Effect of Smoking during pregnancy on the Dimension of the Newborn and Anthropometric Indices: a cohort study in Lattakia, Syria

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Abstract: Objective: To investigate the effect of smoking during pregnancy on the anthropometric measurements of the newborn and the effect of stopping smoking during the first trimester of pregnancy.

Patients and methods: Our study was a cohort-analytical study conducted at Tishreen University Hospital in Lattakia-Syria during the period from January 2020 to January 2021. The study included 180 pregnant women with a single live pregnancy who met the inclusion criteria. They were divided into non-smokers, smokers who stopped smoking during the first trimester of pregnancy (group 1), smokers who continued smoking until the end of pregnancy (group 2). After birth. Neonate identified with Small for gestational age and low birth weight.

Results: The study was founded that smoking during pregnancy increases the risk of (low birth weight) LBW by 16.3% and the risk of SGA (small for gestational age) by 79%, and smoking was associated with the birth of children with lower anthropometric measurements compared to the children of non-smoking mothers. As for the Ponderal Index >90th, A.OR was 4.9 for group (1) versus 5.8 for group (2) and Head to Length Ratio >90th was 3.4 for group (1) versus 4.6 for group (2), as it was found that increasing the number of cigarettes smoked per day increases the risk of The occurrence of adverse birth outcomes

Conclusion: Maternal smoking, regardless of duration of smoking during pregnancy, was associated with neonates abnormal body proportions resulting from greater reductions in body length and head circumference compared to weight, smoking during the first trimester of pregnancy was associated with adverse birth outcomes, but with a lower A.OR than group (2).

Keywords: Smoking during pregnancy, anthropometric indices.

تأثير التدخين أثناء الحمل على حجم الوليد والمشعرات الأنثروبومترية: دراسة حشدية في اللاذقية، سوريا

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المستخلص: الهدف: تحري تأثير التدخين أثناء الحمل على القياسات والمشعرات الأنثروبومترية للوليد مع دراسة تأثير إيقاف التدخين خلال الثلث الأول للحمل مقابل الاستمرار في التدخين حتى نهاية الحمل

المرضى والطرائق: دراستنا دراسة حشدية تحليلية أجريت في مشفى تشرين الجامعي في اللاذقية- سوريا خلال الفترة من كانون الثاني 2020-كانون الثاني 2021. شملت الدراسة 180 سيدة حامل مع حمل حي وحيد حققن معايير الاشتمال. تم تقسيمهن إلى غير مدخنات، مدخنات أوقفن التدخين خلال الثلث الأول للحمل (مجموعة 1)، مدخنات استمرين في التدخين حتى نهاية الحمل (مجموعة 2). بعد الولادة تم قياس وزن، طول جسم ومحيط رأس الوليد وحساب المشعرات الأنثروبومترية وتحديد المشعرات غير الطبيعية. تم تحديد الوليد الصغير بالنسبة لعمر الحمل (SGA) والوليد مع وزن الولادة المنخفض (LBW).

النتائج: وجدت الدراسة أن التدخين أثناء الحمل يزيد خطر LBW بنسبة 16.3% وخطر SGA بنسبة 79%، كما ترافق التدخين مع ولادة أطفال ذوي قياسات أنثروبومترية أقل مقارنة مع ولدان الأمهات غير المدخنات. أما بالنسبة للمشعر الوزني 90th < فكان A.OR: 4.9 للمجموعة (1) مقابل 5.8 للمجموعة(2) ونسبة الرأس إلى الطول < 90thكان 3.4 للمجموعة (1) مقابل 4.6 للمجموعة (2)، كما تبين أن زيادة عدد السجائر المدخنة في اليوم يزيد خطر حدوث النتائج الولادية السلبية، وكان لتدخين الزوج أهمية بشكل تآزري مع تدخين الأم المستمر حتى نهاية الحمل ولم يكن هناك فرقاً هاماً إحصائياً فيما يتعلق بنوع التدخين.

