

REVIEW ARTICLE

Effects of Occupational Tobacco Exposure on Mother and Foetus in Beedi Rollers

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ABSTRACT

Background and objectives: Beedi rolling is a popular household occupation amongst the economically poor female population of coastal Karnataka districts. This study aimed to identify the effects of occupational tobacco exposure on the beedi rolling pregnant mother and her neonate. The objectives were to study the maternal outcomes with respect to hypertension in pregnancy, anemia, abruptio-placenta, preterm labor and the neonatal outcomes such as low birth weight, low appearance, pulse grimace, activity, respiration (APGAR) and clinical assessment of nutrition status (CANS) score.

Methods: This prospective cohort study was conducted in a tertiary care hospital in Mangaluru from February 2014 to June 2015. A sample size of 500 was calculated with a 95% confidence level and 85% power. Cohort groups of 250 each were randomized as beedi rollers and non-beedi rollers based on the history of exposure and were prospectively followed till delivery.

Results: The study results showed overall complications of 37.6% among the beedi rollers which was clinically and statistically significant. Among the beedi rollers, 22.4% mothers had hypertension in pregnancy, of which 13.4% had gestational hypertension, 8.2% pre-eclampsia, 0.4% had eclampsia, 27.6% were anaemic, and 9.6% had fetal growth restriction. There was no increase in the incidence of preterm labor, abruptio-placenta. Our study also showed an increased risk of low birth weight (29.4%), but no significant difference in APGAR scores and CANS score among both groups. Based on the ROC curve we found, rolling 425 beedis can be taken as a safe limit during pregnancy with a sensitivity of 73.4% and specificity of 53.2% and 22 weeks period of gestation can be taken as safe limit up to which beedis can be rolled during pregnancy with a sensitivity of 61.7% and specificity of 64.1%.

Clinical significance: In this study, dreadful complications can be attributed to beedi rolling. Majority of it can be prevented by health education and simple preventive measures such as using masks and gloves while rolling beedis for which further studies are warranted.

Keywords: Beedi rolling, Foetal growth restriction, Hypertension in pregnancy, Low birth weight, Tobacco exposure

How to cite this article: Channegowda S, Rao B, Shetty P, Rao D. Effects of Occupational Tobacco Exposure on Mother and Foetus in Beedi Rollers. *J South Asian Feder Obst Gynae* 2018;10(3):209-214.

Source of support: Nil

Conflict of interest: None

Date of received: 07/12/2017

Date of acceptance: 08/13/2018

Date of publication: December 2018

BACKGROUND AND OBJECTIVES

Beedi is called as poor man's smoke, made merely from raw materials available naturally and does not require sophisticated processing or manufacturing. Beedis are made by rolling tobacco flakes in tendu leaves.¹ There is the absorption of nicotine through cutaneous and nasopharyngeal routes. Studies have proven excretion of cotinine, a metabolite of nicotine, in these workers who had no history of tobacco usage in any form.² The effects of cigarette smoking and persistent tobacco usage are considered hazardous during pregnancy whereas minimal information is available about the effects of occupational tobacco exposure.

Cigarette smoking in pregnancy is known to cause spontaneous abortion,³ placenta previa,⁴⁻⁶ placental abruption,⁷ preterm birth,^{8,9} stillbirth,^{10,11} fetal growth restriction,^{12,13} low birth weight,^{14,15} and sudden infant death syndrome,¹⁶ and many other complications. The key agent responsible for all these problems is nicotine. Beedi rollers are also exposed to approximately 250 to 450 gms of tobacco flakes containing nicotine every day.³ Majority of women choose beedi rolling as an occupation as a part-time or sole source of income. These women are unaware of the consequences of exposure to nicotine.

Since beedi rolling is one of the major household occupations among the reproductive age group in Dakshina Kannada district of coastal Karnataka. This study was conducted with an aim to study the effects of occupational tobacco exposure on mother and fetus in beedi rollers. The objectives were (i) to study the maternal outcome in beedi rollers in the form of hypertension in pregnancy, anemia,

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abruptio-placenta, preterm labor, fetal growth restriction; and (ii) to study the neonatal outcomes in beedi rollers by assessing birth weight, APGAR score and CANS score.

