EFFECTS OF PASSIVE SMOKING AND DIFFERENT PATTERNS OF FEEDING ON PHYSICAL AND MENTAL HEALTH OF INFANTS

By

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ABSTRACT

Background: *Passive smoking and different types of feeding have an important and crucial effect on physical, mental, and over-all health and future productivity of infants.*

Aim of the Work: *To detect the impact of passive smoking and suboptimal infant feeding (partially breastfed or artificially fed) on the growth and health of infants.*

Patients and Methods: *This prospective study has been conducted at Al-Azhar Assiut University Hospital from 1st of May 2020 to 30th of November 2020 on 200 full-term infants, 150 of them exposed to passive smoking from a closed family member and all infant are free from any chronic disease. Preterm infants, infants aged more than 1 year, infants with major congenital anomalies and infants with chronic disease or receiving any chronic medication were excluded from our study. The 200 full-term infants included in this study were further subdivided into 4 groups: group (1) 50 infant fed by exclusive breast feeding and exposed to passive smoking, group (2) 50 infant fed by artificial feeding and exposed to passive smoking, group (3) 50 infant fed by complementary feeding and exposed to passive smoking and group (4) 50 infant fed by exclusive breast feeding and not exposed to passive smoking. Infant anthropometry was performed at first visit and months 1, 2, 4, and 6 after the first visit. Modeling and linear regression were used to calculate growth rates over 6 months. The association between environmental tobacco smoke (ETS) exposure with growth rate was assessed using multivariate linear regression adjusted for confounders, with ETS.*

Results: *It was found that the mean±SD for age of studied infants was 7.27±3.82 months with male predominance. The predominant effect on physical and mental health was pronounced and statistically significant in group (2) in which their anthropometric measurement (weight, length, head circumference and mid-arm circumference) and Bayley-IV scale (cognitive, language, motor, social-emotional and adaptive behavior) were significantly decreased. And the least affected group was group (4) in which the infants not exposed to environmental tobacco smoke and were on exclusive breast feeding. A categorical analysis using multi nominal logistic regression test taking into consideration Group (4) as reference group, Group (2),*

Group (3), Group (1) were respectively had a statistically significant lower weight, height, head circumference, and Weight gain rate adjusted for length gain rate (WLG) compared to this reference group, (P<0.05).

Conclusion: *The concordance of passive smoking with artificial feeding had dramatic bad effects on physical health of infants in form of marked decrease in their weight, length, head circumference, mid-arm circumference, and also mental health in form of decrease in Bayley scale reflecting impaired cognitive, language, social-emotional and adaptive behavior. Breast feeding in association with no exposure to passive smoking was found to be protective from hazardous effects of passive smoking.*

Recommendation: *We should encourage breast feeding and avoid exposure of infants to passive smoking during this critical period of life.*

Keywords: *Passive smoking, infant feeding, Physical health, mental health.*

INTRODUCTION

Tobacco smoke is toxic to humans. It contains about 3000 chemicals of which more than 200 are regarded as poisons and 50 as possible carcinogens, generally there is no safe level of exposure to tobacco smoke[(1)]. Passive smoking is defined as an involuntary exposure to environmental tobacco smoke (ETS)[(2)]. The disease burden correlated to environmental tobacco smoke exposure accounted for about 1% of worldwide mortality in 2004, with 28% of the affected population being children[(3)]. Most of the exposure to environmental tobacco smoke occurs in the home and the major source is paternal smoking[(4)]. Maternal smoking has a more significant impact on children's health than the smoking of other members of the family[(5)]. The associations between children's environmental tobacco smoke exposure and all-causes of medical service utilization have been controversial, while the positive associations were more consistently found in specific disease conditions such as asthma exacerbation and respiratory tract infections[(6)]. Children's exposure to environmental tobacco smoke is associated with a number of poor child health outcomes as increase incidence of asthma wheeze, bronchitis, cough, pneumonia, bronchiolitis, impaired pulmonary function and also associated with diarrheal diseases[(7)]. A study conducted by **Kanellopoulos[(24)]** stated that weight and HC were significantly smaller in neonates whose mothers smoked ≥ 15 cigarettes/day, but the difference disappeared by 3 years of life while they continued to lag behind in length growth until the age of 6 years.

