Experimental
&
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# The Effect of Maternal Smoking on the Height, Weight and Apgar Scores of the Newborn and on Placental Parameters

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**OBJECTIVE:** The aim of this study was to evaluate the effect of smoking on weight, length, 1. and 5. minute apgar scores of newborn and weight, surface area, number of cotyledon of placenta, and coiling index of umbilical cord.

**STUDY DESIGN:** This study was run in Etlik Zübeyde Hanım Maternity And Women's Health Academic and Research Hospital and Gülhane Military Medical Academy Department of Anatomy between January 2003 to January 2004 and perfomed on 258 freshly delivered human placentas. The collected placentas were examined macroscopically, after removing the excess blood, and membrane and the umbilical cord was cut at 1 cm from the placental disc. In order to see if maternal smoking influences newborn and placental parameters, patients were divided into two groups: habitual smokers (46 women) and non-smokers (212 women) and these groups were compared according to placental parameters and newborn APGAR scores,weight and length of newborn.

**RESULTS:** It is determined that placental surface area and Apgar score at 1minute were statistically different among the groups ($p<0.05$). Number of cotyledon, placental weight, coiling index of umblical cord, fetal length and weight and Apgar at 5 minutes were not different between smokers and non-smoker mothers.

**CONCLUSION:** Smoking seems to effect placental surface area and neonatal Apgar score at 1 minute. Large randomized prospective studies are needed to reveal exact relationship between maternal smoking and fetal placental parameters.

**Key Words:** Smoking, Apgar Score, Maternal-fetal exchange, Newborn

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## Introduction

The effects of smoking on human health are being studied with great interest in various fields. Since the number of woman who smoke is increasing, it is imperative to study the effect of smoking on female reproductive function, especially during the period of gestation and delivery. The cigarette consumption of mothers during pregnancy has been the subject of many studies of its effects on fetal growth. Because this substance can easily reach the fetus by placental transfer, it is of prime importance to study the effect of interaction of this substance on fetal-placental parameters. Since Simpson and Linda[1] showed that the incidence of low birth weight in smokers was twice that of non-smokers, a stream of publications about smoking during pregnancy began and become an important subject because of the increasing population of young female smokers.

Smoking has been associated with spontaneous pregnancy loss, placental abruption, PPROM, placenta previa, preterm labor and delivery and low birth weight. Impaired fetal oxygen delivery is the best studied cause of adverse fetal outcome in pregnant women who smoke. The pathophysiology of the mechanism is not well understood but possible mechanisms related to gas exchange, direct toxicity and sympathetic activation have been proposed.

The objective of this study was to evaluate the effect of smoking on weight, surface area, number of cotyledon of placenta, coiling index of umbilical cord, newborn weight, length and Apgar scores at 1 and 5 minutes after delivery.

## Material and Method:

Mothers and newborns were evaluated according to maternal (age, gestational age, height, weight) and neonatal (height,

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weight) parameters. The ages of mothers, weight of mothers (both pregestational and at term), height of mothers, their gestational ages, heights and weights of newborn, Apgar scores at 1 and 5 minutes after delivery were recorded.

In order to see if maternal smoking influences fetal placental parameters, patients were divided into two groups: habitual smokers (46 women) and non-smokers (212 women) and these groups were compared according to fetal-placental parameters.

From January 2003 to January 2004, singleton placentas were collected immediately after birth from 258 consecutive women at Etlik Zübeyde Hanım Maternity And Women's Health Academic and Research Hospital and transferred Gülhane Military Medical Academy Department of Anatomy within 10% formalin solution. The collected placentas were examined macroscopically, after removing the excess blood, and membrane and the umbilical cord was cut at 1 cm from the placental disc. Afterwards, placentas were fixed in 10% formalin during an average period of seven days. Number of cotyledon and placental weight, length and width were measured with Vernier caliber in the Anatomy Dissection Laboratory of Gulhane Military Medical Academy. Surface area of the placenta (SAP) was calculated by formula of ellipse area ([3.141592654* length of the placenta* width of the placenta]/4).