METHODS

This was a hospital-based cohort study, conducted among the pregnant women who visit the Outpatient Department of Govt. Lady Goschen hospital, a tertiary care center in Mangaluru, Karnataka, India between February 2014 and June 2015. A sample size of 500 was drawn with a 95% confidence level and 85% power. Ethical approval for this study was taken from Kasturba Medical College Institutional Ethical committee, Mangaluru on January 2014. The cohort groups were divided as exposed and unexposed, depending upon their exposure status to beedi rolling and the participants were equally randomized in both groups, i.e., 250 in each cohort group. History such as number, duration, time spent per day and period of gestation till when beedis were rolled was taken.

All pregnant women who were between 20 to 35 years of age with more than 28 weeks period of gestation and those who came for delivery to the same hospital were included in the study. Those pregnant women with gestational age less than 28 weeks, history of smoking, chronic medical disorders, diabetes were excluded from the study. Pregnant women were compared in terms of age, parity, and BMI and then included in the study. They were followed-up from 28 weeks period of gestation until delivery.

Complications like hypertension in pregnancy, anemia, abruption, fetal growth restriction and preterm labor, if any occurring in these participants were noted. After delivery details such as birth weight, APGAR score and CANS score was noted in these neonates.

Clinical assessment of nutrition status (CANS) score is a scoring system based on clinical evidence of malnutrition in neonates determined by inspection and examination of loss of subcutaneous tissue and muscle. This is a simple, quick and quantifiable examination to assess the nutritional status of children. It was originally developed by Rebeca Michels Hills. It was later developed by Mc lean and Usher. Jack Metcoff modified CANS and applied it on 1382 singleton babies.¹⁷ According to this, there are nine signs of nutritional status in newborn term infants. Each of the sign is rated from four (best/no evidence of malnutrition) to one (worse/definite evidence of malnutrition in utero). These nine signs are as shown in Figure 1¹⁸

- *Hair*: Large amount (4) Thinner, “staring” hair (3) Still thinner (2) flag sign (1)
- *Cheeks*: full buccal pads (4) to reduced buccal fat with narrow, flat face (1)

