Future Natural Products
doi: 10.34172/fnp.164 2024;10(1):1-6 https://fnp.skums.ac.ir

Original Article

Comparing the effect of bananas and dates on the reactivity of the non-reactive fetus non-stress test: A randomized clinical trial

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Abstract

Background and aims: The non-stress test (NST) is one of the pregnancy screening tests used to measure fetal well-being. Any factors that can increase the reactivity or reduce the time to reach reactivity in the NST test are beneficial. This study aimed to investigate the effect of pregnant mothers' consumption of bananas and dates on the reactivity of the non-reactive fetus NST test.

Methods: One hundred sixty pregnant women with 37 weeks of pregnancy and more referred for fetus electrocardiography to the midwifery clinic of Hajar hospital in Shahrekord were randomly assigned into 4 groups, including group 1 (one banana and 500 cc water), group 2 (7 dates and 500 cc water), group 3 (25 g glucose and 500 cc water) and group 4 or control group (500 cc water). Before and one hour after the intervention, NST and the mother's blood sugar were recorded. Data was analyzed by SPSS software.

Results: There were no significant differences between the gender of the fetus, blood glucose level, mean age of the mother, and mean gestational age in the studied groups at baseline ($P>0.05$). The abundance of non-reactive results in bananas plus water, dates plus water, glucose plus water, and water groups were 6 (15%), 11 (27.5%), 11 (27.5%), and 13 (32.5%), respectively. Based on the chi-square test, the frequency of reactive and non-reactive results in the studied groups showed no significant difference ($P=0.315$).

Conclusion: According to the study results, consuming bananas before the NST test does not affect NST results, and blood glucose did not change in the groups before and after the intervention.

Keywords: Term pregnancy, Non-stress test, Non-reactive, Dates, Bananas

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Received: November 29, 2023
Accepted: September 28, 2024
ePublished: December 31, 2024

Introduction

Non-stress test (NST) is one of the pregnancy screening tests that is used for fetal well-being before the onset of labor (1). In this test, accelerating the fetal heart rate in response to the fetal movements is considered a sign of fetal health and includes using an external monitor to see the fetus's movements (2). Nowadays, NST is one of the most widely used basic methods to measure fetal health. This test is used after 26 to 28 weeks of pregnancy (3). Before 32 weeks, NSTs have variable diagnostic values and often yield high false-positive results because of the fetal heart's immaturity (1,4). Therefore, any factors that increase or reduce the necessary time to reach the reactive test in NST are helpful (5). Bananas contain three simple sugars: glucose, fructose, and sucrose. Rapid digestion causes an increase in energy, especially in the third trimester of pregnancy, and in cases where the mother's blood sugar is low, consuming a banana quickly causes a rise in the mother's blood sugar (6).

Since 50% of the carbohydrates in dates are fructose, this carbohydrate is converted into energy faster than glucose. It can provide the power needed by the body quickly (7). Studies show that consuming dates at the end of pregnancy reduces the need for oxytocin to speed up labor and is effective in reducing the length of labor. Therefore, consumption of dates is recommended for women without contraindications (8). It was indicated that providing food, using music therapy, and applying fetal vibroacoustic and halogen light stimulation before the NST can enhance fetal movements and reduce the duration of the NST (9).

In 2010, in a study by Sarafraz et al, the effectiveness of glucose oral solution on fetal NST indices was evaluated. The subjects were fasted for two consecutive days, and

one hour after drinking 240 ml of mineral water on the first day and an oral solution containing 50 g of glucose on the second day, they underwent NST. There was no significant relationship between glucose consumption and fetal NST indices, and a significant difference was observed in the mean duration of fetal heart rate increases in the two groups (10).

In 2016, Michaan et al evaluated the effect of glucose administration on perceived fetal movements in women with decreased fetal movement in 50 healthy pregnant women aged 28 to 41 weeks. Data from this study show that glucose administration does not increase maternal perception of fetal movements compared to normal saline and does not change the number of patients requiring hospitalization (11). Any action or factor that increases reactivity or shortens the time needed to achieve reactivity in the NST is valid. Considering that no study has been done in this regard, the present study was designed to investigate the effect of bananas and dates consumption by pregnant mothers on the reactivity of the non-reactive fetus NST test.

