

# Assessment of Gross Parameters in Maternal Albino Rats after Consumption of a High Carbohydrate Diet: A Comparative Study

Albino Rats after Consumption of a High Carbohydrate Diet

Shahid Maqbool Korai<sup>1</sup>, Maria Kazi<sup>3</sup>, Abroo Fatima Qazi<sup>4</sup>, Sarah Sughra<sup>5</sup>, Sindhu Zahid<sup>2</sup> and Fareha Kashan Theba<sup>6</sup>

## ABSTRACT

**Objective:** Assessment of gross parameters of abdominal circumference and maternal weight in maternal albino rats after utilization of a high carbohydrate diet.

**Study Design:** Experimental study

**Place and Duration of Study:** This study was conducted at the Anatomy Department of Al-Tibri Medical College and Hospital from June 2022 to December 2022.

**Materials and Methods:** After attaining ethical approval from the review board, 8 female albino rats were randomly sampled and allocated into two groups with 2 male rats also being introduced into the two groups for mating purposes. The allocation in the groups was such that in Group A the rats received a normal diet, while in Group B they received a high carbohydrate diet through the gestational period. The weights of the rats and the abdominal circumference were measured after they achieved pregnancy on the 1<sup>st</sup> and 21<sup>st</sup> day, in the form of mean and standard deviation. Data were analyzed using SPSS version 21.0, with a comparison between groups done using an independent t-test, while a simple t-test was used for comparison within groups.

**Results:** No significant difference is observed between Group A and B in maternal weight on the 1<sup>st</sup> day (P: 0.760) or the 21<sup>st</sup> day (P: 0.986) of pregnancy. No significant difference is observed between Group A and B in abdominal circumference on the 1<sup>st</sup> day or the 21<sup>st</sup> day of pregnancy. A significant difference is observed within Group A when comparing the abdominal weight on the 1<sup>st</sup> and 21<sup>st</sup> day of pregnancy (P: ). A significant difference is observed within Group B when comparing the abdominal weight on the 1<sup>st</sup> and 21<sup>st</sup> day of pregnancy (P: ).

**Conclusion:** High carbohydrate diet has no significant effect on both abdominal circumference and maternal weight when compared to a normal diet.

**Key Words:** High carbohydrate, Diet, Maternal weight, Abdominal circumference.

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## INTRODUCTION

Humans must strive towards achieving a balanced diet that contains all the necessary energy and nutrient intakes that are required for healthy living and also to

<sup>1</sup>. Department of Anatomy / Biochemistry<sup>2</sup>, Al Tibri Medical College, Isra University, Karachi Campus.

<sup>3</sup>. Department of Biochemistry / Physiology<sup>4</sup>, Isra University, Hyderabad.

<sup>5</sup>. Sir Syed of Medical Sciences for Girls, Karachi.

<sup>6</sup>. Dow University of Health Sciences, Karachi.

Correspondence: Dr. Shahid Maqbool Korai, Assistant Professor of Anatomy, Al Tibri Medical College, Isra University, Karachi Campus.

Contact No: 03213903902

Email: koraishahid86@gmail.com

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manage and prevent the development of chronic diseases.<sup>1</sup> The concept of a balanced diet becomes even more crucial in those situations in which people are suffering from chronic illnesses such as hypertension, cardiovascular disease, and diabetes. The idea of attaining a balanced diet and promoting healthy eating habits should be emphasized from a young age. Developing a positive eating habit among children has the potential to improve the public health of the population as a whole.<sup>2</sup> Development of the fetus, also known as fetal programming can also be impacted if there is a poor maternal diet leading to severe consequences in the developing fetus.<sup>3</sup> Studies have indicated that different types of diets in fetuses can have different types of morphological and biochemical effects. Therefore, a prenatal environment must be perfect, as otherwise, it might have far-reaching effects throughout the life of the offspring.<sup>4</sup> One study conducted on mice showed that a diet consisting of 45%-60% fats leads to reduced fetal and birth weight.<sup>5</sup> Proteins and carbohydrates also play an important role in fetal development. Therefore, maternal nutrition in