الاستنتاج: ارتبط تدخين الأم بغض النظر عن مدة التدخين أثناء الحمل بنسب غير طبيعية في الجسم لحديث الولادة ناتجة عن انخفاض أكبر في الطول ومحيط الرأس مقارنة مع الوزن. كما ترافق التدخين خلال الثلث الأول للحمل مع نتائج ولادية سلبية ولكن مع A.OR أقل من المجموعة (2).

الكلمات المفتاحية: التدخين أثناء الحمل، المشعرات الأنثروبومترية.

Introduction.

Epidemiology:

The tobacco epidemic is one of the biggest public health dangers that the world has ever witnessed. It kills more than 8 million people annually around the world, including more than 7 million who use it directly and about 1.2 million passive smokers. All forms of tobacco are harmful and there is no safe level of tobacco exposure. Cigarette smoking remains the most common type of tobacco use worldwide [1]. According to the American Society of Medical Oncologists, smoking causes a third of cancer deaths, and 30 million people join the smokers' caravan each year [2]. Experts say that about half of these people die from smoking.

Smoking and Women

Women have received the largest proportion of the harms of smoking. In addition to the general harms that affect women and men, women exposed to additional risks, the most important of which is the increased risk of cervical cancer and osteoporosis. Moreover, the risk spectrum increases for pregnant women, who in turn carry damages to their fetus [3, 4, 5]

Smoking and Pregnancy

Although cigarettes are the tobacco products most harmful to public health, there is no a safe tobacco for use in pregnant women because all tobacco products, including E-cigarettes, contain nicotine

which crosses the placenta and interferes with embryonic development, as Sachs Benjamin said, Professor at Harvard University, "When you smoke during pregnancy, you poison the fetus "

smoking during pregnancy is associated with many adverse pregnancy outcomes such as miscarriage, placenta previa, premature rupture of membranes, placenta previa, preterm labor, preterm birth, stillbirth, premature placental abruption, ectopic pregnancy [6]

some studies have shown that the newborns of smoker mothers have a higher PI of 0.040 and lower birth weight and length. [7]

Aim of the study

1. Is to investigate the effect of smoking during pregnancy on the anthropometric measurements and indices of the newborn.

2. Is to study of the effect of stopping smoking during the first trimester of pregnancy versus continuing to smoke until the end of pregnancy

Patients and Methods.

This is Analytic Cohort Study of a group of pregnant women who admitted and delivered at the Department of Obstetrics and Gynecology at Tishreen University Hospital in Lattakia-Syria during one-year period (January 2020-January 2021).

The inclusion criteria were:

- Pregnant women with a single live pregnancy with a gestational age of ≥ 37 gestational weeks.

The exclusion criteria were:

- Fetal complications (congenital anomalies)

- Pregnancy complications (placental abruption)

- Metabolic diseases (gestational diabetes, type 1 diabetes, type 2 diabetes)

- Cardiovascular diseases and pressure disorders during pregnancy (chronic hypertension — chronic hypertension mixed with preeclampsia — gestational hypertension — preeclampsia)

- 25≤ Body Mass Index (BMI) < 18.5

- Anemia (Hemoglobin < 10.5 mg\dl)

The following workup included history, last menstruation and the presence of any complications that accompanied the current pregnancy, the question was asked about any diet followed during pregnancy, and then details were given in the case of smoking. For women who smoke, where they were asked about the date of smoking start and date of smoking quit (if it was quitted), number of cigarettes per

day, type of smoking, smoking of the husband. After birth, weight, body length and head circumference of the newborn measured, recorded, anthropometric parameters were calculated from: [8]

$$PI = 100 * \frac{\text{birth weight}}{\text{body length(cm)}^3}$$

$$HLR = \frac{\text{head circumference(cm)}}{body\ length(cm)}$$

$$BBR = \frac{100*0.037*\text{head circumference(cm)}^{2,57}}{\text{birth weight}}$$

, and abnormal parameters were determined according to the modified Fenton chart (2013). Newborns also identified with LBW, SGA according to the modified Fenton chart (2013). [9]