Materials and Methods

Trial design and setting

Pregnant women with a gestational age of 37 weeks and older who were referred to the midwifery clinic of Hajar Hospital in Shahrekord in 2019-2020 for NST and whose test results were non-reactive, were included in the present study, which is a clinical trial. The study population consisted of 160 nulliparous and healthy pregnant women.

Participants' inclusion and exclusion criteria

Inclusion criteria included singleton pregnancy, gestational age of 37 weeks and more, NST non-reactivity, average fetal heart rate (160-110), fetal health according to ultrasonographic evidence, and maternal fasting (three hours before the test). Exclusion criteria were multiple pregnancies, the mother's history or suffering from diseases such as diabetes, blood pressure, heart, kidney, and thyroid diseases, a fetus with intrauterine growth restriction, rupture of water sac or reduction of amniotic fluid, and unwillingness to participate in the study.

Sample size and sampling method

Pregnant women with a gestational age of 37 weeks and older are considered the target population. We used stratified random sampling for the study. After creating separate lists for participants in each stratum, randomization software was used to select participants from each stratum randomly. After that, we assigned each participant to a specific stratum based on the stratification variables, and patients randomly assigned selected participants from each stratum into two groups (Bananas group and Dates group), ensuring equal representation from each stratum in both groups. Age in diversity, gestational age, and baseline NST results were considered for stratifying the sampling. The sample size was considered for each group of 40 patients and 160 people using similar studies (12) (Figure 1), and the following formula was used:

$$n = \left(2\left(Z_{1-\alpha 2} + Z_{1-\beta}\right)2SD2\right)/d = 38\alpha = 0.05$$

$\beta = 0.2D = 2.5$
$d = 1.6$

Randomization

In this study, using the simple randomization method, the participants are assigned to 4 groups. For this purpose, 160 identical cards, on which 40 letters A, 40 letters B, 40 letters C, and 40 letters D are inserted, are mixed in an envelope, and one card is randomly drawn for each participant. The letter inserted on the card will show the patient's treatment group.

Blinding

Blinding was not done in this study.

Intervention and control groups

In this study, the eligible people were interviewed first, the study's objectives were explained to them, and written consent was obtained from them. In this study, pregnant women with non-reactive results in NST were randomly divided into 4 groups. The assignment of individuals to groups was random and based on the order of their referrals. One group under hydration with 500 cc of drinking water, one group under hydration with drinking 500 cc of water and consuming a medium banana, one group under hydration with drinking 500 cc of water and consuming 7 medium dates, and one group under hydration 500 cc of water and 25 g of glucose were mixed with drinking water. NST was performed again after one hour. A computer in both cases recorded NST, and if there are 2 increases in fetal heart rate to 15 from the baseline for 15 seconds, the result is reactive. Individuals who had previously entered the study were no longer included in repeated visits. Individual blood glucose was measured and recorded at the beginning of the study and one hour after the intervention with a glucometer.

Data analysis

Data were collected in SPSS software version 22 and analyzed by descriptive statistics, chi-square, and ANOVA. The significance level was considered less than 0.05.

Results

In this study, regarding the fetus' gender, 50% of the bananas and water group, 60% of the dates and water group, 52.5% of the glucose and water and water groups were female, and the rest were male. Based on the findings of the chi-square test, the comparison between the groups showed that there is no significant difference in terms

