Effect of hydration with oral water on nonstress test in a hospital, Turkey: a randomized controlled trial

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Received 25 December 2020
Revised 24 January 2021
6 March 2021
Accepted 19 March 2021

Abstract

Purpose – The aim of this study was to assess the effect of hydration with oral water on non-stress test (NST).
Design/methodology/approach – The study was conducted as single-blinded and randomized controlled. Healthy and outpatient 32- to 40-week pregnant women who were aged 19 and older were included in the study. Intervention group pregnant women ($n = 66$) drank 500 ccs of water before the NST, and no attempt was made to the control group ($n = 66$). The NST parameters of the groups with fetal heart rate (FHR), variability, acceleration, deceleration, reactivity and nonreactivity were evaluated.
Findings – Both groups were found to be similar in terms of their descriptive characteristics and variables related to pregnancy ($p > 0.05$). The median FHR was 130.0 in the intervention group, 140.0 in the control group ($p < 0.001$), and the median number of the acceleration was 6.0 in the intervention group and 4.0 in the control group ($p < 0.001$). In terms of the median number of decelerations, the groups were similar ($p > 0.05$).
Originality/value – It was found that hydration with oral water had an effect on NST parameters of FHR and the number of accelerations. However, it was observed that the FHR was within the normal range in both groups. It was thought that it tended to increase the number of accelerations.

Keywords Nonstress test, Fetus, Pregnancy, Turkey
Paper type Research paper

Introduction

One of the important diagnostic tests applied in the prenatal period is the nonstress test (NST) [1]. NST can be defined as recording fetal heart sounds using electronic fetal monitorization and tracking the relationship between fetal movements and heart rate [2]. The NST evaluates the well-being of the fetus by assessing the fetus using variability, acceleration, deceleration, fetal heart rate (FHR), reactivity and nonreactivity parameters [3]. In addition to being a painless test that does not require any invasive procedure, it is thought to be risk-free for both the mother and the fetus [4].

In a healthy pregnancy that continues normally, a healthy fetus is active during the pregnancy. With every movement of the fetus in the womb, an acceleration in FHR occurs. The fact that fetal heartbeats are accelerating during each activity that the fetus creates is an

The authors would like to thank Ferhan Elmalı for statistical analysis.

Journal of Health Research
Vol. 36 No. 4, 2022
pp. 607-614
Emerald Publishing Limited
e-ISSN: 2586-940X
p-ISSN: 0857-4421
DOI 10.1108/JHR-12-2020-0647

indication of fetal well-being. Because this situation shows that the fetus is not affected by hypoxia in the womb, there is no damage to the central and autonomic nervous systems and their integrity [5].

There are many factors that affect fetal movement patterns and uteroplacental perfusion when performing the NST. One of these factors is hydration [6]. In addition, the European Food Safety Authority (EFSA) states that recommended total water intake increases during pregnancy. For pregnant women, EFSA recommend the same amount of water intake as nonpregnant women as well as an increase proportional to the increase in energy intake [7]. Adequate fluid intake has a positive effect on the blood flow to the fetus by increasing the blood volume. As a result of the increased blood flow to the fetus, fetal activity increases, and this increases the possibility of a positive NST result [6]. There are studies in the literature demonstrating that ensuring maternal hydration has positive effects on maternal health, pregnancy status and pregnancy outcomes, hence on the fetus [8–11].

In previous studies that were conducted using the NST results, a set of methods have been tried for fetal well-being. These methods include BL67 point stimulation, chocolate or orange juice, cocoa or caffeine, halogen light and vibroacoustic stimulation, acupressure, music, maternal position and other similar methods [12–18]. However, among these, none of these studies investigated the effect of hydration with oral water on NST parameters. In this respect, the aim of this study was to assess effect of hydration with oral water on NST.

H1. Hydration with oral water affects FHR.

H2. Hydration with oral water affects the number of accelerations.

H3. Hydration with oral water affects the number of decelerations.

H4. Hydration with oral water affects the reactive NST result.