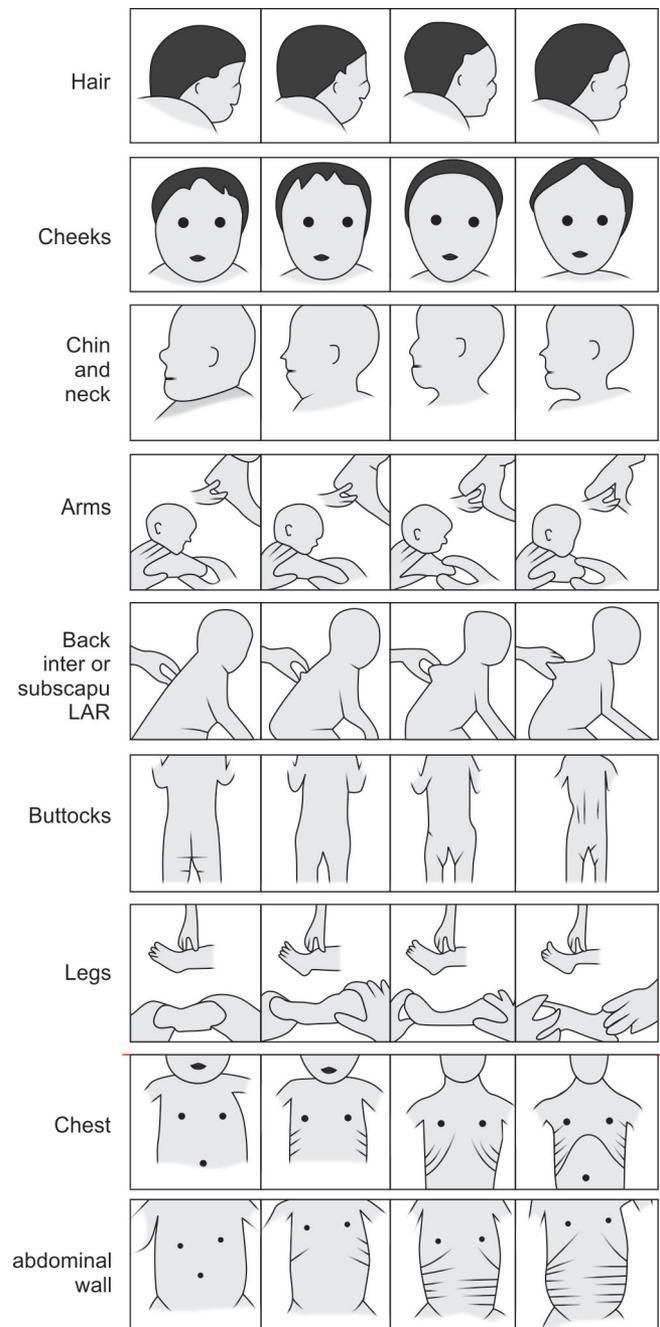
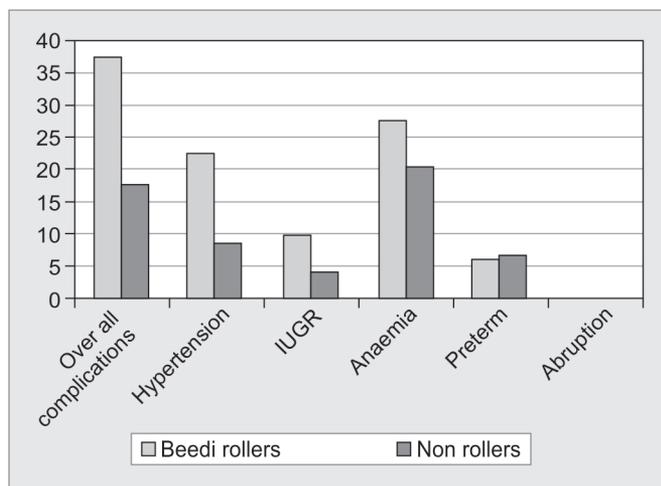
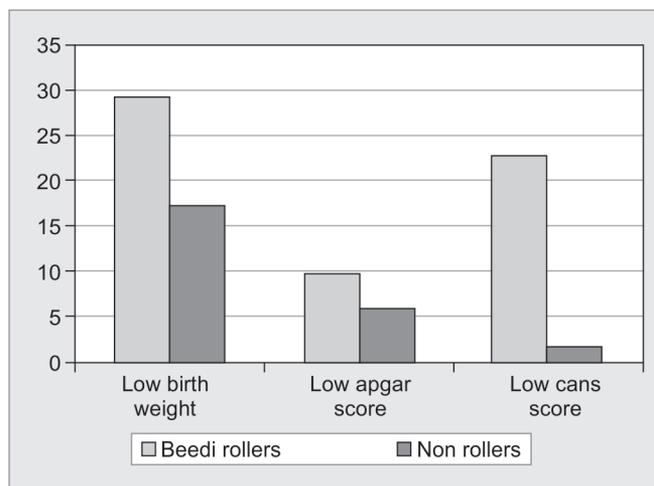


Fig. 1: Clinical assessment of nutrition status scoring.

- *Neck and chin*: Double or triple chin (4) to thin chin. Wrinkled skin (1)
 - *Arms*: Full, round (4) to a striking accordion folding of lower arm
 - *Legs*: Like arms
 - *Back*: Difficult to lift skin in interscapular area (4) to skin loose, easily lifted
 - *Buttocks*: Full round gluteal fat pads (4); to no evidence of gluteal fat (1).
 - *Chest*: Full round, ribs not seen (4) prominence of the ribs (1)
 - *Abdomen*: Full round, no loose skin (4) to scaphoid (1)
- Scores less than or equal to 24 are taken as clinical evidence of malnutrition, which is occurring in utero. In our



Graph 1: Comparison of maternal complications in both groups.