Fenton preterm growth chart - girls
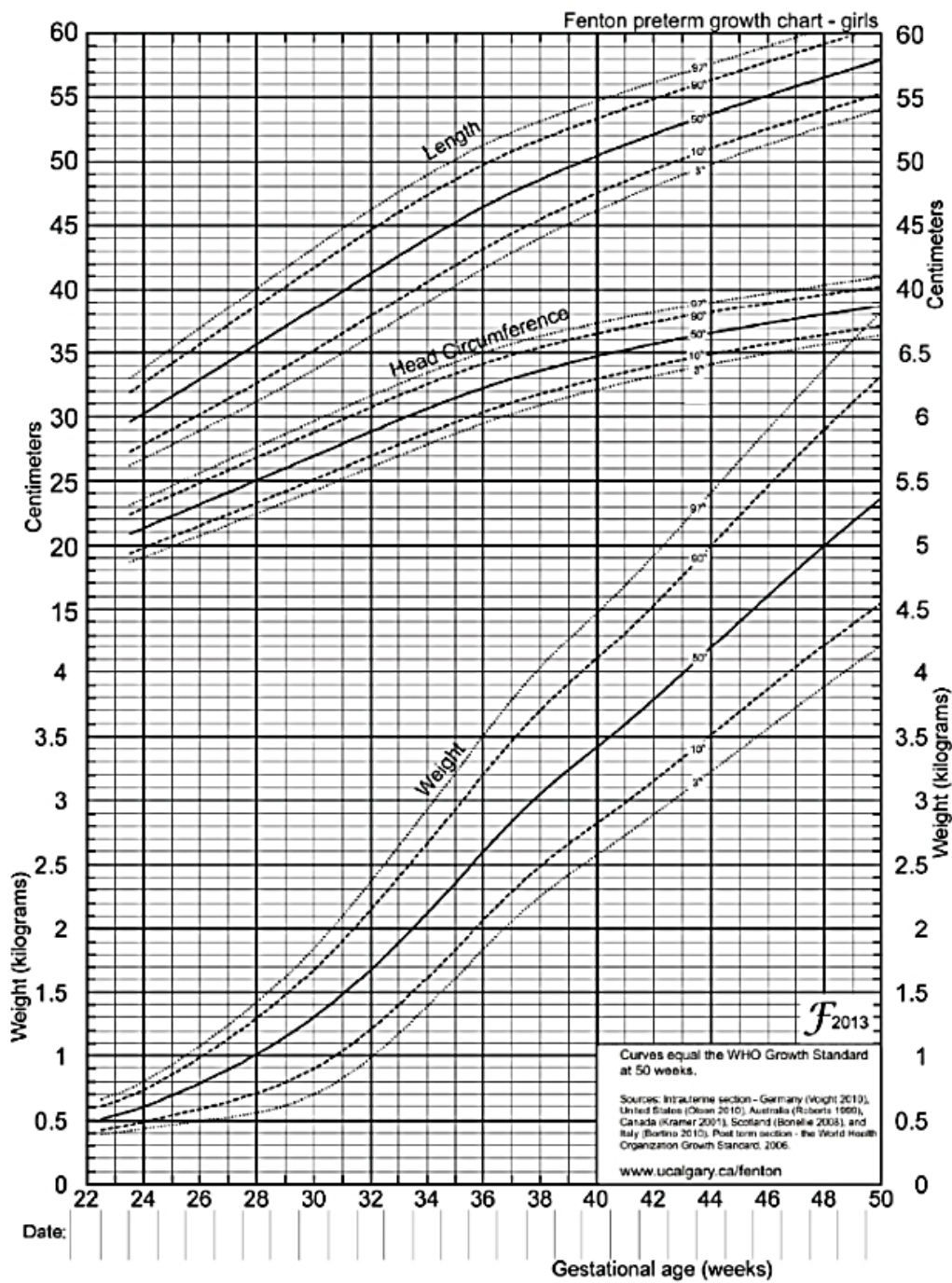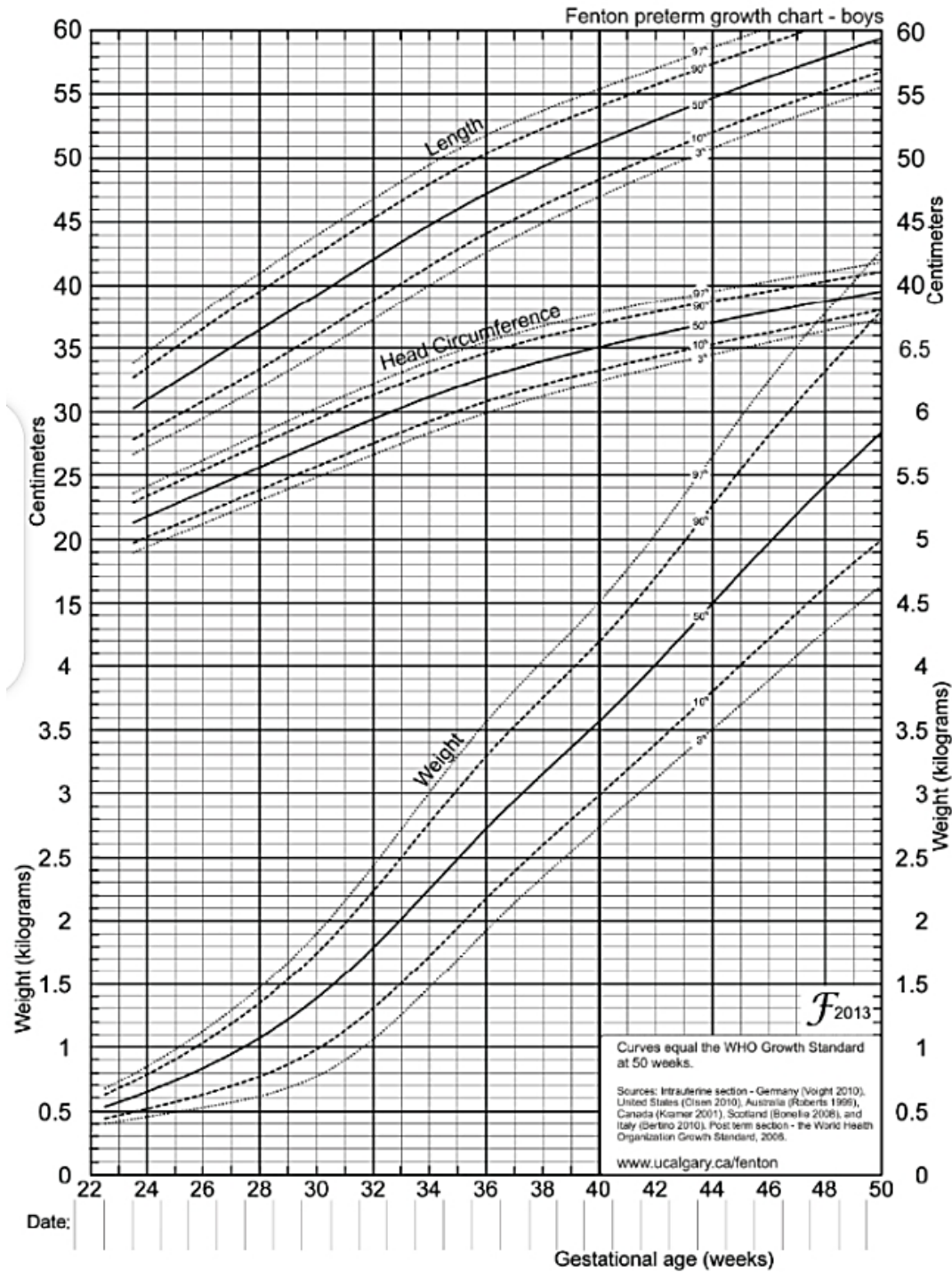
Ethical consideration: All patients provided a complete and clear informed consent after discussion about the study.