Mother's breast milk is the best source of infant nutrition breast milk contains many bioactive agents that modify the function of the gastrointestinal tract and the immune system, as well as in brain development. Thus, breast milk is widely recognized as a biological fluid essential for optimal infant growth and development. **Savino et al.**, in their study suggested that breast milk decrease infant risk of late metabolic diseases, mostly protecting against obesity and type 2 diabetes[(8)]. The Academy of Nutrition and Dietetics confirms that exclusive breastfeeding provides ideal nutrition and health protection for the first six months of life, and that breastfeeding with complementary foods from six months until at least 12 months of age is the ideal feeding pattern for infants[(9)]. Protein fortified human milk is expected to improve postnatal growth and development, in part by providing essential amino acids and energy for tissue growth, and in part by interacting with endocrine systems, as the insulin-like growth factor I (IGF-1) system. IGF-1 is important for growth, body composition, and cognition of preterm infants[(10)]. Inadequate consumption of adequate amounts of proteins, especially during the first few weeks, can lead to compromised growth and organ development[(11)]. Introducing the first solid food is an important milestone in the infant's development. The World Health Organization (WHO) recommends exclusive breastfeeding during the first six months of life, followed by a gradual introduction of food in parallel with continued breastfeeding[(12)].

The child is a whole person - physically, emotionally, intellectually, socially, morally, culturally, and spiritually. Learning about child development involves studying patterns of growth and development. Developmental standards (norms) are sometimes called milestones- they define the recognized pattern of development that children are expected to follow. Every child develops in a unique way; however, using norms helps in understanding these general patterns of development while recognizing the wide variation between individuals. One way to recognize developmental disorders is if infants fail to meet the development milestones in time or at all[(13)]. Milestones are changes in specific physical and mental abilities (such as walking and understanding language) that mark the end of one developmental period and the beginning of another[(14)].

Cognitive development is mainly concerned with ways in which young children acquire, develop, and use internal mental capabilities such as problem solving, memory, and language. Newborn infants do not appear to experience fear or have preferences for contact with any specific people. In the first few months they only experience happiness, sadness, and anger. A baby's first smile usually occurs between 6 and 10 weeks. It is called a 'social smile' because it usually occurs during social interactions. By about 8–12 months, they go through a fairly rapid change and become fearful of apparent threats; they also begin to prefer familiar people and show anxiety and distress when separated from them or approached by strangers. Separation anxiety is a typical stage of development to an extent. Kicking, screaming, and throwing temper tantrums are perfectly typical symptoms for separation anxiety[15]. **Hernández-Martínez**[35] showed that infants prenatally exposed to cigarette smoke recorded poor cognitive development scores. Language development was most consistently affected, specifically those aspects related to auditory function (vocalizations, sound discrimination, word imitation, prelinguistic vocalizations, and word and sentence comprehension).

AIM OF THE WORK

The aim of this study is to detect the impact of passive smoking and suboptimal infant feeding (partially breastfed or artificially fed) on the growth and health of infants.

PATIENTS AND MATERIALS

This study has been conducted at Al-Azhar Assiut University Hospital from 1st of May 2020 to 30th of November 2020. on 200 full-term infants 150 of them exposed to passive smoking from a closed family member The 200 full-term infants included in this study were further subdivided into 4 groups: group (1) 50 infant fed by exclusive breast feeding and exposed to passive smoking, group (2) 50 infant fed by artificial feeding and exposed to passive smoking, group (3) 50 infant fed by complementary feeding and exposed to passive smoking and group (4) 50 infant fed by exclusive breast feeding and not exposed to passive smoking. Infant anthropometry was performed at first visit and at follow up visit (1, 2, 4, and 6) months after first visit. All infants' anthropometric measurements were plotted on Egyptian growth

chart for normal development in first 2 years of age. Modeling and linear regression were used to calculate growth rates over the 6 months. The association between environmental tobacco smoke (ETS) exposure with growth rate was assessed using multivariate linear regression adjusted for confounders, with environmental tobacco smoke ETS. As growth is linear during the first six postnatal months, infants with at least two measurements available within that period were included in analyses (36,37). Linear regression was performed to calculate the predicted values per child, giving the estimated length gain rate (reflecting lean mass accumulation), weight gain rate and HC increment per child. Weight gain rate was expressed as weight gain per day, while height gain rate and HC increment were expressed per month. Weight gain rate adjusted for length gain rate (WLG) was assessed (to reflect excess weight gain) for each infant by deriving Z-score internal in our study population and calculating the standardized residuals from the linear regression model with weight gain as the dependent variable and length gain as the independent variable (36,37). Level of education, maternal age, maternal BMI, and parity were a priori considered as possible confounders (38, 39, 40, 41).