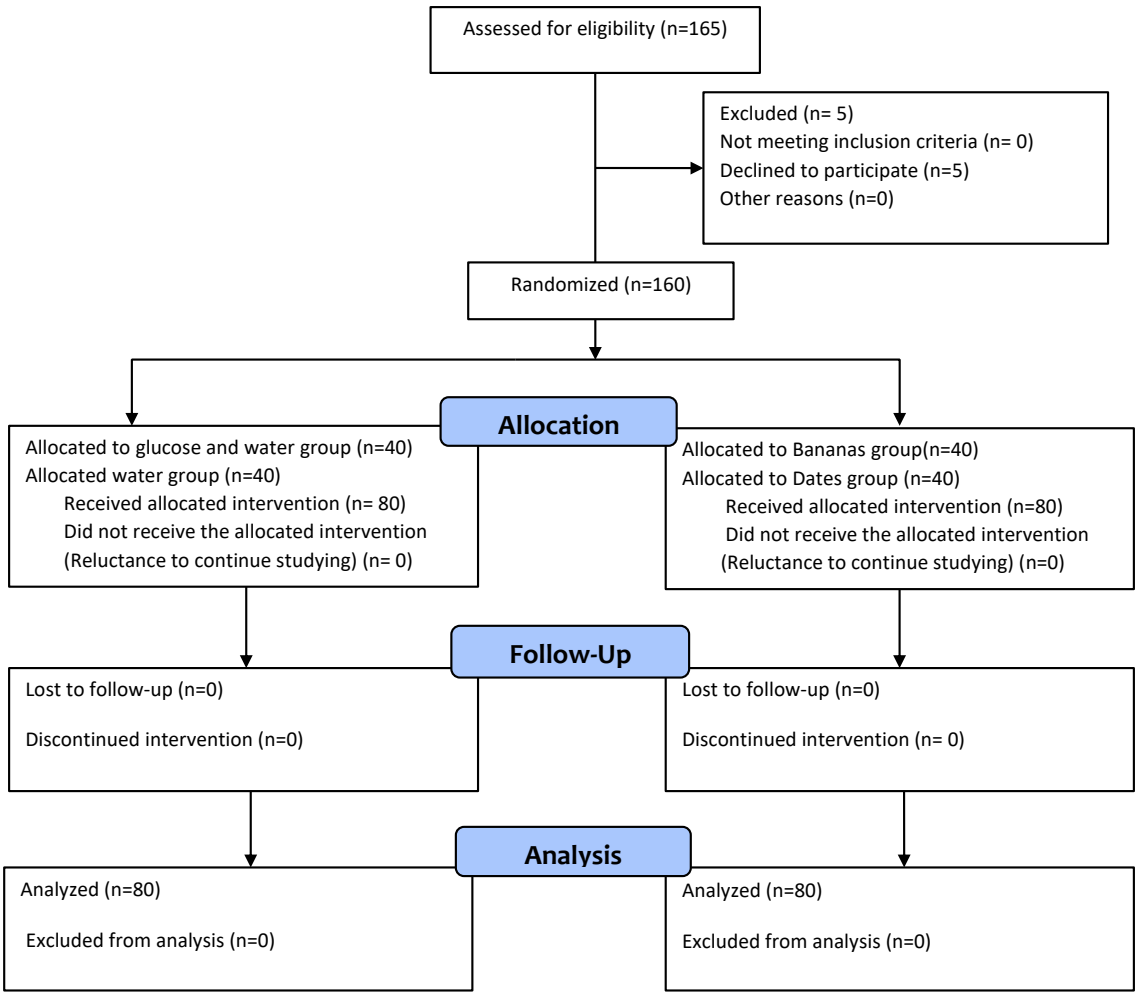

Figure 1. CONSORT diagram to illustrate the flow of participants through the trial

of fetus gender between the studied groups. They were homogeneous ($P=0.823$) (Table 1).

The mean maternal age in bananas and water, dates and water, glucose and water and water groups was 28.53 ± 4.36, 27.25 ± 5.11, 27.78 ± 3.54 and 27.75 ± 4.70 years, respectively. This study matched the groups according to the mother's age. Based on the analysis of the variance test, there was no significant difference in maternal age between the studied groups ($P=0.372$). Also, the mean gestational age in bananas and water, dates and water, glucose and water and water groups were 38.65 ± 0.94, 38.50 ± 0.96, 38.28 ± 0.98 and 38.28 ± 1.14 years, respectively. In terms of gestational age, the groups were similar to each other. There is no significant difference in gestational age between the studied groups ($P=0.945$) (Table 2). In this study, there is a statistical difference based on the analysis of variance of the blood glucose level in the groups of bananas plus water, dates plus water, glucose plus water, and water before the intervention ($P=0.874$) and after the intervention ($P=0.220$). It did not drive them meaningfully.

