African Journal of Biomedical Research, Vol. 10 (2007); 257 - 261
ISSN 1119 – 5096 © Ibadan Biomedical Communications Group

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Full Length Research Article

Maternal Consumption of Aqueous Extract of *Hibiscus Sabdariffa* During Pregnancy Attenuates Pregnancy Weight Gain and Postpartum Weight Loss

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Received:
December 2006

Accepted (Revised) :
May 2007

Published
September 2007

ABSTRACT

The effect of maternal consumption of aqueous extract of *Hibiscus Sabdariffa* during pregnancy on pregnancy weight gain and postpartum weight loss was investigated in Sprague-Dawley rats. Fifteen in-bred pregnant female Spague-Dawley rats were randomly assigned to groups A, B and C on day one of pregnancy. Group C rats had tap water while groups A and B rats had 0.6g HS extract and 1.8g HS extract respectively in 100ml tap water to drink throughout pregnancy and through 34 days postpartum. All the rats in all the groups were fed normal rat chow ad libitum. Dam weights were measured daily throughout pregnancy and at delivery, 10, 14, 20 and 34 days postpartum. Results of the present study show a significant concentration dependent decrease in both pregnancy weight gain and postpartum weight loss at the doses tested.
(Afr. J. Biomed. Res. 10: 257 – 261)

Key words: - *Hibiscus Sabdariffa*, Pregnancy weight gain, Postpartum weight loss, Food and Fluid intake.

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Abstracted by:
African Index Medicus (WHO), CAB Abstracts, Index Copernicus, Global Health Abstracts, Asian Science Index, Index Veterinarius, Bioline International , African Journals online

INTRODUCTION

Hibiscus sabdariffa (HS) (family: malvaceae) has been reported to decrease weight gain in non-pregnant rats (Orisakwe *et al*, 2003; Orisakwe *et al*, 2004; Ojokoh, 2006) following subchronic administration through a mechanism not yet fully understood. Some of the phytochemical constituents of HS that have been postulated by Daffalah and a-Mustafa (1996) to be responsible for its pharmacological effects are flavonoids, polysaccharides and organic acids.

Zobo drink (a sweetened aqueous extract of HS) is commonly produced, sold and consumed in Nigeria by both males and females irrespective of their physiological states. Some females even consume zobo drinks during pregnancy.

Pregnancy is frequently associated with postpartum weight retention and several studies have shown a clear association between pregnancy weight gain and postpartum weight retention (Kac *et al*, 2004; Abrams *et al*, 2000; Ohlin and Rossner, 1990; Lederman, 1993, Linne and Rossner, 2003; Lederman *et al*, 2003). The higher the pregnancy weight gain, the higher the postpartum weight retained and vice versa (Kac *et al*, 2004; Olson *et al*, 2003; Gore *et al*, 2003; To and Cheung, 1998).

Whether or not consumption of aqueous extract of HS during pregnancy affect pregnancy weight gain and postpartum weight loss is not yet established. The present study was therefore designed to investigate this.

MATERIALS AND METHODS

Experimental Animals

Fifteen in-bred virgin female Spague-Dawley rats were used for this study. These rats were housed individually in cages. The estrous cycles were monitored and male rats of proven fertility were introduced into the cages of the female rats that were expected to get into the estrous phase within 12 hours to allow for mating. Day 1 of pregnancy was taken as the day sperm were seen in the vaginal smear of the rats. At day 1 of pregnancy, five rats each were randomly assigned to groups A, B and C. Group C rats had tap water while groups A and B rats had 0.6g HS extract and 1.8g HS extract respectively in 100ml tap water to drink throughout pregnancy and through 34 days postpartum. All the rats in all the groups were fed normal rat chow ad libitum. Dam weights were measured daily throughout pregnancy and at delivery, 10, 14, 20 and 34 days postpartum.

Extraction Procedure

Mature calyces of HS were purchased from a local market in Enugu, Nigeria, and authenticated at the department of botany, University of Nigeria, Nsukka, Nigeria. The extraction procedure used in our laboratory was as described previously (Iyare and Iyare, 2006a; 2006b). Briefly, 30g of the dry petals of HS was brewed in 400ml of boiled tap water for 45min. The resulting decoction was filtered using a filtration sieve (pore size 0.5mm diameter). 10ml of the filtrate was evaporated to dryness and yielded 0.3665±0.002g, giving a concentration of 36.65±0.002mg/ml.

