

The effect of route of tobacco smoke exposure of breastfed and non-breastfed infants on urinary cotinine levels

Gonca Yılmaz MD, PhD
Ankara, Turkey

Tobacco smoke is the most common environmental pollutant causing a variety of health related hazards.

(Group A carcinogen)

'Healthy' Children With
Smoking Parents Aren't
Really So Healthy.



Turkey smoking profiles

- The rates of smokers is 44 %.
- 28 % of Turkish women between 15-49 years of age are smokers.
- 33 % of high school students smoke.
- 20 % of boys aged 8-12 years have tried tobacco at least once.

What are the passive smoking rates?



- 700 million children have been exposed to 1.2 billion adult smokers smoke (WHO).
- There is at least one smoking person in >50% of European Houses.
- Only 25 % of houses are smokeless in Turkey

Tobacco smoke is shown to have negative consequences on infant's health especially during the first year of life.



The aim of our study was

- To investigate tobacco smoke exposure of infants by measuring their urinary cotinine levels.

Methods

- A cross-sectional analysis on 254 six month-old infants.



- A questionnaire to mothers



- Objective tobacco smoke exposure determination

Questionnaire

- Demographics of family, birth weight
- # of cigarettes the mother smoked per day
- additional smokers living in the household
- # of cigarettes smoked in the house per day
- Nutrition history: Breastfeeding, formula

For objective determination of tobacco smoke exposure

- Urine samples, kept at -80°C until analysis.
- Gas chromatography method (GC-MS-MS) for urinary cotinine analysis
- Urinary creatinine concentrations were determined
- Urinary cotinine/creatinine ratio (ng/mg)

Patients, infants observed, were divided into 4 groups:

- 1. Patients free from any exposure
- 2. Those who were exposed to cigarette through breast feeding
- 3. Those exposed passively
- 4. Those exposed both passively and through breast feeding

Multivariate analysis of factors effecting urinary cotinine/creatinine level: independent variables

- Education and occupation of mother and father
- Number of babies in the family
- Income of the family
- Health status of mother
- Breastfeeding status of the infants
- Smoking status of mother, father and other family members
- Type of family
- Whether there is another child at home less than 5 years of age
- Sex of infant
- Birthweight of infant
- Start of formula feeding
- Total number of cigarettes smoked at home per day
- Birth season

■ **Table 1:** Demographic characteristics of mothers (n=254).

Age of mother 29 ± 4.0 (23-28) years

Education of mother

Illiterate	18 (7 %)
Primary	101 (40 %)
Secondary	78 (31 %)
High School	40 (16%)
University	17 (6%)

Occupation of mother

Housewife	74 (29%)
Worker	77 (30%)
Government official	63 (25%)
Trades people	24 (9%)
Employer	16 (7 %)

Total number of cigarettes smoked/day by mother

0	130 (51%)
One	4 (2 %)
Five	52 (20%)
Ten	41 (16 %)
Twenty	27 (11%)

Resume smoking after delivery for smoking mothers

One month	35 (28%)
2 months	56 (45%)
3 months	33 (27%)

Table 2: The comparisons of beginning of formula feeding, mean breast feeding durations and mean birth weights of infants of smoking and non-smoking mothers (Mean±SD)(n=254).

		Smoker		Statistics
		Yes	No	
Only brestfeeding	No (n=121)	41 (34)	80 (66)	Chi-square test, $\chi^2= 40.6$, $p< 0.001$
	Beginning of formula feeding			
	At birth (n=40)	16 (40)	24 (60)	
	2. month (n=12)	7 (58)	5 (42)	
	3. month (n=14)*	12 (86)	2 (14)	
	4. month (n=36)*	31 (86)	5 (14)	
5. month (n=31)*	17 (55)	14 (45)		
Mean breast feeding duration (month)		3.53±2.49	4.31±2.41	t=2.74, p=0.007
Birth weight (gr)		3356 ± 427.1	3560 ± 204.5	t= 4.88, p< 0.001

(Numbers in parenthesis are percentages)(* indicates the group making statistical significance)

Table 3: The comparison of mean cotinine/creatinine ratios (ng/mg) of tobacco smoke exposure groups (Mean±Standart deviation).

Tobacco smoke exposure groups	Cotinine/Creatinine ratio (ng/mg)
No (n=89)	1.14 ± 0.56
Breast feeding (n=15)	1461.1 ± 505.26
Passive (n=117)	108.93 ± 63.70
Breast feeding + passive (n=33)	602.66 ± 244.37
Variance Analysis	F=246, p<0.001

Table 4: Linear regression analysis of independent factors effecting urinary cotinine/creatinine ratio of infants.

	B	p	95% confidence interval	
Smoking status of mother	540.98	.000	354.4	727.5
Smoking status of father	2.368	.000	1.220	3.517
Smoking status of other family members	1.13	.001	0.185	2.066
Total number of cigarettes smoked at home	4.2	.003	1.5	6.9
Breast feeding	170.7	.002	5.7	284.2
Start of formula feeding (months)	-63.3	.000	-91.4	-35.2

(B value shows how many units the dependent variable changes when independent variable changes 1 unit.)