Comparing the frequency of reactive and non-reactive results in the NST test in the studied groups is shown in Table 3. According to Table 3, the frequency of non-reactive results in the consumer group of bananas with water, dates with water, and glucose with water and water were 6 (15%), 11 (27.5%), and 13 (32.5%), respectively, after the intervention. According to the chi-square test, the frequency of reactive and non-reactive results in the studied groups did not significantly differ ($P=0.315$) (Table 3).

Table 1. The frequency of fetal gender in the study groups

Groups	Fetal gender	
	Girl	Boy
Bananas and water (40 individuals)	20 (50%)	20 (50%)
Dates and water (40 individuals)	24 (60%)	16 (40%)
Glucose and water (40 individuals)	21 (52.5%)	19 (57.5%)
Water (40 individuals)	21 (52.5%)	19 (57.5%)
P value*	0.823	

* Chi-square test; pre-test.

Discussion

Maternal mortality in developing countries has decreased significantly. Therefore, the focus has shifted towards fetal health. During childbirth, the fetus is the second patient with a high risk of complications and mortality. 56% of stillbirths can be prevented by using diagnostic tests (13). Fetal assessments significantly reduce fetal mortality and

Table 2. Mean and standard deviation of blood glucose level, pregnancy age, and mother's age in the study groups

Variable	Group	Mean ± Standard deviation	Maximum	Minimum	*P* value
Blood glucose level before intervention	Bananas and water	103.70 ± 8.34	118	86	0.874[b]
	Dates and water	100.00 ± 14.34	127	69	
	Glucose and water	101.33 ± 13.46	133	71	
	Water (Control)	101.05 ± 14.02	138	74	
Blood glucose level after intervention	Bananas and water	108.33 ± 8.69	120	81	0.220[a]
	Dates and water	103.25 ± 14.64	139	73	
	Glucose and water	104.48 ± 11.06	135	71	
	Water (Control)	103.52 ± 14.48	135	70	
The amount of change in blood sugar levels	Bananas and water	-4.62 ± 8.59	-	-	0.780
	Dates and water	-3.20 ± 8.22	-	-	
	Glucose and water	-3.15 ± 11.99	-	-	
	Water (Control)	-2.47 ± 8.66	-	-	
Pregnancy age	Bananas and water	38.65 ± 0.94	41	37	0.945[b]
	Dates and water	38.50 ± 0.96	40	37	
	Glucose and water	38.28 ± 0.98	40	37	
	Water (Control)	38.28 ± 1.14	41	37	
Maternal age	Bananas and water	28.53 ± 4.36	36	19	0.372[b]
	Dates and water	27.25 ± 5.11	37	19	
	Glucose and water	27.78 ± 3.54	36	22	
	Water (Control)	27.75 ± 4.70	39	19	

* One-way ANOVA with post-hoc Tukey; [a] Post-test; [b] Pre-test.

Table 3. Comparing the frequency of active and non-active results of NST test in the study groups after intervention

Group	NST result	Frequency	Percent
Bananas and water	Non-reactive	6	15
	Active	34	85
Dates and water	Non-reactive	11	27.5
	Active	29	72.5
Glucose and water	Non-reactive	11	27.5
	active	29	72.5
Water (Control)	Non-reactive	13	32.5
	Active	27	67.5
P value*	0.315		

* Chi-square test; post test.

perinatal complications. NST is a sequential standard assessment method among fetal health assessment tests (14). The use of glucose (11,15,16), beverages containing glucose (17), and chocolate (18) before the test has been used in several studies and often no significant results have been observed.

In the present study, to study and compare the effect of consuming bananas, dates, and glucose by pregnant women on the reactivity of the non-reactive fetus NST, 120 pregnant women with 37 weeks of pregnancy were into 4 groups, including group 1 (one banana and 500 cc water), group 2 (7 dates and 500 cc water), group 3 (25 g glucose and 500 cc water) and group 4 (500 cc water). Before and one hour after the intervention, NST and the mother's blood sugar were recorded.