Umblical cords usually show twist, this coiling arises because the longer umbilical vein twists around the umbilical arteries. The coiling index of the umblical cord is defined as the number of coils completed per centimeter of the umblical cord length.

Statistical analysis were performed by using SPSS 10.0 (SPSSFW, SPSS Inc., Chicago, IL.,USA) statistical software. Descriptives of the parameters were given as the mean±SD notation. Independent-samples t test was used to compare two group parameters. Analysis of variance (One way ANOVA) test was used for the groups more than two. Kendall's tau-b or Spearman ranks correlation of coefficients were calculated. P values less than 0.05 were evaluated as statistically significant.

## Results

The median age of patients was 24,89±5,01 (range 16-42 years), height of mother was 160.65±11.43 cm, height of newborn was 50.56±3.03 cm, weight of newborn was 3208.44 ± 513.28 g, gestational age was 274.26±15.88 day, weight of mother (pregestational) was 58,01±9,76 kg, weight of mother (at term) was 70.38±9.73 kg. The length of umbilical cords was 42.13±9.08 cm (range 22-76 cm). Coiling index of the umbilical cord was 0.32±0.15 coils per centimeter in non-smokers' group and 0.36±0.15 coils per centimeter in smokers' group. Number of umbilical artery and vein was two and one in all cases. We found that diameter of umbilical artery 2.48±0.38 mm, diameter of umbilical vein 2.97±0.49 mm. Surface area of the singleton placenta was 194.7±41.61 $cm^2$. The number of cotyledon was 16±2.22.

It is determined that placental surface area and Apgar scores at 1 minute were different among the groups ($p<0.05$). Number of cotyledon, placental weight, fetal length and weight and Apgar scores at 5 minutes were not different, statistically, between smokers and non-smoker mothers (Table I).

## Discussion

Most studies have stressed that smoking had no effect on placental weight.[2-4] Although Newnham JP et al. found reduced placental weight in heavy smokers.[5] In our study the weight of placenta, in non-smokers and smokers was 494±38 g and 503±46 g, respectively. The difference between groups was not statistically significant. Increase in placental angiogenesis may be responsible for preservation of placental weight in smokers.[6]

*Table 1: Placental and fetal parameters of smokers and nonsmokers*

| Parameters | Smokers (n=46) | Nonsmokers (n=212) | p |
|---|---|---|---|
| | Mean+ Standard deviation | Mean+ Standard deviation | |
| Placental surface area | 1925 ± 974 $mm^2$ | 1202 ±302 $mm^2$ | 0.04* |
| Coiling index of the umbilical cord | 0.36 ± 0.15 coils/cm | 0.32 ± 0.15 coils/cm | 0.40 |
| Number of cotyledon | 15.28 ± 1.96 | 15.24± 2.23 | 0.49 |
| Placental weight | 494± 38 g | 503 ± 46 g | 0.55 |
| Fetal length | 50.78±3.13 cm | 50.50 ± 3.01 cm | 0.92 |
| Fetal weight | 3295± 520 g | 3189 ± 510 g | 0.90 |
| Apgar 1 minute | 7.05± 0.55 | 7.99 ± 0.73 | 0.03* |
| Apgar 5 minute | 9.91±0.28 | 9.89 ± 0.32 | 0.38 |

* *Statistically significant difference.*

Surface area of placenta was considered to be a predictor of fetal outcome and measured in limited studies. Larsen LG et al. reported that smoking during pregnancy diminishes placental surface area.[7] However, in our study placental surface area was found to be 1925 $mm^2$ in smoking group and 1202 $mm^2$ in nonsmoking group. The groups were significantly different ($p<0.05$). Since placental weight is stable and birthweight diminishes with cigarette consumption, an increase in the placental ratio results. Wingerd et al. suggested that smoking causes chronic fetal hypoxia, which results in a reduction of fetal growth, and that the relative placental hypertrophy is compensatory.[8]

Also we have found that the groups were different with regard to Apgar score at 1 minute, and this may be explained by reduced placental surface area where gas and nutrient exchange occur. On the other hand Apgar score at 5 minute was not significantly different between smokers and nonsmokers. There are some reports showing no difference with regard to Apgar score at 1 minute between smokers and nonsmokers.[3] Placental abruption and intrauterine fetal death associated with smoking.[9]

Decrease of birthweight and increase of perinatal mortality are the major consequences of maternal smoking during pregnancy.[10-11] Adverse effect of maternal smoking on fetal birthweight has been pointed out in most studies[12-16] but limited studies about no effect of moderate smoking on birthweight were found during the literature research.[3] In this study, birthweight was 3295 g in smokers and 3189g in nonsmokers. No difference was found between groups. Also the groups were not different with regard to fetal length.