Statistical Analysis:

Measures of central tendency and measures of dispersion used for quantitative variables, in addition to percentage values and confidence intervals for qualitative variables. All variables tested using the One Way ANOVA test to study mean differences between more than two independent groups and the chi-square or (Fisher exact) test to study the relationships between qualitative variables. The adjusted odds ratio (CI95%) was determined to study risk factors and considered relevant. value more than 1. The results considered statistically significant with a p-value of < 5%. Adoption of the program (IBM SPSS statisticsVersion20) to calculate the statistical transactions and analyze the results.

Outcome measures Body proportions indicated by low brain-to- body ratio (BBR) (defined as <10th percentile); high ponderal index (PI) and high head-to- length ratio (HLR) (defined as>90th percentile); small body size for gestational age at birth (defined as weight, length or head circumference<10th percentile) and low birth weight (2500 g).

Results.

Table (1) The percentage of smoking status during pregnancy

Smoking Status	Number	Percentage
Non-smoker	114	63.3%
Quit smoking during first trimester(Group 1)	16	8.9%
Continued smoking until the end of pregnancy(Group 2)	50	27.8%

As shown in Table (1), 36.7% of the studied sample were smokers during pregnancy, 8.9% of the studied sample were Quit smoking during first trimester and 27.8% of the studied sample were Continued smoking until the end of pregnancy

Table (2) The percentage of parity in studied groups

Parity	Number	Percentage
Nulliparous	58	32.2%
Multiparous	122	76.8%
All	180	100%

As shown in Table (2), 32.2% of the studied sample were Nulliparous, and 76.8% of the studied sample were Multiparous

Table (3) Type of smoking in studied groups

Type of smoking	Number	Percentage
Cigarettes	51	77.3%
Water Pipe	15	22.7%

Type of smoking	Number	Percentage
All	66	100%

As shown in Table (3), 77.3% of smokers group smoked cigarettes, and 22.7% of smokers group smoked Water Pipe

Table (4) Distribution of maternal factors in the studied groups

Maternal Factors	Non-Smoker	Group (1)	Group (2)	P-value
Mother's age(year)	27.2±5.1	29.4±6.4	28.1±5.4	0.2
Gestational age(weeks)	37.9±0.7	37.7±0.5	37.6±0.8	0.1
Nulliparous	34(29.8%)	8(50%)	34(68%)	0.06
Multiparous	80(70.2%)	8(50%)	16(32%)	

As shown in Table (4), there are no statistically significant differences according to maternal factors between the three groups.

Table (5) Distribution of smoking related factors in the studied groups

Smoking related factors	Non-Smoker	Group (1)	Group (2)	P-value
Smoking type				
cigarettes	0(0%)	13(81.3%)	38(76%)	0.5
water pipe	0(0%)	3(18.7%)	12(24%)	
The amount of cigarettes smoking				
minimum	0(0%)	5/13(38.5%)	3/38(7.9%)	0.001
mild	0(0%)	7/13(53.8%)	7/38(18.4%)	0.009
moderate	0(0%)	1/13(7.7%)	13/38(34.2%)	0.0001
severe	0(0%)	0/13(0%)	15/38(39.5%)	0.0001
Husband's smoking	76(66.7%)	9(56.3%)	43(86%)	0.01

As shown in Table (5), regarding the type of smoking, the differences between the two groups of smokers were not statistically significant. As for the amount of smoking, we noticed that the results are subject to a dose-response relationship, where the greater the amount of cigarettes consumed per day, the greater the statistical significance. The effect of the husband's smoking on the results was statistically significant.