Inclusion criteria: Full term infants (1 day to 1 year) exposed to direct smoking (tobacco or shisha) from a close family member at home and with healthy mothers free from any chronic diseases.

Exclusion criteria: Preterm infants, Age more than one year, Presence of major congenital anomalies, Babies with chronic diseases, receiving chronic medications or supplements and infants for a mother with chronic disease were excluded from this study.

Ethical consideration:

1. A written informed consent was obtained from patients or their legal guardians.
2. An approval by the local ethical committee was obtained before the study.
3. The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.
4. All the data of the patients and results of the study are confidential, and the patients have the right to keep it.
5. The authors received no financial support for the

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All Infants enrolled in this study were subjected to: A thorough history was taken including the following items: Personal history, history of present illness, Family history, history about other members specially smokers. Perinatal history, Nutritional history: type of feeding, number of feeds, signs of satisfaction. Developmental history: motor milestones using Egyptian growth charts and the following questions that can be used to elicit features suggestive of developmental delay: Are there any smokers in the family? When did you recognize that the baby can support his head? Time of crawling? Time of sitting with support. Time of sitting alone. Time of standing with support. Time of standing alone. Time of social smile? Time of mother recognition? Time of father recognition? Dose the baby can say (Baba or Mama)? Is there any history of chronic disease? What is the type of feeding? Vaccination history. History of any chronic disease, blood transfusion or surgical operations.

Full clinical examination:

General examination, Developmental assessment according to **Ongbanjo M[(42)]**.

Statistical Analysis:

Collected data were coded, analyzed, and computed using Statistical package for social sciences (SPSS) version 2016.

The collected data were revised, organized, tabulated, and statistically analyzed using statistical package for social sciences (SPSS) version 23.0 for windows. Data are presented as the Mean ± standard deviation (SD), frequency, and percentage. Categorical variables were compared using the chi-square ($\chi 2$) and Fisher's exact tests (if required).

- **Descriptive analysis of the results** in the form of percentage distribution for qualitative data (minimum, maximum, mean, and standard deviation) calculation for quantitative data.
- **Cross tabulation test:** For comparison between percentages values (Chi-squared).
- **Student t- test:** For comparison between means of two groups.

- **Binary logistic regression:** In order to identify independent prognostic factors, multiple regression analysis was performed with outcome (discharged, and died).
- Multivariate linear regression adjusted for confounders was used to assess the association between SHS-exposure and growth rate (weight, length, HC, and WLG) and also between ETS-exposure.
- WLG was assessed for each infant by deriving Z-score internal in our study population and calculating the standardized residuals from the linear regression model with weight gain as the dependent variable and length gain as the independent variable.

RESULTS

Table (1): Baseline demographic characteristics of infants and their family

Variable	Non exposed to ETS N=50	Exposed to ETS N=150	P-value
Age in months	7.59±3.18	7.58±3.36	0.98 NS
Sex n (%)			
Male	28 (56%)	83 (55.3%)	0.62 NS
Female	22 (44%)	67 (44.7%)	
Family			
Maternal age (years)	28.2±4.4	27±4.6	0.16 NS
Parity*	3.9±2.3	3.7±2.1	0.42 NS
BMI of the mother (kg/m^2)	26.3±4.9	27.2±5.1	0.062 NS
Educational level of mother n (%)			
University	22 (44%)	62 (41.3%)	0.38 NS
High school	23(46%)	69 (46%)	
Illiterate	5 (10%)	19 (12.7%)	
Number of household members smoking n (%)			
1 member	0	121(80.7%)	
2 members	0	13 (8.7%)	
3 members	0	14 (9.3%)	
4 or more members	0	2 (1.3%)	
Total cigarettes per day	0	14±12	

Numbers are expressed as Mean±SD frequency and percentage, *Numbers are expressed as median and IQR, NS: No statistically significant difference, P>0.05.

This table shows no statistical significance difference between exposed to ETS and non-exposed to ETS in demographic characteristics of infants and their family.