Macroscopically, fetal surface of placenta is smooth, shiny and transparent. The umbilical cord is usually attached near the centre of the fetal surface. The maternal surface is finely granular and mapped into some 15-30 lobes by a series of fissures or grooves. The lobes are often somewhat loosely termed cotyledons.[17] We found that this value was 8-20 lobes. The numbers of cotyledons were not different between the groups.

The normal human umbilical cord measures approximately 55 cm at term. At term a cord shorter than 35 cm or longer than 85 cm is considered to be abnormal. Both short and long cords may be associated with intrauterine problems. A cord less than about 32 cm may increase the likelihood of placental abruption. Long cords may increase the probability of cord entanglement, prolapse and true knot development.[18] We found that the length of umbilical cord was 42,13±9,08 cm (range 22-76 cm).

The normal umbilical cord coiling was reported to be 0.19 to 0.44 coils per centimetre.[19-26] Abnormal cord coiling, i.e.UCI <10 th centile or > 90 th centile is associated with adverse pregnancy outcome.[19]

In conclusion smoking seems to effect placental surface area and neonatal Apgar score at 1 minute. Large randomized prospective studies are needed to reveal exact relationship between maternal smoking and newborn and placental parameters.

## Maternal Sigara Kullanımının Yenidoğanın Boyu Ağırlığı ve Apgar Skoru ile Plasental Parametreler Üzerindeki Etkisi

**AMAÇ:** Bu çalışmanın amacı sigara kullanımının yenidoğanın ağırlığı, boyu, birinci ve beşinci dakika apgar skorları; plasentanın ağrılığı, yüzey alanı, kotiledon sayısı ve umblikal kordun coiling indeksi üzerindeki etkisini belirlemekti.

**GEREÇ VE YÖNTEM:** Bu çalışma Ocak 2003-Ocak 2004 yılları arasında Etlik Zübeyde Hanım Kadın Hastalıkları Eğitim ve Araştırma Hastanesi ve Gülhane Askeri Tıp Akademisi Anatomi Anabilim Dalı'nda yürütüldü ve 258 taze doğmuş insan plasentası üzerinde çalışıldı. Plasentalar kan ve membranları ayrıldıktan sonra makroskopik incelendi. Umblikal kord plasental diskten 1cm uzaklıktan kesildi. Maternal sigara kullanımının yenidoğan ve plasental parametreler üzerinde etkisi olup olmadığını görmek için hastalar iki gruba ayrıldı: sigara bağımlıları (46 vaka) ve sigara kullanmayanlar (212 vaka) ve bu gruplar plasental parametreler ve yenidoğanın APGAR skorları, doğum ağırlıkları ve boyları açısından karşılaştırıldı.

**BULGULAR:** Bu çalışmada iki grup arasında plasental yüzey alanı ve 1. dakika Apgar skorları açısından istatistiksel olarak anlamlı fark olduğu görüldü ($p<0.05$). Kotiledon sayısı, plasenta ağırlığı, umblikal kord coiling indeksi, fetal ağırlık, fetal boy ve 5. dakika Apgar skoru açısından iki grup arasında istatistiksel olarak anlamlı fark yoktu.

**SONUÇ:** Sigara kullanımı, plasentanın yüzey alanını ve yenidoğanın 1. dakika Apgar skorunu etkiler. Maternal sigara kullanımı ile fetal plasental parametreler arasındaki ilişkinin daha doğru bir şekilde ortaya konabilmesi için daha geniş ve randomize çalışmalara ihtiyaç vardır.

**Anahtar Kelimeler:** Sigara kullanımı, Apgar skoru, Maternal-fetal değişim, Yenidoğan

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