ABSTRACT:

Breastfeeding barriers in substance using mothers is an important issue to be addressed as the benefits offered by breastfeeding might be counteracted by the infant and maternal health consequences of drug exposure. A literature review is conducted in this regard, to focus on the new advancements in the literature, and to get proof and evidence to support the topic of review.

Smoking, alcohol, heroin, cocaine and cannabis/marijuana were the drugs of abuse and were searched in relation to breastfeeding. Seventeen studies were selected out of hundred after extensive literature search.

A negative association was concluded in smoking, alcohol use and breastfeeding initiation, duration and exclusivity of breastfeeding. There was a gap found in the literature about other substances of use, and no study could properly or completely define barriers to breastfeeding.
BREASTFEEDING BARRIERS IN MOTHERS WHO USE SUBSTANCES

by

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Chapter 1

1.1 OBJECTIVE

Answers to the following questions were sought: What is the rate, duration and exclusivity of breastfeeding in women using substances? What are the breastfeeding barriers in women who use substances? What circumstances force a substance using woman to quit breast feeding, and start formula? Is it acceptable to initiate breastfeeding in a substance using mother? Is there any safe amount of substance use which could be continued without any harm to the child? This last question appears controversial.

1.2 INTRODUCTION:

Breastfeeding is the gold standard for infant nutrition. Pregnant mothers that use substances, which include smoking, alcohol (both legal), cocaine, marijuana and heroin (last three illegal), should keep in mind their known hazards on the fetus, due to their transmission through breastmilk. The term substance abuse refers to an unhealthy pattern of substance (alcohol or drug) use that results in significant problems in one of the following ways: an inability to adequately take care of one’s responsibilities or fill their role, the frequent use of substances in situations where it might be dangerous to do so (for example, driving while under the influence or during pregnancy), repeated legal problems due to substance use, and the continued use of substances even though the substance use is causing considerable problems in the life.
Certain substances like alcohol whilst using during normal social life is never considered substance abuse, but during pregnancy and breastfeeding the situation is quite different. Caution is necessary when smoking, drinking or using illicit drugs after delivery as it can convey to the baby via breastmilk. Therefore, for the purposes of this research, we define substance use during breastfeeding as the intake of any amount of substances, including tobacco, alcohol, and illicit drugs, or continuum of the habit of taking these substance during breastfeeding.

Mothers are advised to stop using and abusing substances during pregnancy and some of them follow their clinician’s advice, but then it is common for them to relapse during the postpartum period. To understand the consequences of these legal and illegal substances on the breastfeeding practices and the infants themselves, we reviewed relevant literature published between the years 2001-2011.

The first chapter in this paper captures objectives and introduction. The second chapter is about the significance of breastfeeding; global and domestic historic trends and barriers to breastfeeding were reviewed with non-anecdotal references. A conceptual model on potential obstacles or support to breastfeeding was also reviewed (fig-1). The third chapter is about women abusing substances like tobacco, alcohol, cocaine, cannabis and heroin. The effects and impact of these legal, and illegal, substances on breastfeeding practices and on infants were evaluated in this chapter. A hypothetical, conceptual model was also discussed to analyze the barriers to breastfeeding in substance using women. (fig-2)
The fourth, and last, chapter consists of a literature review of chosen articles from 2000 to 2011 in relation to breastfeeding in women using substances. In this final chapter, seventeen selected studies were reviewed critically to understand the modern trend about breastfeeding in women using substances. This review was also to judge the amount of work done in the last decade on this topic, tried to identify the barriers to breastfeeding in mothers using substances, and to understand the ways to overcome the problems and issues for better intervention. The gaps and limitations were identified in the literature to guide new studies.
Chapter 2

2.1 SIGNIFICANCE OF BREASTFEEDING

Breastfeeding should be protected, promoted and supported globally in all communities, as it is best for an infant’s health. Breastfeeding is an interactive process between maternal biology and infant instinct. Breastmilk naturally contains appropriate amounts of carbohydrates, proteins, fats, minerals, vitamins, and hormones as well as maternal antibodies. Among the most important benefits to the infant is the safest and best method for nurturing and optimizing infant development, growth and health. Women who breastfeed their infants experience several health benefits, including concurrent fertility reduction, lower risks of breast cancer, and probable protection against osteoporosis and late onset obesity. There is an important public health question about the costs related to infant feeding. It is estimated that if full (exclusive) breastfeeding were practiced for 12 weeks in the United States, 2.16 billion dollars would be saved annually (using illness as a sole indicator of cost).