Table (6) Percentage of newborn related factors in the studied groups

Factors related to the newborn	Non-Smoker	Group (1)	Group (2)	P-value
Newborn sex				
male	57(50%)	8(50%)	19(38%)	0.3
female	57(50%)	8(50%)	31(62%)	
Body length(cm)	48.09±1.6	46.31±1.7	45.32±1.5	0.006
Head circumference(cm)	34.1±1.1	33.5±1.4	32.9±1.9	0.02
Body weight(g)	3220 [2200-4100]	3218 [2300-3500]	2922 [2200-3500]	0.001

As shown in Table (6), the sex of the newborn was not statistically significant. As for the anthropometric measurements, we noticed that the differences between the groups are statistically significant

Table (7) Percentage of low birth weight (LBW) in the studied groups

LBW	Non-Smoker	Group (1)	Group (2)	P-value
Body weight<2500g	2(1.8%)	1(6.3%)	5(10%)	0.04

As shown in Table (7), 1.8% of the newborns of the Non-smoker group were low birth weight, 6.3% of the newborns of the Group (1), and 10% of the newborns of the Group (2), and these differences were statistically significant.

Table (8) Percentage of small for gestational age (SGA) in the studied groups

SGA	Non-Smoker	Group (1)	Group (2)	P-value
<10th Body Weight	1(0.9%)	1(6.25%)	2(4%)	0.04
Crown Heel Length<10th	2(1.7%)	2(12.5%)	18(36%)	0.02
Head circumference<10th	11(9.6%)	0(0%)	10(20%)	0.04
All	14(12.2%)	3(18.75%)	30(60%)	

As shown in Table (8), 12.2% of the newborns in the non-smoking group were (SGA) small for gestational age, 18.75% of newborns in smokers group 1, and 60% of the group of smokers 2, these differences were statistically significant.

Table (9) Percentage of Anthropometric indices in the studied groups

Anthropometric indices	Non-Smoker	Group (1)	Group (2)	P-value
PI>90th	35(30.7%)	11(68.75%)	36(72%)	0.001
HLR>90th	53(46.5%)	12(75%)	40(80%)	0.0001
BBR<10th	53(46.5%)	8(50%)	26(52%)	0.08

As shown in Table (9), for PI>90th and HLR>90th, the differences between the studied groups were statistically significant, and the statistical significance was greater in the smoker group 2. As for BBR<10th, the difference between the studied groups was not statistically significant.
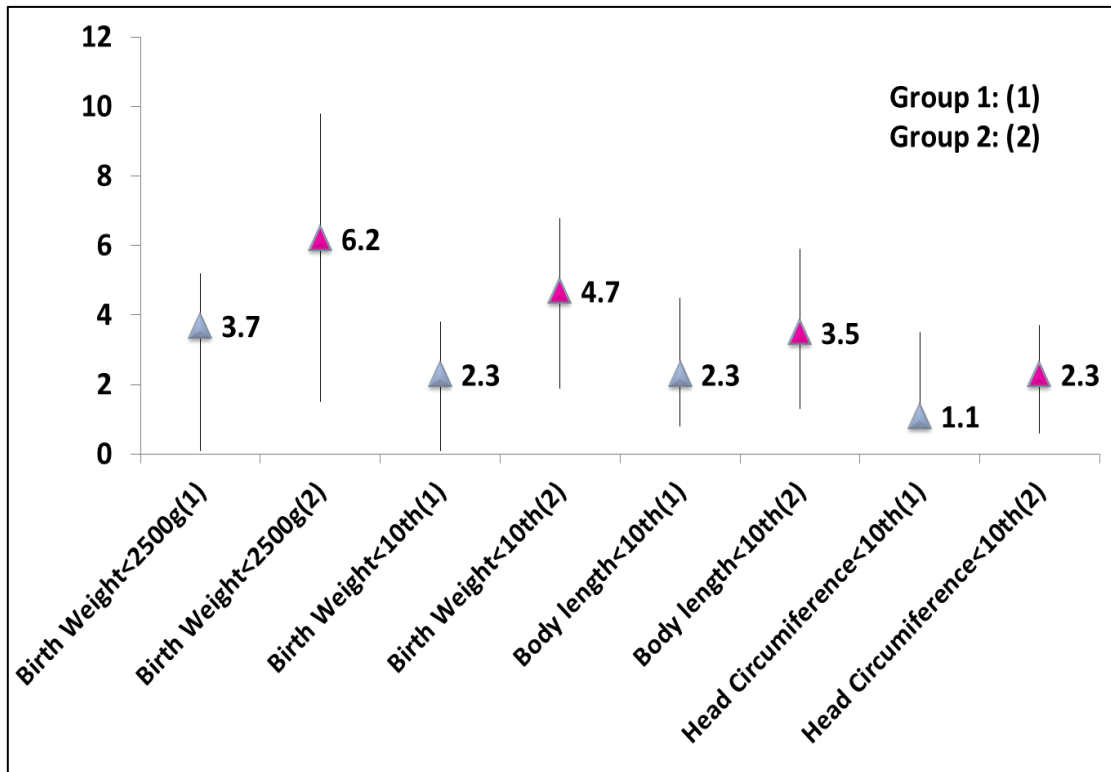