NST was considered reactive for 15 seconds or more if there were 2 increases in heart rate to 15 or more than the baseline. The frequency of fetal gender, maternal age, and blood glucose before and after intervention did not show a significant difference in the study groups, which shows the similarity of the groups. According to the statistical results of the NST test, the frequency of non-reactive results in the groups consuming bananas with water, dates with water, and glucose with water and water were 6 (15%), 11 (27.5%), 11 (27.5%), and 13 (32.5%), respectively. The chi-square test did not show a significant difference between the frequencies of reactive and non-reactive results in the study groups. In the present study, the effectiveness of bananas was observed. In this group, the rate of non-reactive results was almost half of the group consuming water. However, the differences were not significant. There was a slight reduction in non-reactive results in the groups consuming glucose and dates. The effectiveness of dates and bananas in reducing non-reactive results of the NST test has not been studied yet. However, the efficacy of edible glucose is investigated in some studies.

Gillis et al showed that the fetus's heart rate did not have a significant difference one hour after consuming 50 g of edible glucose from the mother (19). While Weissman et al showed that the fetus's heart rate increased after consuming 100 grams of glucose, the frequency of short-term changes in the fetus's heart rate did not have a significant difference (20). Esin, in their Meta-analysis systematic study, indicated that consuming glucose by the mother did not significantly affect the fetus's heart rate,

fetal activity, NST specialty, start time of reactivity and reactive results. However, a few studies have shown good glucose consumption effectiveness (21).

In the present study, like the mentioned studies, consuming glucose did not significantly affect the frequency of reactive results of the NST test compared with water. In the present study, consuming dates showed the same effectiveness as consuming glucose. However, bananas had the best effect in reducing non-reactive results. In general, knowing the results of this research can be helpful for the officials and staff of antenatal care centers to react quickly to pregnant women who want to do NST tests. As a result, it saves patients' time and money and reduces the anxiety of pregnant mothers by performing other tests as soon as possible if the NST test is non-reactive. Also, by avoiding unnecessary interventions before the test, they can prevent the fetus from being endangered. It is suggested that the effectiveness of other nutritious and valuable snacks, such as banana milk and date milk, be evaluated on NST results.

Limitations of the study

The small sample size was one of the limitations of this study due to the limitation in the number of referring patients. Other limitations of this study are the lack of investigation of the effective ingredients of the investigated fruits and the short interval between treatment and measuring variables. Therefore, well-designed clinical trial studies with a larger sample size and the evaluation of the effects of major compounds of bananas and dates are suggested for future studies.

Conclusion

According to the results of the present study, although the frequency of non-reactive results in pregnant women consuming bananas with water was 15%, which was less than the groups consuming dates compared to other groups, it was not statistically significant. Moreover, blood glucose did not change in the groups before and after the intervention. Therefore, consuming a banana one hour before the NST test is suggested to reduce false positives and increase accuracy and frugality in the time and cost of pregnant women and medical personnel. However, it is necessary to measure the effectiveness of bananas in future studies with a bigger sample, and there should be significant changes.

Acknowledgments

The authors would like to thank the Clinical Research Development Unit, Hajar Hospital, Shahrekord University of Medical Sciences, Shahrekord, Iran, for their support, cooperation, and assistance throughout the study period (Grant number: 2950, Date: 1397.12.12).

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Competing Interests

The authors declare that there is no conflict of interest.

Ethical Approval

Ethical considerations in this study included obtaining permission from the Ethics Committee of Shahrekord University of Medical Sciences (Ethical Code: IR.SKUMS.REC.1397.302) and obtaining written consent from the participants to participate in the study. This article was registered with the code IRCT20160709028844N3 in the Iranian Registry of Clinical Trials.

Funding

Shahrekord University of Medical Sciences funded this study.

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Cite this article as: Moazen Dehkordi S, Taghipour M, Malekpour A, Shabanian S. Comparing the effect of bananas and dates on the reactivity of the non-reactive fetus non-stress test: A randomized clinical trial. Future Nat Prod. 2024;10(1):1–6. doi: 10.34172/fnp.164