2.2 HISTORY AND GLOBAL TRENDS OF BREASTFEEDING

For millennia, infants were normally breastfed and the breastfeeding mother was idealized as a source of strength, power and family. Indeed, although archaeologists have found infant feeding vessels in grave sites dating back to 4000 BC, babies born before the 19th century who were denied breastmilk were unlikely to survive. Moreover,
early medical writers told mothers that artificial feeding led to children being “stupid, vacant and not right in the head.”  

During the 18th century, if a woman chose not to breastfeed or she could not, the most likely situation was to have the baby fed by another lactating woman called wet nurse. In 1870; a German chemist called Liebig devised a substitute for breastmilk. By the early 20th century, manufacturers had begun to advertise such product as an option for all newborns. The International Code of Marketing of Breastmilk Substitutes (1981) has been in place for about two decades, and simultaneously, much effort to protect breastfeeding from commercial influences has followed.

In 1990, the United States signed onto the Innocenti Declaration on the Protection, Promotion and Support of Breastfeeding, which was adopted by the World Health Organization (WHO) and the United Nations Children’s Fund (UNICEF). This declaration called upon all governments to nationally coordinate breastfeeding activities, ensure optimal practices in support of breastfeeding through maternity services, take action on the International Code of Marketing of Breast-milk Substitutes (the Code), and pass legislation to protect and preserve breastfeeding among working women. In 1991, UNICEF and WHO jointly launched the Baby Friendly Hospital Initiative, by putting into practice the "10 steps to successful breastfeeding". Many maternity facilities throughout the world are now striving to achieve "Baby Friendly" status. One requirement for being "Baby Friendly" is that a facility shall not accept or distribute free samples of infant formula.
2.3 RECOMMENDATIONS

The WHO recommends exclusive breastfeeding for six months for all infants, with continued breastfeeding until two years of age together with complementary foods.\textsuperscript{16} UNICEF also recommends exclusive breast feeding for about 6 months.\textsuperscript{17} The position of the American Academy of Pediatrics is unclear; in two different sections of their Pediatric Nutrition Handbook, they alternatively recommend human milk “as the exclusive nutrient source ... during the first 6 months,” and “to delay introduction of solid foods until 4 to 6 months.”\textsuperscript{18} The recommended rate, duration and exclusivity of the breastfeeding should be adopted and made to benefit all; however, the risk associated with women who use substances and breastfeed needs to be carefully considered. It is possible that there may be certain substances for which there is no harm done to the infant via breastfeeding; however, these pathways need to be better understood before reaching a conclusion and implementing any policy.

2.4 PREVALENCE OF BREASTFEEDING

The global data from UNICEF (2003 to 2008),\textsuperscript{19} show that the exclusive, global breastfeeding rate was almost 37\% in the first few months (<6 months) of age, and this rate was actually the same as shown for developing countries.

In Sub-Saharan Africa, it was 32\%, and in Asia and Latin America it was 41\%.\textsuperscript{20} The Rates of Healthy People MICH -21 Data Report of 2007-09 shows that 74\% of infants born in US in 2006 were breastfed, while the goal was 81.9\% and 47.3\% were breastfed at 6 months while the target was 60.6\%.\textsuperscript{20}
2.5 CONCEPTUAL MODELS IN PREVIOUS LITERATURE DESCRIBING BARRIERS TOWARDS BREASTFEEDING

The behaviors towards breastfeeding are described by different conceptual models in the literature.\(^{21,22}\) These models were unfolding the different barriers or determinants of breastfeeding by exclusivity, duration and/or rate.

Fig-1 identifies the different factors that may influence the breast feeding practices, or the decision to breastfeed, and shows the time period where they have the most influence. The figure also shows the factors related to initiation and duration of breastfeeding in a hospital or clinical setting and afterwards in the daily life as follows:

1- Commercial marketing: Media representation in television and cinema for formula and lack of breastfeeding, aggressive marketing of formula (samples, gifts and coupons) to mothers through hospitals and clinicians’ offices and public perception secondary to aggressive marketing influences decision for breastfeeding initiation and continuation.\(^{22,23}\)