Methods

This study was conducted as a randomized controlled, single-blind, experimental study. The research was carried out in the NST outpatient clinic of a public hospital in Kayseri province. There are three NST rooms in the outpatient clinic where the research is conducted. In the outpatient clinic, NST is applied to approximately 40 pregnant women a day, and it provides service every weekday between 08.00 and16.00.

Study sampling

The patients who applied to the NST outpatient clinic, took outpatient care and were at the 32–40th week of gestation were accepted for the research. To reveal the medium effect size difference between the two groups, it was decided to work with 132 volunteers who meet the research criteria, 66 in each group with 5% type 1 error and 80% power. Groups were randomized in the electronic environment with equal numbers of participants in each group.

Inclusion criteria for the research

(1) Being 19 years old and older,

(2) Being a healthy pregnant at the 32–40th week of the gestation and

(3) Outpatient care.

Exclusion criteria for the research

(1) Multiple pregnancies,

(2) Having systemic disease (congestive cardiac failure, renal failure, thyroid, etc.),

(3) Being in the category of risky pregnancies (preeclampsia, early membrane rupture, gestational diabetes, polyhydramnios, oligohydramnios, etc.) and

(4) Having a defined risk factor in the fetus.

Requirements to be met before the NST

At least two hours before the NST application;

(1) To have eaten

(2) To have not smoked and not been in a smoking environment,

(3) To have not consumed alcohol,

(4) To have not consumed caffeine,

(5) To have not done exercise (trekking, etc.) and

(6) Having urinated just before the NST,

Data collection

Pregnant Information Form and NST Findings Information Form were used to collect data.

Pregnant Information Form: It consisted of questions determining the descriptive characteristics and variables related to pregnancy according to the literature [18–20].

NST Findings Information Form: FHR, variability, acceleration, deceleration, reactivity and nonreactivity were recorded in this form.

Pre-application of data collection tools

Preliminary application of data collection tools was done with ten pregnant women who came to the NST outpatient clinic of the study and were not included in the study. In the preapplication process, the clarity and applicability of the questions used in the survey were evaluated. After the preapplication, it was determined whether the forms used in the research were clear and understandable. Pregnant women who participated in the preapplication were not included in the study.

In this study conducted between November 2019 and December 2019, *the Pregnant Information Form* was filled prior to NST for both groups. In light of the literature [7, 10, 21, 22] and expert opinions, it was decided that hydration with oral water was going to be with 500 cc's of intake, and that NST will be performed 15 min after the hydration with oral water. Then, 500 ccs of water was given to the intervention group, and they were ensured to drink it completely. After 15 min elapsed, the pregnant women were taken to the left side position and the NST was performed. On the other hand, the NST was taken by giving the left side position to the control group without administering water. For each group, the NST Findings Information Form was filled after NST. NST results obtained were evaluated by the same Obstetrician and Gynecologist. As the researcher (Obstetrician and Gynecologist) interpreting the results was not aware of the intervention and control groups, the study was conducted as a single blind study.

The data were evaluated in the IBM SPSS Statistics Standard Concurrent User V 25 (IBM Corp., Armonk, New York, USA) statistical package program. Descriptive statistics were given as the number of units (n), percent (%), mean ± standard deviation, median (M), 25th percentile (P1), 75th percentile (P3). The normal distribution of data of numerical variables was evaluated with the Shapiro Wilk normality test and Q–Q graphs. The homogeneity of the variances was evaluated by the Levene test. Comparisons between groups for variables not normally distributed were made with the Mann–Whitney U test. The exact method of the Pearson chi-square test was used to compare the groups with categorical variables. The value

$p < 0.05$ was considered statistically significant. Comparisons between groups for age, number of pregnancies and number of live births were evaluated using independent two samples *t*-test.

Ethical issue

Within the scope of the research, written permission was obtained from the Ethical Board of Erciyes University Faculty of Medicine (Resolution No: 2019/728 and Date: 23.10.2019) and from the relevant institutions for the preliminary and actual implementation of the research.

Results

While the average age of the pregnant women participating in the study was 26.62 ± 5.44 in the intervention group, it was 28.08 ± 5.32 in the control group. It was determined that 47.1% of the intervention group, 45.6% of the control group only completed primary education, 87.9% of the intervention group and 90.9% of the control group were unemployed. It was determined that the groups were similar in terms of age, educational status, employment status, and there was no statistically significant difference between them ($p > 0.05$; Table 1).