Graph 2: Comparison of neonatal complications in both groups.

study, neonates have been assessed 24 to 48 hours after birth, and clinical signs of malnutrition were noted. Statistical Package for Social Sciences (SPSS) version 15 was used for statistical analysis. The results were analyzed using the Chi-square test and the fisher extract test. A p-value of < 0.05 was considered as statistically significant. An ROC curve was plotted to establish safety limits in terms of the number of beedis and period of gestation up to which beedis can be safely rolled.¹⁸

RESULTS

A total of 500 pregnant mothers included in the study, were divided into two cohorts were comparable in terms of age, parity, and body mass index (BMI). The study showed an increase in overall complications among the beedi rollers (Graph 1). The complications such as hypertension in pregnancy, anemia, fetal growth restriction were significantly higher among beedi rollers compared

to non-beedi rollers (Graph 1). On the contrary, there was no statistically significant increase in complications such as preterm labor and abruptio-placenta as shown in Table 1. Our study also showed an increased risk of low birth weight (LBW) among beedi rollers (Graph 2). There was no difference in APGAR scores and CANS score among both groups as shown in Table 1 and Graph 2. Increased incidence of complications was associated with longer years, hours and number of beedis rolled per day which was statistically proven. By plotting an ROC curve based on number of beedies rolled, 425 beedis can be taken as cut off as a safe limit during pregnancy with a sensitivity of 73.4% and specificity of 53.2% and 22 weeks period of gestation can be taken as cut off as a safe limit during pregnancy with a sensitivity of 61.7% and specificity of 64.1% as shown in Tables 2 and 3 respectively.

Table 1: Comparison of maternal and neonatal complications, p-value and odds ratio

	Beedi rollers	Non rollers	p-value
<i>Maternal complications</i>	250	250	<i>Odds ratio</i>
Overall complications	94 (37.6%)	44 (17.6%)	0.000, OR=2.8
PIH	56 (22.4%)	21 (8.4%)	0.000, OR=3.14
Gestational hypertension	33 (13.2%)	16 (6.4%)	0.000
Pre-eclampsia	21 (8.2%)	5 (2%)	0.000
Eclampsia	2 (0.8%)	0 (0%)	0.000
Foetal growth restriction	24 (9.6%)	10 (4%)	0.01,OR=2.5
Anaemia	69 (27.6%)	51 (20.4%)	0.037, OR=1.4
Abruptio placenta	1 (0.4%)	2 (0.8%)	0.5, OR=0.4
Preterm labour	15 (6%)	16 (6.6%)	0.5, OR=0.9
<i>Neonatal complications</i>	<i>Beedi rollers</i>	<i>Non rollers</i>	<i>p-value</i>
			<i>Odds ratio</i>
Low birth weight	73 (29.2%)	43 (17.2%)	0.001, OR=1.9
Low APGAR score	24 (9.6%)	15 (6%)	0.133, OR=1.6
Low CANS score	57 (22.8%)	46 (18.4%)	0.224, OR=1.3

Table 2 : Number of beedis which can taken as cut-off

Positive if greater than or equal to (a)	Sensitivity	1-specificity
99.0000	1.000	1.000
150.0000	0.979	0.974
225.0000	0.968	0.942
275.0000	0.957	0.942
350.0000	0.894	0.833
425.0000	0.734	0.468
475.0000	0.734	0.462
525.0000	0.234	0.090
575.0000	0.223	0.090
650.0000	0.085	0.051

Table 3 : Weeks of pregnancy which can be taken as cutoff

Positive if greater than or equal to (a)	Sensitivity	1-specificity
-1.0000	1.000	1.000
4.0000	0.894	0.885
10.0000	0.872	0.859
14.0000	0.840	0.699
18.0000	0.830	0.699
22.0000	0.617	0.359
26.0000	0.564	0.314
30.0000	0.394	0.160
34.0000	0.266	0.109
37.0000	0.000	0.000

DISCUSSION

The is minimal information regarding the effects of beedi rolling or occupational exposure of tobacco in pregnancy. Our study has shown beedi rolling to be hazardous during pregnancy, producing similar effects as that of smoking. As there are not many studies done on beedi rollers we have compared some of our results such as fetal growth restriction, preterm labour, and abruption with studies on cigarette smoking in pregnancy. The available studies on anemia in beedi rollers and neonatal birth weight among beedi rollers were compared.