2- Obstetric and maternity staff: As described above hospital staff especially obstetric and maternity staff has a great influence in initiation and continuation (duration) of breastfeeding as they are in direct contact with the patient while they are in hospitals for first few days after delivery and also when they come for follow-up during postpartum period.\(^{23}\)
3- Pediatric staff: Has the same role as maternity and obstetric staffs as the patients visit them for vaccination and regular pediatric check-ups.\textsuperscript{24,21,22}

4- Maternal concerns about exclusive breastfeeding: Single parenting, lethargy, lack of sleep, nutritional deficiency, postpartum infection and depression all can contribute to mothers concerned about initiation, duration and exclusive breastfeeding.\textsuperscript{25}

5- Family, work place and social pressure:\textsuperscript{24,26} These are the most important factors as there are different myths in every culture and society related to breastfeeding initiation, duration and exclusivity, although they have no relation to facts, it still transfers to other generations. Breastfeeding is still not publically popular and there are no separate rooms or areas at work or public places for mothers to feed their babies.
Figure 1: Potential Obstacles or Supports for Exclusive Breastfeeding, by Time Period

Chapter 3

3.1 SUBSTANCES IN BREASTMILK

There are different illicit drugs and medications which secrete in the breastmilk and could cause harmful effects on the baby, constituting a contraindication to breastfeeding. Tobacco, alcohol, marijuana, cocaine and heroin are the most commonly used substances, both domestically and internationally. The substances impact not only the infants, but breastfeeding practices as well. Clinicians need to first determine if the mother is using any drug and which drugs she is using. Once the drug has been identified, a decision has to be made about the infant’s safety. If breastfeeding is determined to be safe for the infant, then the mother will be counseled to do so, since the breastfeeding would be beneficial for the infant and mother both.

3.2 PREVALENCE OF SUBSTANCE USE DURING BREAST FEEDING:

It is estimated globally that more than half of the breastfeeding women are taking some type of drugs. Almost 43% of women who were breastfeeding in the past 12 months reported alcohol use; whereas, 36% of women who were both pregnant and breastfeeding in the past 12 months reported alcohol use. A Norwegian study reported that 80% of breastfeeding women with a 6-month old child reported using alcohol. The 2007 National Survey on Drug Use and Health revealed that among pregnant women 15-44 years of age in the United States, 5.2% had used illicit drugs in the past month, compared to 9.7% in non-pregnant women of the same age group. The National Institute on Drug Abuse (NIDA), in one of the few large surveys of maternal abuse,
found that 5.5% of mothers reported taking an illicit substance during gestation.\textsuperscript{33} Mothers who abuse substances during pregnancy were also more likely to continue, or relapse in the postpartum period or during the breastfeeding period.\textsuperscript{34} The 1985 National Maternal and Infant Health Survey (NMIHS) found that only one third of the women who quit smoking during pregnancy were still abstinent one year postpartum, with the majority relapsing in the first 3 months after delivery.\textsuperscript{35}

### 3.3 IMPACT OF SUBSTANCES ON INFANT AND BREAST FEEDING:

The impacts of these substances on infants and on breastfeeding, as well, have a wide range of effects, depending on the substance and the population.

#### 3.3.1 TOBACCO

Data from National Health Survey of 2005 show that, in the US, about 21.5% of women of childbearing age are smoking regularly, and 17% are continuing smoking during pregnancy.\textsuperscript{36} The data from Canada\textsuperscript{37} has similar statistics, reporting 21.3% in childbearing age, and 13% during pregnancy, and in Australia\textsuperscript{38} it is 21.6% and 17.3 % respectively.

Nicotine is the primary health hazard substance which is inhaled rapidly via smoking. From the respiratory tract, it absorbs quickly and rapidly goes into the blood circulation. Nicotine passes from the circulation by simple diffusion to the breast milk. The half life of nicotine is almost 97 minutes.\textsuperscript{39} The primary metabolite of nicotine is cotinine, which has a half-life of 15 to 20 hours and serum concentrations that are 10-fold higher than nicotine.\textsuperscript{40}
Cigarette smoking affects large numbers of women with approximately 25% using tobacco during pregnancy, and 5% to 20% during breastfeeding.\textsuperscript{13,41} It is associated with a shortened duration of breastfeeding,\textsuperscript{14} and decreases the milk volume.\textsuperscript{42} Shortened breastfeeding duration may be caused by the effects on milk volume. Although some studies report shortened duration, they have not specifically measured the volume. However, a lower prevalence of breastfeeding at 6 to 12 weeks postpartum among smokers was reported when compared with nonsmokers, even within the same socioeconomic group.\textsuperscript{32,14} It is also claimed that nicotine changes the flavors of the breastmilk.\textsuperscript{32}

