients with additional risk factors for aspiration or at increased risk for operative delivery may be restricted to oral intake (2). Solid food avoidance was recommended to all (2). According to a new Committee Opinion released from The American College of Obstetricians and Gynecologists (ACOG), women in labor may be allowed to quench their thirst with more than just the standard allowance of ice chips (4). None significant effect of a light diet on labor outcomes was seen in a large number of nulliparous women (15). The goal of our oral carbohydrate protocol was to determine the effect of enough hydration and necessary calories support for the normal processes of labor and to prevent prolonged labor. We could find a positive effect on the second stage of labor but not in the whole process of active labor. Recruitment of women into the study with different cervical dilatation might affect on the whole duration of labor and different results. Concurrent measurement of metabolic markers would provide accurate information regarding fuel changes of energy during labor and should be assessed at frequent intervals in future studies. It is assumed that women would be able to control their oral intake based on their preferences and clinical signs and symptoms. Women should be notified of potential benefits and risks regarding eating and drinking during labor (12). According to the present study and recommendations from ASA, ACOG, and ACNM, (2-4) final decision in low risk laboring women might be left to women's preferences.

Conclusions

In summary, for low-risk women with 3-4 cm cervical dilatation, intake of dates or orange juice during active labor could decrease the length of second stage of labor phase. There was no significant difference between oral intake and other maternal and neonatal outcomes. Further studies are required to investigate the effects of various types of simple carbohydrates on different stages of labor and changes in metabolic markers at frequent intervals during the whole process of labor. Food characteristics such as energy density, types of carbohydrates, fiber, digestibility and glycemic index might be considered.

Implications for Clinical Practice

The results from this study can not provide convincing documents to change practice, but provides information about the importance of simple carbohydrates for women during labor. Oral carbohydrate intake from dates or fruit juice did not increase the frequency of vomiting, or any other adverse outcomes. This is consistent with the latest recommendations from ACNM and ACOG. Small and frequent simple carbohydrates provide enough hydration, stable blood glucose and comfort with a natural feeling of control. These findings suggest an approach to researching different sources of simple carbohydrates as a valuable source of energy during labor.

Ethical considerations

Ethical issues (Including plagiarism, Informed Consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc) have been completely observed by the authors.

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