Table 5: The reliability of self reports by mothers related to household smoking compared to urinary cotinine levels of infants.

		Urinary cotinine/creatinine level		Total
		≥ 10	< 10	
Household smoke	Yes	156	11	167
	No	0	87	87
Total		156	98	254

Sensitivity= 100%

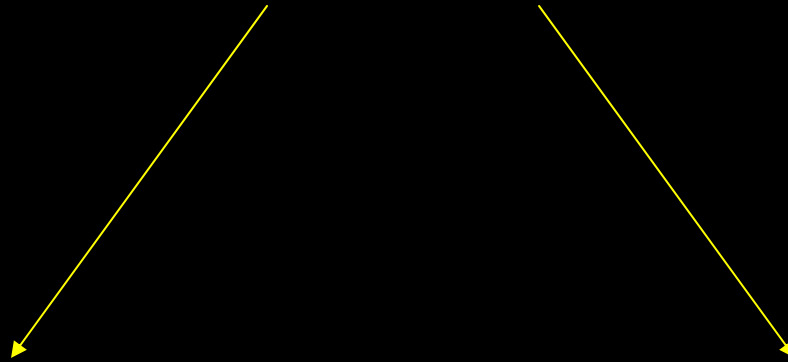
Specificity= 88.8%

Discussion

- There are approximately 250 million women regular smokers on earth (WHO).
- Only 3 % of that smoking women can succeed to cease smoking every year.



Early weaning in smoking mothers



■ Physiological problems

Prolactin ↓ → Letdown reflex ↓

Psychosocial problems

Less motivation

Society

Health care community

In our study, on coupled comparisons of groups the highest mean cotinine/creatinine level was found in the breast-milk-exposed group.

Major concern about the presence of nicotine in mother's milk is

- Whether gastrointestinal absorption of this toxin is hazardous to infants or not.



According to our multivariate analysis on urinary cotinine level

- Maternal smoking (x541) and breastfeeding (x171) appear to be the strongest determinants of urinary cotinine level.



High cotinine levels

- Intimate mother-child relationships
- Altered metabolism, immature hepatic and renal elimination
- Altered distribution volumes as compared to the adult

On the other hand; cotinine is

- Pharmacologically inactive, and it is unlikely that cotinine in breast milk has any adverse effects on infants' health.

As a conclusion

- Tobacco exposure via breast milk led to 13.4 times more cotinine exposure to the baby compared to passive exposure.
- Maternal smoking and breastfeeding appear to be the strongest determinants of urinary cotinine level.
- The possible harmful effects to the infant of gastrointestinally absorbed cotinine remains to be determined.

The effect of passive smoking and breast feeding on serum antioxidant vitamin (A, C, E) levels in infants

1 Gonca Yılmaz (gonca.yilmaz@tr.net)¹, Pınar Isik Agras¹, Samil Hizli¹, H Tanju Besler², Kadriye Yurdakok³, Turgay Coskun³

1.Department of Pediatrics, Keciören Training and Research Hospital, Ankara, Turkey

2.Department of Nutrition and Dietetics, Hacettepe University, Ankara, Turkey

3.Department of Pediatrics, Hacettepe University Faculty of Medicine, Ankara, Turkey

Keywords

Antioxidants, Breast feeding, Smoking

Correspondence

Gonca Yılmaz, M.D., Ph.D., Birlik Mah., 5. Cadde,

Zirvekent 1 Sitesi D Blok No: 46, 06650

Çankaya, Ankara, Turkey.

Tel: +90-312-4963322 |

Fax: +90-312-3569029 |

Email: gonca.yilmaz@tr.net

Received

17 July 2008; revised 28 August 2008;

accepted 18 September 2008.

DOI:10.1111/j.1651-2227.2008.01084.x

Abstract

Aim: Toxic substances in tobacco smoke are known to have negative effects on the antioxidant capacity of human body. In order to investigate the effect of passive smoking on serum antioxidant levels in infants, serum vitamin A, E, C levels and urinary cotinine/creatinine levels were measured in 254 infants at the age of 6 months.

Methods: The information about infants' nutrition and exposure to tobacco smoke was obtained from the mothers by the help of a questionnaire. The infants were grouped according to both smoking status of mother and urinary cotinine/creatinine levels.

Results: The mean serum vitamin A, C and E levels of infants of smoking mothers were significantly lower than those of non-smoking mothers ($p < 0.05$). Vitamin A, E and C levels were negatively correlated with urinary cotinine/creatinine levels ($p < 0.05$, $r: -0.61, -0.42, -0.53$, respectively). Multivariate analysis revealed independent factors determining the serum vitamin A, E and C levels of infants as maternal smoking and breast feeding ($p < 0.05$).

Conclusion: Tobacco smoke exposure of infants significantly decreases their serum antioxidant vitamin A, C and E levels. However, breast feeding may help to prevent the decrement of antioxidant vitamin levels of passive smoking infants.

Cotinine in infants' urine

- Nicotine inhaled by passive smoking
- Nicotine ingested with breast milk
- Maternal cotinine which is ingested with breast milk and excreted by the infant unchanged



In the future, the growing number of smoking bans in public places might cause parents to smoke more in their own homes,.

- Bert Arets, M.D., Ph.D