In our study higher incidence of fetal growth, the restriction was found in beedi rollers (9.6%) compared to non-beedi rollers (4%) with an odds ratio of 2.5. A study done by Fourn et al.¹⁹ showed 10.9% to have IUGR and odds ratio of 1.8. Anemia was significantly present in beedi rollers (27.6%) compared to non-beedi rollers (20.4%). Anil et al.²⁰ found anemia to be present in 47% of the study population which did not exclusively include pregnant women. Although statistically, significant anemia was present in both studies the difference in percentage could be due to iron and Folic acid supplementation in pregnancy, as the compared study was done on the general population.

There was no significant relationship between abruption and beedi rolling in our study. A study by Ananth et al.²¹ in 1996 was a cohort study done on 87,184 pregnant patients, and the incidence of abruption in smokers was 9.9 per 1000, which was statistically significant. A study by Kryklund-Blomberg et al.²² was a prospective study done on 311,977 patients found a significant association between cigarette smoking and a higher incidence of preterm labor, the odds ratio is 1.7. A meta-analysis by Shah et al.²³ reviewed 20 studies and an odds ratio of 1.27 was obtained. In our study, the statistically significant relation was not obtained with preterm labor or abruption which may be due to a smaller sample size or because of other toxic substances exposed by cigarette smoke.

Significant low birth weight was present among babies born to beedi rollers (29.2%) which is in accordance to Sardesai et al.²⁴ average decrease in birth weight among babies born to beedi rollers was by 310 gms.

The role of nicotine causing harmful effects in various organ systems was the basis for this study. Nicotine exposure causes vasoconstriction, platelet aggregation, endothelial damage which is also the possible etiology implicated in hypertension in pregnancy.²⁵ In our study hypertension was significantly present in beedi rollers. The protective effect of smoking on hypertension in pregnancy is due to carbon monoxide exposure by burning of paper, exposure to which is not present while rolling beedis.²⁶ Nicotine exposure also causes vasoconstriction, endothelial damage with basement membrane thickening causing uteroplacental insufficiency and foetal growth restriction.^{24,25} In our study as well fetal growth restriction was significantly present among beedi rollers.

Nicotine is a bone marrow suppressant, causes damage to DNA, inhibits marrow cell proliferation and impaired iron absorption, decrease in vitamin B12 and maternal red blood cell folate.²⁷ Our study found a significant association with mild anemia due to correction in earlier trimesters of pregnancy.

The contractile sensitivity of myometrium in response to oxytocin and the number of oxytocin receptors is increased in smokers.²⁸ In our study, there was no significant relationship between beedi rolling and preterm labor. This could probably be due to other components present in cigarette smoke.

Smoking causes vasoconstriction, endothelial damage and micro infarction causing hypoxia which can lead to abruption. In our study, there was no increased incidence of abruption among smokers. This might be because the dose of nicotine due to exposure was not sufficient to cause an abruption. Moreover, there is exposure to various other toxic metabolites in cigarette smoke which could cause abruption.

Effects of nicotine exposure through beedi rolling on fetus were assessed by birth weight, APGAR, and CAN's score. Low birth weight: Due to uteroplacental insufficiency, inadequate nutritional support, and anemia, low birth weight babies were more common in beedi rollers in our study. APGAR and CANS score were comparable in both the groups, probably suggesting no significant relationship with overall well being of newborn and nutritional status.

This study is one of its kind which exposes the harmful effects of nicotine through beedi rolling. These are modifiable risk factors which can be easily avoided to prevent dreadful complications in pregnancy.