Figure (1)Adjusted OR for the association of maternal smoking with low birth weight <2500g and SGA..
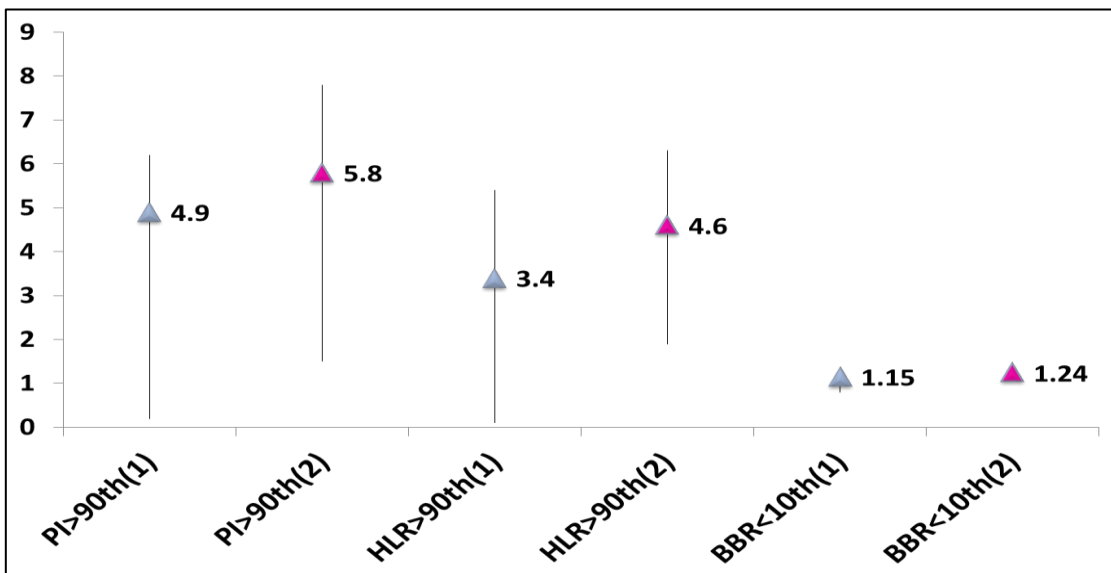

Figure (2) Adjusted OR for the association of maternal smoking and anthropometric body parameters

Figure (1) and (2) show that the adjusted odds ratio was lower in-group 1

Discussion.

In this work, we investigated the effect of maternal smoking during pregnancy, categorized as quit during the first trimester and continued after the first trimester on body size and body proportions at birth.

The study found that smoking during pregnancy increases the risk of LBW by 16.3%, and the risk of SGA by 79%

Smoking during pregnancy is associated with the birth of children with anthropometric measurements (weight, crown heel length, head circumference) less than that of children born to non-smoking mothers.

The study also found that smoking during pregnancy is associated with an increase in the percentage of abnormal anthropometric indices, as we found that the PI >90th was 68.75% in-group (1), and 72% in-group (2), and this suggests a greater decrease in length compared to weight.

The rate of HLR>90th →75% in-group (1), and 80% in-group (2), which suggests a greater decrease in length compared to head size.

BBR<10th showed a statistically non-significant high risk as (A.OR=1.15 in group 1) compared to 1.24 in group (2), and this suggests a somewhat greater decrease in brain volume compared to weight.