The concentrations in the exposed groups above were derived as follows: 48mls of tap water was added to 10mls of filtrate to make approximately 0.6g/100ml tap water (group A) while 9mls of tap water was added to 10mls of filtrate to make approximately 1.8g/100ml tap water (group B).

Statistical analysis

Results are expressed as mean ± s.e.m. (standard error of mean). Statistical difference was calculated by the students' t-test and $p<0.05$ was considered as statistically significant.

RESULTS

Fluid intake/day/rat

Groups A and B dams consumed less ($p<0.05$) fluid per day compared with the control dams at all the trimesters of pregnancy (table 1). There was a significantly increased fluid intake in the 2nd trimester compared with the fluid intake in the 1st trimester in group A whereas groups B and C showed no difference. Group B dams also drank less ($p<0.05$) fluid in the 2nd trimester compared

with groups A and C. Fluid intake in the 3rd trimester in groups A and B was greater than the fluid intake in the 1st trimester whereas the control group showed no difference. There was a significant difference in fluid intake between the 3rd and the 2nd trimester in groups B and C (B dams higher while C dams were lower) while fluid intake in group A dams in the 3rd and 2nd trimester were similar.

Pregnancy weight gain

Results of the present study show a significant ($p<0.05$) reduction in weight gain (term weight – pregravid weight) during pregnancy by the exposed dams (groups A and B) without a statistically significant difference in postpartum weight retained (postpartum weight – pregravid weight) immediately after delivery (table 3).

Food intake/day/rat

There was a significantly reduced food intake/day ($p<0.05$) in groups A and B dams compared with group C dams at all stages of pregnancy (table 2). There was a similar change in food intake in all the groups as pregnancy progressed except in group B where the food intake by the dams in the 2nd trimester was not different from the 1st trimester but less than ($p<0.05$) that of the 3rd trimester.

Table 1:
Mean volume (ml) of fluid consumed/day in each trimester of pregnancy

Group	1st trimester	2nd trimester	3rd trimester
A	20.5±1.4*	25.5±1.8$*	26.1±1.5$*
B	18.9±1.3*	19.9±0.5P*	26.3±0.6$*#
C	34.6±2.1	40.5±2.3	32.6±1.4#

** p<0.05 vs C (control); $p<0.05 vs 1st trimester*
P p<0.05 vs A (low dose HS); #p<0.05 vs 2nd trimester

Table 2:
Effect of HS on food consumption during pregnancy

Group	1st trimester	2nd trimester	3rd trimester
A	19.6±0.7*	24.6±0.5*P	23.5±0.8*P
B	18.0±0.6*	18.1±0.5*	19.6±0.3*P#
C	24.1±0.6	30.1±1.2P	27.7±0.8P

* p<0.05 vs C; P p<0.05 vs 1st trimester
\# p<0.05 vs 2nd trimester

Table 3:
Effect of HS on Weight gain (g) during pregnancy

Group	Pregravid weight	Term weight	Pregnancy weight gain		Postpartum weight	Postpartum weight retention	
			Absolute	Relative		Absolute	Relative
A	128.8±8.6	217.5±12.5	88.8±3.8*	69.1±1.8*	177.5±0	48.8±8.8	55.5±12.2
B	122.5±2.3	202.5±4.5*	80.0±5.1*	65.5±4.9*	167.5±7.8	45.0±7.9	56.8±9.7
C	125.0±4.5	229.2±6.3	104.2±2.6	83.5±2.7	180.0±12.7	55.0±8.2	52.6±7.1

*p<0.05 vs C (control)

Table 4:
Effect of HS on postpartum weight changes

Group	Pregravid weight	PPD 0	PPD 10	PPD 14	PPD 20	PPD 34
A	128.8±8.6	177.5±0#	193.5±2.5P#	200.5±0.5P#	205.0±2.5P#	198.5±6.5P*#
B	122.5±2.3	167.5±7.8#	181.9±5.7#	183.8±7.8#	184.1±11.1#	172.5±11.6#
C	125.0±4.5	180.0±12.7#	195.8±6.9#	194.0±9.5#	184.7±12.3#	149.3±9.4

P p<0.05 vs PPD 0; * p<0.05 vs C #p<0.05 vs pregravid weight

Postpartum weight changes

There was no difference in postpartum weight changes among the various groups at all stages of measurement except at postpartum day (PPD) 34 when the weight of dams in group A were higher ($p<0.05$) than those of control dams (table 4).
There was also no difference in the weight of dams at all measurement periods compared with weight at PPD 0 (day of delivery) in all groups except in group A where dams showed significant increase in postpartum weight compared with weight at PPD 0 at all periods of measurement (table 4).