Table (2): Comparison of mean anthropometric measurements of different studied infant groups at 1st visit, Total N=200

Variable	Groups		Mean±SD	F-Value	P-Value
Age in months	**Exposed to ETS**	**Group (1)**	8.2±3.27	1.28	>0.05 NS
		Group (2)	8.08±3.22		
		Group (3)	7.89±3.32		
	Non exposed to ETS	**Group (4)**	7.98±3.1		
Weight in Kg	**Exposed to ETS**	**Group (1)**	8.1±1.2	14.8	<0.001 S
		Group (2)	6.55±1.07		
		Group (3)	7.74±1.33		
	Non exposed to ETS	**Group (4)**	8.98±1.2		
Length in cm	**Exposed to ETS**	**Group (1)**	65.02±6.86	9.74	<0.001 S
		Group (2)	59.9±6.49		
		Group (3)	62.3±5.75		
	Non exposed to ETS	**Group (4)**	66.12±5.55		
Head circumference in cm	**Exposed to ETS**	**Group (1)**	42.3±2.87	11.3	<0.001 S
		Group (2)	39.9±2.32		
		Group (3)	40.89±2.4		
	Non exposed to ETS	**Group (4)**	43.2±1.89		
Mid-arm circumference in cm	**Exposed to ETS**	**Group (1)**	10.84±0.63	8.1	<0.05 S
		Group (2)	10.6±0.46		
		Group (3)	10.77±0.5		
	Non exposed to ETS	**Group (4)**	11.33±0.67		

This table shows a comparison between studied groups (Exposed to ETS & Non exposed to ETS) in (Age, Weight, Length, Head circumference and Mid-arm circumference) as there were a statistical significant difference, $p<0.05$ for wt, length, Head circumference and Mid-arm circumference and no statistical significance for Age, $p>0.05$.

Table (3): Comparisons of Mean Bayley-IV scales of studied infants' groups, Total N=200

Bayley-IV	Groups		Mean±SD	F-Value	P-Value
Cognitive	**Exposed to ETS**	**Group (1)**	100.2±8.8	14.2	<0.001 S
		Group (2)	92.3±9.3		
		Group (3)	101.2±8.65		
	Non exposed to ETS	**Group (4)**	105.8±10.8		
Language	**Exposed to ETS**	**Group (1)**	90.3±8.25	16.3	<0.001 S
		Group (2)	86.5±8.5		
		Group (3)	88.2±7.84		
	Non exposed to ETS	**Group (4)**	96.2±9.5		
Motor	**Exposed to ETS**	**Group (1)**	93.6±10.4	13.5	<0.001 S
		Group (2)	91.1±12.2		
		Group (3)	91.3±8.6		
	Non exposed to ETS	**Group (4)**	102.7±10.3		
Social-emotional	**Exposed to ETS**	**Group (1)**	93.6±10.5	14.5	<0.001 S
		Group (2)	90.3±8.4		
		Group (3)	91±10.4		
	Non exposed to ETS	**Group (4)**	101.5±16		
Adaptive behavior	**Exposed to ETS**	**Group (1)**	80.3±9.3	15.6	<0.001 S
		Group (2)	73.2±8.65		
		Group (3)	78±7.4		
	Non exposed to ETS	**Group (4)**	90.2±14.2		

Data presented as Mean±SD, F test (Anova), S: Statistically significant difference, P≤0.05.

This table shows the relation between mean Bayley IV scales and cognitive development, communication, social or emotional development, and adaptive development of the studied infants. Among all domains of mean Bayley IV scales, Group (4) had a high statistically significant difference compared to other studied groups whereas Group (2) a lower means Bayley IV scales compared to other studied groups, P<0.001.

Table (4): Associations between exposure to ETS and growth rate markers

		Linear regression coefficients (95% confidence intervals)			
Categorical	**Model**	**Weight** (g/day)	**Length** (mm/months)	**HC** (mm/months)	**WLG (Z-score)**
Group (1)	Crude	-0.50 (-1.58, 0.57) [b]	-0.11 (-0.28, 0.06) [b]	-0.11 (-0.31, 0.08) [b]	-0.17 (-0.49, 0.17) [b]
	Adjusted[a]	-0.60 (-1.69, 0.49) [b]	-0.10 (-0.27, 0.06) [b]	-0.13 (-0.32, 0.07) [b]	-0.19 (-0.52, 0.14) [b]
Group (2)	Crude	0.14 (-1.39, 1.67) [b]	0.18 (-0.05, 0.43) [b]	-0.34 (-0.62, -0.07) [b]	0.07 (-0.39, 0.53) [b]
	Adjusted[a]	0.03 (-1.54, 1.60) [b]	0.18 (-0.06, 0.43) [b]	-0.32 (-0.60, -0.03) [b]	0.03 (-0.45, 0.50) [b]
Group (3)	Crude	0.14 (-1.39, 1.67) [b]	0.18 (-0.05, 0.43) [b]	-0.34 (-0.62, -0.07) [b]	0.07 (-0.39, 0.53) [b]
	Adjusted[a]	0.1 (-1.2, 1.4) [b]	0.08 (-0.2, 0.35) [b]	-0.22 (-0.42, -0.03) [b]	0.025 (-0.45,0.50) [b]
Group (4)	Reference	Reference	Reference	Reference	Reference

a Adjusted for confounders, b Statistically significant, P<0.05.