The study also showed that an increase in the number of cigarettes smoked per day increases the risk of adverse birth outcomes.

The husband's smoking had a synergistic importance with the mother's continuous smoking until the end of pregnancy.

There was no statistically significant difference with respect to the type of smoking.

The results of our study are similar to most of the international studies that studied the effect of smoking during pregnancy on measurements and anthropometric indices of the newborn. In a study conducted by Veronika Günther *et al* in 2021 in Germany on 110047 single pregnancies to investigate the effect of nicotine on the birth weight of the fetus based on data recorded in the German Perinatal Survey between 2010-2017, it was shown that smoking during pregnancy increases birth weight loss with an important difference Statistically p<0.001 with an average weight of 3473±444 for non-smokers and 3195±448 for female smokers. The study showed that increased tobacco consumption increases birth weight loss with a statistically significant difference, p<0.001. [10]

In Isabell Rumrich *et al* study, in Finland 2021, a prospective study to investigate the effect of maternal smoking on body size and body proportions at birth, 24, 000 pregnant-newborns participated from medical birth records in Finland between 1991-2016, where an increased risk of LBW was observed in the newborns of female smokers (OR: 1.25/95%CI) and an increased SGA risk for height and weight (OR: 1.35), while head circumference was statistically less significant (OR: 1.1) and this is consistent with the results of our study and the OR for PI>90th / HLR>90th BBR<10th \ respectively (1.15-1.1-1.26). [11]

In a meta-analysis conducted by Elise Philips _et al_ in 2020, with the participation of 229, 000 live births in Europe and North America to investigate the relationship between changes in smoking during pregnancy and the risks of adverse pregnancy outcomes and weight gain in adolescence, this analysis concluded that maternal smoking in the first trimester of pregnancy was not associated with adverse birth outcomes compared to non-smokers, and this is inconsistent with the results of our study, while continued smoking was associated with a higher risk of SGA OR: 2.15 (95% CI 2.07-2.23). The analysis also showed that reducing the number of cigarettes consumed between the first and third trimesters of pregnancy without stopping, it was also associated with a higher risk of SGA (OR: 1.89), but lower than women who continued the same amount of cigarettes during pregnancy (OR: 2.20). Passive smoking was not associated with adverse birth outcomes according to this analysis. [12]

One of the most important findings in our study is that stopping smoking during the first trimester of pregnancy reduced the risk of adverse birth outcomes, and we noticed a decrease in the adjusted odds ratio values in smokers group [1] compared with smokers group [2]. Thus, it is not too late for pregnant smokers and they can stop smoking to reduce the risk of adverse birth outcomes.

We studied the husband's smoking among non-smokers [passive smoking] and among smokers [synergistic smoking] to show the effect in each group.

Our results showed that smoking during pregnancy affects all stages of fetal development, whether the stage of cellular hypertrophy and the accumulation of fats.

Conclusions.

- Smoking during pregnancy (at any period of pregnancy) increases the risk of babies being born with LBW, SGA, and abnormal anthropometric indices.

- The averages of newborn weight, body length and head circumference were greater in the group of non-smokers compared to the group of smokers with a statistically significant difference.

- Stopping smoking during the first trimester of pregnancy leads to a decrease in the risk of having children with LBW (the difference was statistically significant compared to the non-smokers group).

- There is a clear correlation between newborns exposed to smoking during the first trimester of pregnancy only, and a decrease in body size, but it is less dangerous than the group (2), and it may be interpreted because of the effect of maternal smoking on cell proliferation during organ formation in early prenatal development.

- Effects on anthropometric measurements (weight, body length, head circumference) were more pronounced when smoking continued until the end of pregnancy.

- The study showed that adverse birth outcomes related to the size of the newborn affected by a dose → response relationship, as increasing the dose of tobacco consumed per day increases the risk of adverse birth outcomes.

- There was no statistically significant difference for the type of smoking, P=0.5.
- Our study showed that the husband's smoking had a synergistic importance in the group of smokers until the end of pregnancy with a statistically significant difference P=0.03.

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