pregnancy must be regulated as its participation in placental-fetal development will have an everlasting impact on the eventual human being<sup>6</sup> The mother must provide adequate amounts of fatty acids, amino acids, and glucose to the fetus which is done through the placenta. These three major nutrients are essential for everyone at all ages of life. But even excess of any of the nutrients is considered harmful, take the example of carbohydrates which are increasingly being implicated in causing obesity, diabetes, and cardiometabolic diseases.<sup>7</sup> Different types of diets that particularly are high in one nutrient such as carbohydrates or proteins have been used during pregnancy and have shown no benefit which has thus resulted in premature birth, low birth weight, alteration in sex, low BMI, and an impairment in physical as well as neuronal activity.<sup>8-9</sup> The knowledge and area of work is minimal in Pakistan in this field and considering this a comparative study was conducted to assess the impact of a high Carbohydrate diet on the morphology of maternal albino rats.

## MATERIALS AND METHODS

This experimental study was conducted at the Anatomy Department of Al-Tibri medical college, Isra University Karachi. The study had a time duration of six months after the ethical approval was taken from the institutional review board ((IRB). The study consisted of normally healthy female albino rats that had an age of 60-90 days were included in the study. These female albino rats weighed between 150-220 gms. They were acquired from the animal house of Al-Tibri Medical College through a random sampling technique. The selected 8 female rats were housed in a circadian rhythm of 12 hours of light as well as 12 hours of darkness with food and water being provided ad libitum. After one week had elapsed, the female rats were then divided into two groups, with each group consisting of four female rats and one male rats respectively. Each group was provided a specific diet in the form of a cake which was specially prepared by a bakery. The composition of the diet is presented as follows:

### GROUP A (Control):

Constituent	Quantity (gm)	Percentage
Fat	26	26%
Carbohydrate	54	54%
Protein	20	20%
<b>Total</b>	<b>100 gm</b>	<b>100%</b>

### GROUP B (High Carbohydrate Diet):

Constituent	Quantity (gm)	Percentage
Fat	12	12%
Carbohydrate	70	70%
Protein	18	18%
<b>Total</b>	<b>100</b>	<b>100%</b>

At the beginning of the study, the female rats were weighed using a digital weight machine and all were housed in a plastic cage. We used a male rat for mating purposes in each group. Pregnancy was confirmed using a vaginal swab that was then studied under a microscope to determine the presence of sperms on the swab, thus confirming pregnancy. On the confirmation of pregnancy, the day was regarded as day zero. After pregnancy had taken place, the male rats were separated and the maternal rats were weighed using an electronic weight machine. Furthermore, the abdominal circumference of the maternal rats was measured using a measuring tape in centimeters. Both of the aforementioned variables were measured on the 1<sup>st</sup> as well as the 21<sup>st</sup> day after achieving pregnancy while during this time the mother was given a constant diet (20-30 grams daily) according to their group allocation. Statistical Package for social sciences (SPSS) version 20.0 will be used for statistical analysis. The entire continuous variables were reported as Mean ± standard deviation (SD). For comparison within groups, the simple t-test was applied, whereas for comparison between groups, the independent t-test was applied. The value for statistical significance was set at P<0.05.

## RESULTS

**Table No. 1: Shows comparison of maternal weight (gm) on 1<sup>st</sup> day and 21<sup>st</sup> day in different groups**

	Maternal weight on 1 <sup>st</sup> day Mean ± SD	p-value	Maternal weight on 21 <sup>st</sup> day Mean ± SD	p-value
Group A	209.0 ± 6.51	0.760	256.0 ± 8.21	0.986
Group B	204.0 ± 13.87		254.0 ± 13.41	

**Table No. 2: Shows comparison of maternal weight (gm) within the group between the 1<sup>st</sup> and 21<sup>st</sup> day**

	Maternal Weight on 1 <sup>st</sup> Day	Maternal Weight on the 21 <sup>st</sup> Day	P-value
GROUP A	209.0 ± 6.51	256.0 ± 8.21	
GROUP B	204.0 ± 13.87	254.0 ± 13.41	

**Table No. 3: Shows comparison of the prenatal abdominal circumference (cm) on 1<sup>st</sup> day and 21<sup>st</sup> day in different groups**

	Maternal weight on 1 <sup>st</sup> day Mean ± SD	p-value	Maternal weight on 21 <sup>st</sup> day Mean ± SD	p-value
Group A	13.0 ± 0.0	∧ 0.999	18.2 ± 0.44	∧ 0.999
Group B	13.0 ± 0.0		18.2 ± 0.83	