In the categorical analysis using multi nominal logistic regression test and z- score for (wt, length and H.C) at 1,2,4and 6 months from first visit taking into consideration Group (4) as reference group, Group (2), Group (3), Group (1) were respectively had a statistically significant lower weight, height, head circumference, and WLG compared to this reference group, P<0.05.

DISCUSSION

Exposure to environmental smoke at home, the workplace, or in public is a major public health concern. According to the World Health Organization, 41.7% of people at home and 50.6% outdoors are exposed to cigarette smoke. In addition, more than half of pregnant women are exposed to environmental cigarette smoke. Smoking poses a serious risk to the health of mothers and future generations. It also affects all stages of women's lives with regard to birth, fertility, middle-age and menopause, and endangers their quality of life[(16)].

Toxic compounds in cigarette smoke such as nicotine and cotinine (a metabolite of nicotine) cause vasoconstriction and

hypoxia generate neurotoxins that cause symptoms such as intrauterine growth retardation, low birth weight, spontaneous abortion, infant mortality, perinatal mortality, and preterm delivery. Increased cotinine in the blood of women exposed to cigarette smoke during lactation is followed by vasoconstriction and decreased blood flow in the breasts and the reduction of the levels of oxytocin, which in turn diminishes the production of milk. Because of the low volume of milk, the process of lactation changes and the duration of breastfeeding are shortened[(17)].

Breast milk is known as the best food source for infants, especially in the 1st year of life. The World Health Organization considers exclusive breastfeeding until 6 months as the most desirable and important food for the child. Breastfeeding provides substantial protection from diseases such as bacterial meningitis, otitis media, urinary tract infection, diabetes, and obesity cancers, and gastrointestinal problems in infants[(18)].

The result of our study shows that the mean age of the studied group was 7.27±3.82 months. More than half of them were males (55%) and 45% of them were females. As regard Comparison of mean age in months of studied children's groups; there was no statistically significant difference between them.

Our results were supported by study of **Yılmaz, et al.,[(20)]** as they reported that out of all infants enrolled in the study (n > 254), 130 (51%) were male and 124 (49%) were female.

However, in the study of **Bugova, et al.,[(21)]** among the 61 children in this study, 23 (37%) were exposed to SHS (second-hand smoke) (14 male, 9 females, mean age 5.5 ± 3 years, range 2-16).

Breastfeeding is recognized as the most appropriate way of providing ideal food to meet the nutritional needs of all children and promoting optimal growth and development. More than 200 substances are found in breast milk composition, among which the following stand out: water, carbohydrates, proteins, lipids, minerals and vitamins, as well as cellular immunological components (macrophages, lymphocytes, neutrophils, and epithelial cells) and soluble components (immunoglobulins A, G, M, D and E, complement system, interleukins 6, 8 and 10, cytokines, bifid factor, resistance factor, lactoferrin, antioxidants,

and hormones such as insulin, erythropoietin, bombesin, thyroxine, among others)[22].

Breastfeeding is beneficial to the child, to the mother, to the family, and also to society. As for the child, the following aspects stand out: reduction of infant mortality, especially from diarrhea and respiratory infections; reduction of allergic manifestations; improvement in neuropsychomotor development; reduction of the incidence of chronic diseases, such as arterial hypertension, diabetes mellitus, Crohn disease, ulcerative colitis, celiac disease, autoimmune diseases, and lymphoma; protective action against dental problems such as dental occlusion, mouth breather syndrome, and speech articulation disorders[23].

Although being aware of the many benefits of breastfeeding, experts are concerned about maternal smoking when it comes to the children, since they may be exposed both to cigarette smoke (second-hand smoker) and to nicotine transferred via breast milk. The consequences of passive exposure to smoke for children are well defined in the literature: worsening and development of allergic diseases, such as rhinitis and asthma, onset of chronic respiratory illnesses, increased duration and frequency of upper and lower airway infections, and greater frequency of hospitalizations[16].

The present study showed that as regard comparison of mean weight in kg of studied children's groups; there was statistically significant difference between them.