While the average of the number of pregnancies and the average of the number of live births were 2.51 ± 1.17 and 1.18 ± 1.05, respectively, in the intervention group, these were 2.71 ± 1.51 and 1.33 ± 1.07, respectively, in the control group ($p > 0.05$). The median gestational week and the median amount of daily oral water intake of the participants were 36.0 and 1.5 liters in the intervention group, respectively, and 37.0 and 1.5 liters in the control group ($p > 0.05$; Table 2).

There was variability in both groups participating in the NST evaluation. The presence of accelerations was 95.5% in the intervention group and 92.4% in the control group. While the presence of deceleration was 39.4% in the intervention group, it was 45.5% in the control group. In terms of the NST result, the reactivity was 93.9% in the intervention group, while it was 83.3% in the control group. It was determined that the groups were similar in terms of the presence of variability, acceleration, deceleration and NST results ($p > 0.05$; Table 3).

Median FHR was found as 130.0 in the intervention group and 140.0 in the control group ($p < 0.001$); the median number of accelerations was found as 6.0 in the intervention group and 4.0 in the control group ($p < 0.001$). In terms of the median number of decelerations, there was no statistically significant difference between the groups ($p > 0.05$; Table 4).

Table 1. Comparison of descriptive characteristics of the groups

Variables	Groups		Test statistics	
	Intervention *(n = 66)*	Control *(n = 66)*	*t*	*p*
Age (*m*±*sd*)	26.62 ± 5.44	28.08 ± 5.32	1.552	0.123
	n (%)	*n* (%)	χ^2	*p*
Educational status				
Illiterate	2 (3.0)	3 (4.5)		
Primary education	31 (47.1)	30 (45.6)	3.495	0.487
High school	22 (33.3)	16 (24.2)		
Associate's degree	3 (4.5)	8 (12.1)		
Bachelor's degree	8 (12.1)	9 (13.6)		
Employment status				
Employed	8 (12.1)	6 (9.1)		
Unemployed	58 (87.9)	60 (90.9)	0.320	0.778
Total	66 (100.0)	66 (100.0)		

Note(s): *m*: mean, *sd*: standard deviation, χ^2: chi-square test statistic and *t*: independent two sample *t*-test statistics

Variables	Groups: Intervention (*n* = 66)	Groups: Control (*n* = 66)	Test statistics	
Number of pregnancies				
m±*sd*	2.51 ± 1.17	2.71 ± 1.51	0.836	0.405
Number of live births				
m±*sd*	1.18 ± 1.05	1.33 ± 1.07	0.820	0.414
			z	*p*
Gestational week				
M (P_1-P_3)	36.0 (35.0–38.0)	37.0 (34.7–39.0)	0.765	0.444
Amount of daily oral water intake (Liter)				
M (P_1-P_3)	1.50 (1.00–2.00)	1.50 (1.00–2.00)	0.925	0.355

Note(s): *m*: mean, *sd*: standard deviation, *M*: median, P_1: 25th percentile, P_3: 75th percentile, *t*: Independent two sample *t* test statistics, z: Mann–Whitney U test statistics

Table 2. Comparison of pregnancy variables of the groups

Variables	Groups: Intervention (*n* = 66) *n* (%)	Groups: Control (*n* = 66) *n* (%)	Test statistics χ^2	*p*
Variability			–	–
Available	66 (100.0)	66 (100.0)		
Not available	0 (0.0)	0 (0.0)		
Acceleration			0.532	0.718
Available	63 (95.5)	61 (92.4)		
Not available	3 (4.5)	5 (7.6)		
Deceleration			0.496	0.597
Available	26 (39.4)	30 (45.5)		
Not available	40 (60.6)	36 (54.5)		
NST result			3.685	0.097
Reactive	62 (93.9)	55 (83.3)		
Nonreactive	4 (6.1)	11 (16.7)		
Total	66 (100.0)	66 (100.0)		

Note(s): χ^2: chi-square test statistic

Table 3. Comparison as to the distribution of the group's variability, acceleration, deceleration and NST results