**Table No. 4: Shows comparison of abdominal circumference (cm) within the group between the 1<sup>st</sup> and 21<sup>st</sup> day**

	Maternal Weight on 1 <sup>st</sup> Day Mean $\pm$ SD	Maternal Weight on the 21 <sup>st</sup> Day Mean $\pm$ SD	P-value
GROUP A	13.0 $\pm$ 0.0	18.2 $\pm$ 0.44	
GROUP B	13.0 $\pm$ 0.0	18.2 $\pm$ 0.83	

**Table No. 1:** Shows comparison of Maternal weight on the 1<sup>st</sup> and 21<sup>st</sup> day in different groups

**Table No. 2:** Shows comparison of Maternal weight on the 1<sup>st</sup> and 21<sup>st</sup> day within groups

**Table No. 3:** Shows comparison of Abdominal Circumference on the 1<sup>st</sup> and 21<sup>st</sup> day in different groups

## DISCUSSION

The period of conception and reproduction is a critical period, in which if not careful the risks of chronic diseases being developed in offspring can take place later on. In this situation, nutrition plays a vital role during the developmental period with the World Health Organization (WHO) laying out comprehensive guidelines which detail the nutritional needs of women during the pregnancy phase and lactation is significantly lacking.<sup>10</sup> Most of the women, unfortunately, don't meet the recommended guidelines concerning weight and nutrition during pregnancy.<sup>11</sup> Weight is an essential factor during pregnancy with a meta-analysis stating that gestational weight gain can lead to childhood obesity in offspring.<sup>12</sup> This study was designed to not just assess the weight during pregnancy but also the abdominal circumference when a particular diet is given in large quantities. When comparing both the groups on the 1<sup>st</sup> and 21<sup>st</sup> day, no significant difference was observed in both maternal weight and abdominal circumference. However, the weight on the 1<sup>st</sup> and 21<sup>st</sup> day did increase significantly within the group. This finding was similar to another study conducted by Wang et al which showed that a high carbohydrate diet increased the body weight in maternal rodents.<sup>13</sup> Similarly, no significant difference was observed in the abdominal circumference between groups on the 1<sup>st</sup> and 21<sup>st</sup> day, but when the comparison was done between the groups on the 1<sup>st</sup> and 21<sup>st</sup> day, a significant difference was observed. Although the findings between the groups showed no significant difference, they can't still be considered a benchmark for the health assessment of females during pregnancy. This is because both maternal weight and abdominal circumference are easily measurable benchmarks but they don't accurately depict the systemic health of the female, nor the ongoing development of the offspring. Thus, other parameters which give a much more accurate depiction of parameters about the health of females and their offspring should be studied in the

future. Weight gain is natural in pregnancy, however, if a certain amount of nutrients is taken in abundance the weight gain can then become impactful. A study by Clapp et al showed that consumption of a high-glycemic carbohydrate-containing diet leads to an excessive gain in maternal weight, in contrast consuming a low-glycemic carbohydrate diet leads to a normal maternal weight gain but produces infants with birth weight in the 25<sup>th</sup> and 50<sup>th</sup> percentile.<sup>14</sup> Our study focused on studying only a high carbohydrate diet, future studies can be done to study high protein or even high-fat diets and compare them with each other. A previous study conducted on females given a high-fat diet found elevated levels of body fat in maternal rats that ultimately lead to maternal obesity.<sup>15</sup> In future studies as mentioned before, other more accurate parameters need to be studied.

## CONCLUSION

There was no significant difference seen between the group with a normal diet and a high carbohydrate diet in regards to maternal weight and abdominal circumference. However, this does not mean that diet doesn't play a major role in pregnancy and pregnancy-related outcomes. This just merely means that other parameters need to be studied concerning different diets that can accurately assess pregnancy and pregnancy-related outcomes.

### Author's Contribution:

Concept & Design of Study: Shahid Maqbool Korai  
 Drafting: Maria Kazi, Abroo Fatima Qazi  
 Data Analysis: Sarah Sughra, Sindhu Zahid, Fareha kashan Theba  
 Revisiting Critically: Shahid Maqbool Korai, Maria Kazi  
 Final Approval of version: Shahid Maqbool Korai

**Conflict of Interest:** The study has no conflict of interest to declare by any author.

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