Our results were supported by study of **Kanellopoulos, et al.,**[24] as they reported that Infants from mothers who smoked 15 or more cigarettes per day during pregnancy had lower weight and smaller head circumference at birth and continued to be smaller until the age of 2 years compared to children of non-smoking mothers.

Also, **Leonardi-Bee, et al.,**[25] revealed that consistent reduction of 31–79 grams in BW for children who born to passive smoked mother than non-smoked.

According to **Shenassa, et al.,**[26] overall, maternal smoking was associated with change in weight-for-length z-score in a dose-response manner. Change in weight z-score was most pronounced among SGA (small-for-gestational-age) infants of heavy smokers (breastfed: 0.53; 95% confidence interval [CI], 0.12-0.94; formula fed: 0.17; 95%

CI, 0.03-0.30). Exposure to tobacco metabolites specifically through breastfeeding was not associated with additional weight gain among AGA (average-for-gestational-age) infants. Among the much smaller sample of SGA infants, exposure specifically through breastfeeding was associated with marginally significant additional weight gain (0.46; 95% CI, 0.00-0.91) among infants of heavy smokers.

However, in the study of **Soesanti, et al.,**[19] there were no interaction found between SHS exposure and Z-score of BW on weight gain rate (interaction term coefficient (β) of 0.31 and 0.44, p> 0.05, respectively) or WLG (β of 0.06 and 0.11, p>0.05, respectively). There was also no interaction found between number of cigarettes consumed by household and BW on weight gain rate and WLG rate (interaction term coefficient of -0.07 and -0.23, p> 0.05, respectively). Furthermore, there was no modification effect of breastfeeding status on weight gain rate, height gain rate, HC increment and WLG rate (all product term p-values were > 0.05). The difference may be attributed to different inclusion criteria between their study and ours.

As for increase in body weight after maternal nicotine exposure, the authors state that maternal smoking during lactation is a risk factor for obesity, because it contributes to the possibility of developing hypothyroidism[27].

The current study showed that as regard comparison of mean length in cm of studied children's groups; there was statistically significant difference between them.

Our results were in line with study of **Yılmaz, et al.,**[20] as they reported that there was statistically significant difference between smoked and non-smoked mothers as regard breastfed infant length.

However, in the study of **Soesanti, et al.,**[19] gain rates of weight, length, and WLG (Weight gain rate adjusted for length gain rate) were increased with higher number of antenatal cigarettes exposure, but none of these relations were statistically significant.

In the study in our hands, as regard comparison of mean head circumference in cm and mid-arm circumference in cm of studied children's groups; there was statistically significant difference between them.

Our results were in agreement with study of **Yılmaz, et al.,**[20] as

they revealed that the mean birthweight, 6-month weight and head circumference of infants of smoking mothers were statistically significantly lower when compared to those of non-smoking mothers ($P < 0.001$).

Head circumference is known as an indicator of abnormal brain condition or neurodevelopmental delay in intelligence and cognitive function[28].

A study conducted by **Kanellopoulos, et al.,**[24] stated that weight and HC were significantly smaller in neonates whose mothers smoked ≥ 15 cigarettes/day, but the difference disappeared by 3 years of life while they continued to lag behind in length growth until the age of 6 years.

Another study showed that at 6 months of age, infants who were born to mothers who smoked during pregnancy had lower weight and HC compared to those of non-smoking mothers[28].

Exposure to SHS in non-smoking pregnant women was reported to be associated with 0.24 cm reduction in HC of the newborn compared to NE group. Active smoking of mothers antenatal was reported to be related to a 0.13 mm/week reduction of fetal HC increment compare to non-smoking mothers and this diminished HC appeared to persist throughout early childhood[29].

This result may be in line with the findings of **Soesanti, et al.,** [19] study, showing that HC of the infant grows slower postnatally when non-smoking mothers were heavily exposed to SHS (≥ 23 cigarettes per day). They believe that their findings are consistent with the proposition that heavy exposure to SHS during pregnancy may well have a similar order of magnitude of effect as with active maternal smoking in pregnancy.

Soesanti, et al.,[19] main finding that SHS exposure in pregnancy slows HC growth in early infancy, and possibly in utero, may reflect hampered brain development. However, mechanisms underlying cigarette smoke toxin, especially nicotine effects on human brain development are incompletely understood. Animal studies showed that nicotine directly influences fetal brain development, even in concentrations that do not cause growth retardation.