Result also show a higher postpartum weight than pregravid weight at all period of measurement in all groups except in the control group (group C) in which the weights of the dams at PPD 34 was not significantly different from the pregravid weight (table 4).

Table 5:
Effect of HS on absolute postpartum weight loss

Group	PPD 10	PPD 14	PPD 20	PPD 34
A	-16.05 ±2.5	-23.0 ±0.5^{P}	-27.5 ±2.5^{P}*	-21.0 ±6.5*
B	-14.4 ±2.8	-16.3 ±1.6^{P}	-16.6 ±5.7	-5.0 ±6.7*
C	-15.8 ±7.1	-14.0 ±4.5	-4.7 ±2.0	30.7 ±5.2^{P}

**p<0.05 vs C (control);* ^{P}*p<0.05 vs PPD 10*

Table 6:
Effect of HS on % relative postpartum weight loss

Group	PPD 10	PPD 14	PPD 20	PPD 34
A	-32.9 ±0.8	-48.6 ±7.7	-59.2 ±15.8^{P}*	-42.0 ±5.8*
B	-36.8 ±10.3	-39.1 ±6.7	-36.8 ±13.5	-8.8 ±16.6*
C	-36.0 ±18.3	-30.0 ±11.8	-9.8 ±5.0	56.0 ±6.0^{P}

^{P}*p<0.05 vs PPD 10;* * ***p<0.05 vs C (control)***

Postpartum weight loss

There was no difference in postpartum weight loss in groups A and B dams compared with control dams at PPD 10, 14 and 20, except for group A dams that lost less weight at PPD 20 (tables 5 and 6). At PPD 34, weight loss in groups A and B dams were lower than weight loss in group C (tables 5 and 6).

DISCUSSION

The reduction in the weight gain during pregnancy in the rats that drank aqueous extract of HS during pregnancy (groups A and B) was expected to lead to low postpartum weights at all periods of measurement (Kac *et al*, 2004; Olson *et al*, 2003; Gore *et al*, 2003; To and Cheung, 1998; Keppel and Taffel, 1993) either as a result of low early postpartum weight gain (due to lactation) or increased postpartum weight loss (due to the suckling pups). This, however, was not the case. Rather, there was no difference in postpartum weight changes at all periods of measurement except at PPD 20 and 34 when the weight loss in the exposed group was significantly less than the weight loss in the control group.
These observations may therefore suggest that exposure to an aqueous extract of HS during pregnancy decreases pregnancy weight gain and postpartum weight loss through a mechanism not yet fully understood.

We, therefore, hypothesize that HS exposure that commenced on day one of pregnancy through PPD 34 in the exposed groups (A and B) may have induced a state of dehydration (water deprivation) in pregnancy, directly or indirectly, in these dams as evidenced by the reduced fluid intake (table 1) which created an osmotic stress (Ross and desai, 2005). Mojiminiyi *et al* (2000) have shown that consumption of aqueous extract of HS causes hypernatremia possibly through its diuretic action. Water deprivation with the accompanying plasma hypernatremia is associated with dehydration-anorexia (Ross and Desai, 2005). This may have been responsible for the decreased food intake (table 2) and the consequent reduced weight gain (table 3) in the exposed groups.

Failure of the exposed dams to lose weight in the postpartum period especially at PPD 34 may have been due to a reduced suckling of their pups relative to control pups that may have been programmed inutero. This is an assumption

derived from our earlier study (Iyare and Iyare, 2006a) in which we gave pups from dams exposed to HS during pregnancy to unexposed dams to nurse. In the study, we observed significant growth attenuation in these pups. It is therefore possible that the reduced suckling in these pups may have led to milk accumulation in these dams and consequently the seemingly persistent postpartum weight retention or decreased postpartum weight loss.

In conclusion, the results of the present study suggest that exposure to an aqueous extract of HS during pregnancy decreases pregnancy weight gain and postpartum weight loss.

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