Clinical Significance

This study is one of its kind which exposes the harmful effects of nicotine through beedi rolling. These are modifiable risk factors which can be easily avoided to prevent dreadful complications in pregnancy. Moreover health education regarding this and simple measures such as use of gloves and masks should be evaluated for prevention of such complications.

Limitations and Future Scope for the Study

Limitations of this study are: power of the study is 85% involving a smaller sample size, exposure to nicotine has not been quantitatively proven by cotinine assay, the workplace of participants was not evaluated, effects of using gloves, masks were not studied and complications of first and second trimester were not studied. We would like to propose further studies in this aspect on a larger scale.

CONCLUSION

The study was done to look for maternal and fetal complications in beedi rollers 250 beedi rollers were compared with 250 non-beedi rollers. A significant relationship with hypertension, fetal growth restriction, low birth weight was obtained. There was no significant relationship with abruption and preterm labor, APGAR or CANS score. Most of the women would not change their occupation as it is convenient for them because they are not bound by time and work can be done at home. Hence we would like to propose the use of masks and gloves while rolling beedis. For those inevitable to roll beedis, we would advise not to roll more than 425 beedis per day and stop beedi rolling after 22weeks period of gestation.

ACKNOWLEDGMENTS

In the arena of academic research, the success cannot be attributed to just one individual. There are many unseen hands silently making their contributions for the

success of the individual without waiting for the world to recognize their work. First and foremost, we want to express our deep sense of gratitude to our teacher Dr Rao. She encouraged us and gave the needed guidance. We are also grateful to all the members of the teaching and non-teaching faculty, Department of Obstetrics and Gynecology, KMC, Mangaluru. It is our bounden duty to thank Mrs Sucharitha Suresh, Statistician who helped us significantly to complete this work. We would not have in our duty, unless we express our gratitude to our family members, especially our parents and spouses. At this joyous moment, we must also be grateful to the almighty God the great sustainer and preserver of life, on this earth.

REFERENCES

1. Sundaramoorthy R, Srinivasan V, Gujar J, Sen A, Sekar N, Abilash VG . Clinical, cytogenetic and CYP1A1 exon-1 gene mutation analysis of Beedi workers in Vellore region, Tamil Nadu. *Asian Pac. J. Cancer Prev.* 2014;14(12):7555-7560.
2. Govekar RB, Bhisey RA. Elevated urinary thioether excretion among bidi rollers exposed occupationally to processed tobacco. *Int Arch Occup Environ Health.* 1992;64(2):101-104.
3. George L, Granath F, Johansson AL, Annaren G, Cnattingius S. Environmental tobacco smoke and risk of spontaneous abortion. *Epidemiology.* 2006;17(5):500-505.
4. Chelmow D, Andrew DE, Baker ER. Maternal cigarette smoking and placenta previa. *Obstet Gynecol.* 1996;87(5 Pt 1):703-706.
5. Faiz AS, Ananth CV. Etiology and risk factors for placenta previa: an overview and meta-analysis of observational studies. *J. Matern. Fetal. Neonatal. Med.* 2003;13(3):175-190.
6. Hung TH, Hsieh CC, Hsu JJ, Chiu TH, Lo LM, Hsieh TT. Risk factors for placenta previa in an Asian population. *Int J Gynaecol Obstet.* 2007;97(1):26-30.
7. Ananth CV, Demissie K, Hanley ML. Birth weight discordancy and adverse perinatal outcomes among twin gestations in the United States: the effect of placental abruption. *Am. J. Obstet. Gynecol.* 2003;188(4):954-960.
8. Fantuzzi G, Aggazzotti G, Righi E, Facchinetti F, Bertucci E, Kanitz S et al. Preterm delivery and exposure to active and passive smoking during pregnancy: a case-control study from Italy. *Paediatr Perinat Epidemiol.* 2007;21(3):194-200.
9. Kolås T, Nakling J, Salvesen KA. Smoking during pregnancy increases the risk of preterm births among parous women. *Acta Obstet Gynecol Scand.* 2000;79(8):644-648.
10. Högberg L, Cnattingius S. The influence of maternal smoking habits on the risk of subsequent stillbirth: is there a causal relation?. *BJOG.* 2007;114(6):699-704.
11. Wisborg K, Kesmodel U, Henriksen TB, Olsen SF, Secher NJ. Exposure to tobacco smoke in utero and the risk of stillbirth and death in the first year of life. *Am. J. Epidemiol.* 2001;154(4):322-327.
12. Hammoud AO, Bujold E, Sorokin Y, Schild C, Krapp M, Baumann P . Smoking in pregnancy revisited: findings from a large population-based study. *Am. J. Obstet. Gynecol.* 2005;192(6):1856-1862.