Variables	Groups: Intervention (*n* = 66) *M* (P_1–P_3)	Groups: Control (*n* = 66) *M* (P_1–P_3)	Test statistics *z*	*p*
Fetal heart rate	130.0 (125.0–135.0)	140.0 (130.0–145.0)	4.857	<0.001
*Acceleration	6.0 (4.0–9.0)	4.0 (2.0–6.0)	4.446	<0.001
*Deceleration	1.0 (1.0–2.0)	1.0 (1.0–2.0)	0.056	0.956

Note(s): *M*: median, P_1: 25th percentile, P_3: 75th percentile, z: Mann–Whitney U test statistics, *Acceleration: intervention $n = 63$, control $n = 61$, *Deceleration: intervention $n = 26$, control $n = 30$

Table 4. Comparison of numbers of fetal heart rate, acceleration and deceleration

Discussion

This research was carried out to assess the effect of hydration with oral water on NST. As there were not any previous studies about this exact condition, the outcomes of the study were discussed in comparison with other studies about the NST.

In this study, pregnant women in the intervention and control groups were similar in age, educational status, employment status, number of pregnancies, number of live births, gestational week and the amount of daily oral water intake.

In this study, it was determined that intervention and control groups were similar in terms of the presence of variability, acceleration and deceleration and in terms of reactivity and non-reactivity. In addition, there was not a statistically significant difference between the groups in the presence of variability, acceleration and deceleration and NST results. In line with this result, "*hydration with oral water affects the reactive NST result*" hypothesis was rejected. However, it is possible to say that administering hydration with oral water in the intervention group does not constitute any negative impacts on fetal well-being. On the contrary, in the study conducted by Erkun Dolker and Basar, it was determined that music was an effective method of increasing reactive NST rates [20]. In the study conducted by Gebuza *et al.* analyzing the effect of music on the cardiac activity of a fetus in a cardiotocographic examination, it was determined that there were significant changes in episodes of higher variability after the music was played [23]. In another study conducted by Şimşek Küçükkelepçe and Timur Taşhan analyzing the effect of music on NST results, it was found that the intervention group had higher reactivity in their NST results in comparison with the control group [18].

In this study, a statistically significant result was found between the intervention and control groups in terms of FHR. However, when FHR's of both groups were evaluated, it was seen that they were both within the normal range [24]. When the groups were assessed from the acceleration aspect, it was determined that the intervention group had higher values, and that there was a statistically significant difference between the intervention and control groups. With this finding, it is thought that hydration with oral water tends to increase accelerations in the fetus. It was found that there was no statistical difference between them in terms of deceleration. This finding gives rise to the thought that hydration with oral water does not increase the number of decelerations, so that it does not affect fetal well-being negatively. These results confirmed two hypotheses, "*hydration with oral water affects FHR*" and "*hydration with oral water affects the number of accelerations*". However, the hypothesis "*hydration with oral water affects the number of decelerations*" was rejected. Previous studies have shown that music increases FHR [25, 26] and the number of accelerations [18, 26]. In the study conducted by Tranquilli *et al.*, it was determined that eating chocolate significantly increased the number of accelerations, episodes of high variation/min and the short-term variation [27]. Buscicchio *et al.* found that the number of acceleration and the short-term FHR variation were significantly higher after taking coffee and chocolate [28]. In a study by Esin *et al.*, it was found that the NST results of orange juice and bitter chocolate groups and the control group did not have a statistically significant difference [12]. Findings of this research are similar to the outcomes of the aforementioned studies.

Limitations of the study

Even though the total amount of water that pregnant women drink daily was questioned in this study, the fact that the amount of water and fluids they received before NST was not questioned can be considered a limitation of the study. Another limitation is that the biophysical profile assessment in the ultrasound was not performed simultaneously.

Conclusion

It was determined that hydration with oral water prior to the NST created a statistically significant difference between the intervention and control groups in terms of FHR and the number of accelerations. However, FHR's were within the normal range in both groups. In terms of accelerations, it was thought that hydration with oral water prior to the NST tended to increase the number of accelerations.

Conflict of Interest: None

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