The infant absorbs nicotine mainly by inhalation, and partially by the breastmilk.\textsuperscript{32} Nicotine is an appetite suppressant.\textsuperscript{32} Babies can be restless and irritated. Sometimes, they refuse to take the milk. In increased doses, nicotine causes diarrhea, vomiting and tachycardia (increased heart rate), respiratory illness, and otitis media.\textsuperscript{32,43}

AAP (American Academy of Pediatrics) recognizes pregnancy and lactation as two ideal times to promote smoking cessation, but does not indicate that mothers who smoke should not breastfeed.\textsuperscript{44}

### 3.3.2 ALCOHOL

Alcohol consumption among lactating women is common in the United States and other countries as well.\textsuperscript{45} Epidemiological studies found that although lactating women were less likely to report occasional binges of heavy drinking, the regular drinking patterns at 1 and 3 months after giving birth (i.e., postpartum) did not differ significantly between women who were elected to breastfeed and women who never breastfed.\textsuperscript{46}
After drinking, alcohol absorbs and comes into the blood stream. By simple diffusion, it quickly comes into breast milk, and achieves almost same concentration as the maternal blood level. Alcohol flavors and changes the smell of the breast milk.

Oxytocin release is affected by ingestion of two standard drinks of alcohol. It can be partially or completely inhibited, which results in hindrance of the milk-ejection reflex. Infant livers are immature, at least for the first three months, and during this period, the detoxification rate of alcohol is about half slower than the rate of adults, so it is harmful for infants. Evidence shows that one standard drink per day is associated with a decrease in psychomotor development of the baby. Binge drinking (five standard drinks), even weekly, has the same effect. Studies have seen that one standard drink causes infant sedation, and it takes 4.5 hours before he is more wakeful. The infant needs to suckle more, but there is less milk ejection.

3.3.3 CANNABIS/ MARIJUANA/ POT

In 2010, marijuana was noted by the United Nations as being the most widely used illicit substance in the world. Studies have shown that marijuana smoke contains 50–70 percent more carcinogenic hydrocarbons than tobacco smoke, and is an irritant to the lungs. In animal studies, the breastfeeding mothers using marijuana had decreased milk production in the mammary glands. Delta-9-tetrahydrocannabinol, or THC, is the main psychoactive ingredient in marijuana. THC is fat-soluble, which means it builds up in the body with chronic use. Studies have shown that it actually concentrates in the breastmilk, and the infant is exposed to a higher level than the mother. After a

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1 Standard drink: A standard drink is any drink that contains about 14 grams of pure alcohol (about 0.6 fluid ounces or 1.2 tablespoons). by National Institute on Alcohol Abuse and Alcoholism (NIAAA), Bethesda, MD, USA
breastfeeding mother uses marijuana, THC is evident in her baby's urine and stools.\textsuperscript{52} During the first month of life, if a baby is exposed to marijuana via breastfeeding; it declines the motor development at one year of age.\textsuperscript{54}

### 3.3.4 COCAINE

Studies have also demonstrated fluctuating rates of cocaine use during pregnancy over time.\textsuperscript{55,56} A study of cocaine use during pregnancy in Boston demonstrated that 18\% of women abused substances at least once during pregnancy.\textsuperscript{57,58}

The use of cocaine is often considerably associated with the use of other drugs or multiple substance use and usually associated with poor lifestyles and low socioeconomic conditions.\textsuperscript{18} This is clear from studies that women using cocaine during pregnancy are at risk for shorter gestation, premature delivery, spontaneous abortion, abruption-placentae and other multisystem malformations.\textsuperscript{59}

Cocaine or crack should not be used near the baby, as there are chances of inhalation and toxicity.\textsuperscript{60} Due to ethical issues, we cannot administer drugs to see the effects on breastfeeding and on babies, so there is a lack of supporting studies, and milk-to-plasma ratios for cocaine have not been determined yet.\textsuperscript{61,62} Additionally, mothers who use cocaine are difficult to enroll in studies as they may have hesitation to share cocaine use with their healthcare providers. A significant amount of cocaine appears in human milk and, after absorption, comes into the fetal circulation, placing the infant at significant risk for toxicity.\textsuperscript{32}
3.3.5 HEROIN

Heroin is an opioid derivative, appears in human milk, and places the infant at high risk for toxicity. Historically maternal breastfeeding has been considered a possible method of treating addicted newborns from withdrawal symptoms, as the heroin secretes in breastmilk, and offsets the withdrawals. Currently, heroin use is considered by the American Academy of Pediatrics as a contraindication to breastfeeding.