13. Nordentoft M, Lou HC, Hansen D, Nim J, Pryds O, Rubin P. Intrauterine growth retardation and premature delivery: the influence of maternal smoking and psychosocial factors. *Am J Public Health*. 1996;86(3):347-354.
14. Bernstein IM, Mongeon JA, Badger GJ, Solomon L, Heil SH, Higgins ST. Maternal smoking and its association with birth weight. *Obstet Gynecol*. 2005;106 (5, Part 1): 986-991.
15. Jaddoe VW, Troe EJ, Hofman A, Mackenbach JP, Moll HA, Steegers EA. Active and passive maternal smoking during pregnancy and the risks of low birthweight and preterm birth: the Generation R Study. *Paediatr Perinat Epidemiol*. 2008;22 (2):162-171.
16. Mitchell EA, Milerad J. Smoking and the sudden infant death syndrome. *Rev Environ Health*. 2006;21(2):81-103.
17. Mehta S, Tandon A, Dua T, Kumari S, Singh SK. Clinical assessment of nutritional status at birth. *Indian Pediatr*. 19 Hiralal Konar 99;35(5):423-428.
18. Metcalf J. Clinical assessment of nutritional status at birth: Fetal malnutrition and SGA are not synonymous. *Pediatr Clin North Am* 1994;41:875-891.
19. Fourn L, Ducic S, Seguin L. Smoking and intrauterine growth retardation in Republic of Benin. *J Epidemiol Community Health [Internet]*. 1999;53(7):432-433.
20. Anil M, Machado L, Sequeira A, Prasanna KS, Subramanya J. Study of morbidity pattern of female beedi workers in the urban field practice area of Mangalore, Southern India. 2012;(1):41-46.
21. Ananth CV, Savitz DA, Luther ER. Maternal cigarette smoking as a risk factor for placental abruption, placenta previa, and uterine bleeding in pregnancy. *Am. J. Epidemiol*. 1996;144 (9): 881-889.
22. Kyrklund-Blomberg NB, Cnattingius S. Preterm birth and maternal smoking: risks related to gestational age and onset of delivery. *Am. J. Obstet. Gynecol*. 1998;179(4):1051-1055.
23. Shah NR, Bracken MB. A systematic review and meta-analysis of prospective studies on the association between maternal cigarette smoking and preterm delivery. *Am. J. Obstet. Gynecol*. 2000;182(2):465-472.
24. Sardesai Suman P, Shinde namdeo S, Patil shailesh B, rayate muktha N, Muley Bharath M. Tobacco handling by pregnant bidi workers : As hazardous as smoking during pregnancy. 2007;57(4):335-338.
25. Rao VK, Morrison WA, O'Brien BM. Effect of nicotine on blood flow and patency of experimental microvascular anastomosis. *Ann Plast Surg*. 1983;11(3):206-209.
26. Karumanchi SA, Levine RJ. How does smoking reduce the risk of preeclampsia?. *Hypertension*. 2010;55(5):1100-1101.
27. Sreevidya Subramoney, prakash C gupta. Anemia in pregnant women who use smokeless tobacco. *Nicotine Tob Res* 2008;10(5):917-920.
28. Egawa M, Yasuda K, Nakajima T Okada H, Yoshimura T, Yuri T. Smoking enhances oxytocin-induced rhythmic myometrial contraction. *Biol. Reprod*. 2002;68 (6): 2274-2280.