Prenatal exposure to nicotine causes altered cell proliferation and differentiation which results in cell damage, cell loss and synaptic

dysfunction. In humans, higher rates of behavioral problems were found in mothers who smoked during pregnancy[30].

The consequences of subnormal HC are well-known in (very) low BW children; this indicator of brain volume is negatively associated with cognitive function and neuropsychological abilities at early school age[31].

It is well known that SHS exposure brings about almost the same adverse health outcomes as active smoking. Smoking during pregnancy is a well-known risk factor for adverse birth outcomes such as spontaneous abortion, low birth weight, and preterm birth that, in turn might affect children's development. Tobacco smoke contains over 7000 chemicals including nicotine, polycyclic aromatic hydrocarbons (PAHs), aromatic amines, and carbon monoxide. Placental passage of these environmental toxicants might affect prenatal nervous system development. Although effects of prenatal exposure to SHS on early neurodevelopment vary among studies, they remain significant issues. Lower development scores in cognition, language, and fine motor sales, gross motor scores, and MDI scores have been reported in children with prenatal SHS exposure. Therefore, SHS exposure should be considered a modifiable risk factor for delayed neurodevelopment and cognitive impairment in children. As cotinine is a predominant metabolite of nicotine, it is considered a biomarker of exposure to SHS[32].

The present study showed that as regard hemoglobin level; there was statistically significant difference between them. As regard Comparisons of Mean Bayley- IV scales of studied children's groups; there was statistically significant difference between them regarding cognitive, language, motor, Social-emotional& Adaptive behavior.

Our results were supported by study of **Lee, et al.,**[33] as they explored the association between maternal SHS exposure during early pregnancy and infant neurodevelopment at 24 months of age. They also examined the effect of genetic polymorphism and exclusive breastfeeding on such association. A significant association was found in children whose mothers had higher (greater than median) levels of cotinine. Cognitive development of 24 months old infants decreased significantly with increasing maternal cotinine level. An association between PDI (psychomotor developmental

index) of 24 months old infants and maternal SHS exposure early in the pregnancy was not evident.

Previous studies have investigated the impact of prenatal maternal SHS exposure on infants' neurodevelopment. Secondhand smoke exposure during pregnancy could be measured by parental self-reports or biomarkers such as cotinine in cord blood and cotinine in maternal urine during pregnancy. Based on self-reported prenatal exposure to SHS, previous studies have shown a negative impact of such exposure on cognitive development of infants aged 6–36 months[33].

Such negative association has also been observed by using cord blood cotinine level and cotinine level in saliva during pregnancy[34].

They showed a consistent result using urinary cotinine as a biomarker of SHS exposure. Another study has shown that maternal exposure to SHS during pregnancy measured through urine cotinine is associated with a decrease in gross motor function among children 18 months old. However, no association was found for the impact of SHS exposure on cognitive function[32].

Also, **Hernández-Martínez, et al.,**[35] showed that infants prenatally exposed to cigarette smoke recorded poor cognitive development scores. Language development was most consistently affected, specifically those aspects related to auditory function (vocalizations, sound discrimination, word imitation, prelinguistic vocalizations, and word and sentence comprehension).

CONCLUSION

From this study we conclude that the concordance of passive smoking with artificial feeding had dramatic bad effects on physical health of infants in form of marked decrease in their weight, length, head circumference, mid-arm circumference, and also mental health in form of decrease in Bayley scale reflecting impaired cognitive, language, social-emotional and adaptive behavior. Breast feeding in association with no exposure to passive smoking was found to be protective from hazardous effects of passive smoking.

RECOMMENDATION

We should encourage breast feeding and avoid exposure of infants to passive smoking during this critical period of life.

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تأثيرات التدخين السلبى والأنواع المختلفة من التغذية على الصحة الجسدية والذهنية للرضع

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التدخين السلبي هو استنشاق الدخان، أو دخان التبغ البيئي، من قبل أشخاص غير المدخن النشط. يحدث ذلك عندما يدخل دخان التبغ في بيئة ما، مما يؤدي إلى استنشاقه من قبل الناس داخل تلك البيئة. التعرض لدخان التبغ البيئي يسبب المرض والعجز والوفاة. هناك العديد من المخاطر الصحية للتدخين السلبي. كانت هذه المخاطر دافعًا رئيسيًا لقوانين حظر التدخين في أماكن العمل والأماكن العامة المغلقة، بما في ذلك المطاعم والنوادي، و كذلك بعض الأماكن العامة المفتوحة. تدخين التبغ مسؤول عن أكثر من 5 ملايين حالة وفاة سنويًا في جميع أنحاء العالم.

يعد التعرض للتدخين السلبي مشكلة صحية عامة رئيسية في جميع أنحاء العالم وخطر حقيقي على صحة الطفل. يحتوي التبغ على أكثر من 3000 مادة كيميائية، منها أكثر من 200 مادة تعتبر سموم و 50 مادة مسرطنة محتملة، ومن المقبول عمومًا أنه لا يوجد مستوى آمن للتعرض لدخان السجائر. تحدث غالبية دخان التبغ البيئي داخل المنزل بشكل رئيسي من تدخين الوالدين. ثبت أن تدخين الأمهات هو الأكثر ضررًا.

يرتبط تعرض الأطفال للتدخين السلبي بعدد من النتائج الصحية السيئة للطفل مثل زيادة الإصابة بأمراض الأذن الوسطى، والصمم الموصل، وأزيز

الربو، والسعال، والتهاب الشعب الهوائية، والتهاب القصيبات، والالتهاب الرئوي، وضعف وظائف الرئة. وقد ارتبط أيضًا بالشخير والتضخم الغداني والتهاب اللوزتين والتهاب الحلق وموت الرضع المفاجئ.

ترتبط الرضاعة الطبيعية بالوقاية من التهابات الجهاز التنفسي الحادة وأمراض الإسهال، بالإضافة إلى تعزيز النمو الفكري والمناعي. ثبت أن التغذية الصناعية ترتبط بارتفاع معدلات الإصابة بالأمراض المعدية وغير المعدية وسوء التغذية. لا يزال هناك قلق من أن الرضاعة الطبيعية يمكن أن تزيد من التعرض للتدخين السلبي عن طريق المرور عبر لبن الثدي والاستنشاق.

أفادت دراسات مختلفة عن آثار التعرض لدخان السجائر على نمو الرضع. أظهرت دراسات مختلفة زيادة الوزن بعد الولادة، وانخفاض النمو وعدم تغير النمو بعد التعرض. ركزت الدراسات السابقة بشكل رئيسي على آثار تدخين الأم على نمو الرضع. بالإضافة إلى ذلك، تم إجراء التقييم عن طريق الاستبيانات ولم يتم قياس التعرض من خلال المؤشرات الحيوية.

كان الهدف الرئيسي من هذه الدراسة هو الكشف عن تأثير التدخين السلبي والتغذية دون المستوى الأمثل للرضع (الرضاعة الطبيعية أو الرضاعة الصناعية) على نمو الرضع وصحتهم.

أجريت هذه الدراسة في مستشفى الأزهر الجامعي بأسيوط خلال الفترة من 1 مايو 2020 إلى 30 نوفمبر 2020. وشملت الدراسة 200 رضيع (150) رضيع تعرضوا للتدخين السلبي مقسمة إلى (3) مجموعات حسب طرق التغذية التالية: المجموعة الأولى (50) رضعوا رضاعة طبيعية حصرية من الولادة وحتى سن التقديم، المجموعة الثانية (50) رضاعة جزئية والمجموعة الثالثة (50) كانت على حليب الرضع أو حليب الحيوان، و (50)

رضيعاً غير معرضين للتدخين والرضاعة الطبيعية فقط. وقد تم قياس المقاييس الانثروبوميترية لكل الرضع ومتابعة الزياده او النقص في المقاييس الانثروبوميترية بعد 1و2و4و6 شهر وقد كشفت النتائج الرئيسية للدراسة ما يلي: فيما يتعلق بمقارنة متوسط الوزن بالكيلوغرام لمجموعات الأطفال محل الدراسه؛ كان هناك فرق ذو دلالة إحصائية بينهما. فيما يتعلق بمقارنة متوسط محيط الرأس بالسنتيمترلمجموعات الأطفال محل الدراسه؛ كان هناك فرق ذو دلالة إحصائية بينهما. فيما يتعلق بمقارنات متوسط- مقاييس بياليي لمجموعات الأطفال محل الدراسه؛ توجد فروق ذات دلالة إحصائية بينهما فيما يتعلق بالسلوك المعرفي واللغة والحركي والسلوك الاجتماعي والعاطفي والتكيفي. ومن الدراسة نستنتج ان التدخين السلبي خطر علي الرضع ويجب حمايتهم من مخاطرة وتشجيع الامهات علي الرضاعه الطبيعية لما لها من فوائد كثيره علي الصحه الجسديه والذهنية للرضع.