3.4 CONCEPTUAL MODEL DESCRIBING BREASTFEEDING BARRIERS IN MOTHERS WHO USE SUBSTANCES

The importance of breastfeeding cannot be overemphasized. The choice of breastfeeding by the pregnant or newly postpartum woman with a history of past or current drug abuse is challenging for many reasons, thus the rate, duration and exclusivity are unpredictable. Besides the known harmful effects of using substances, the barriers, attitudes and behaviors that are the determinants of breastfeeding in women who use substances are not well understood. To address this gap in the literature, we developed a conceptual model that explains the breastfeeding barriers in mothers who use substances. The components are as follows (Figure 2):

1- Behavior: Women who use substances frequently engage in risk-taking behavior, such as carelessness and negligence, which also puts the infant at risk.

2- Pharmacological effects: There are side effects and withdrawal symptoms of drug exposure on the baby. Psychiatric disorders that require pharmaco-therapeutic
Intervention are prevalent in the drug abuse population. Illicit drugs are frequently included with dangerous adulterants. These all can pose additional threats to infants.

3- Infection risk: Populations who use drugs are at higher risk for infections, by using syringes or risky sexual activity, such as human immunodeficiency virus and/or hepatitis B or C virus infections.

4- Poor nutrition: This can reduce milk production, and also predisposes the women to infection, which can also be harmful to the baby.

5- Reduced production of milk: Milk production depends upon different factors, not only nutrition of mother, but also the effects of different illicit substances the mother uses and suckling action of baby.

6- Single parenting: Mothers using substances are usually single mothers, with many other stressors to respond and attend to, so it is quite difficult for them to continue breastfeeding, or exclusively on breastfeeding in the first place.

7- Availability of formula: Although this occurs less often, mothers using substances might be dependent on social services, and WIC programs. Formula milk is made more easily available for them, so they prefer to quit breastfeeding and use the easily available formula.

8- Recommendations of health care provider: Breastfeeding is always recommended by health care providers except in selected cases of mothers who are using substances. Usually, a careful individual evaluation is required prior to the institution of breastfeeding and if necessary, the mothers either stop using the substance or stop breastfeeding due to the concern about potential harm to the baby. This evaluation and decision is always challenging for a health care provider.
Fig- 2: Breastfeed barriers in mothers who use substances.
Chapter 4

4.1 EVIDENCE: LITERATURE SEARCH AND ANALYSIS

To support the conceptual model and objective of this paper to analyze the barriers to breastfeeding, a literature review was conducted. Eleven years of data\(^2\) were searched, and seventeen studies, published from 2000 to 2011, were selected for further study. These mainly encompassed the topics of initiation, rate, duration, exclusivity and effects of breastfeeding on the infants of mothers who use substances. These studies were of different population groups who use substances of US, UK, Italy, Norway (Oslo), Turkey and Australia. Data extracted from each of the included studies has been summarized using a narrative chart summary, and organized using different themes (Appendix). The analyses of the studies were performed on the basis of key measures, analytic process, major findings and their selected strengths and weaknesses. Study population groups were also reviewed. We found ten studies on smoking, four on alcohol, two on other substances, including opioids and one study mentioned all substances (smoking, alcohol, etc) (Figure 3).

\(^2\)Method: A systematic review was undertaken; a wide range of medical, social and public health electronic databases to identify published studies addressing breastfeeding barriers in women using substances.

Databases searched: The following key electronic health, social science and education databases were searched: Embase, CINHAL, PsychInfo, Medline PubMed and the Cochrane Database of Systematic Reviews, Google and Google Scholar, using a combination of medical subject headings (MeSH) and free text search. Literature search was done for studies published in English from 2001 to July, 2011, reporting quantitative or qualitative data studies on breastfeeding and substance use.

(Key words): breastfeeding barriers in women using substances, substance abuse and breastfeeding, smoking and breastfeeding, Alcohol and breastfeeding, Cannabis and breastfeeding, cocaine and breastfeeding, Nicotine and breastfeeding).

Search result: More than 100 studies were found.

Inclusion criteria: Only 17 original study articles selected including randomized control trials, controlled, longitudinal studies, prospective and retrospective studies. Only smoking, alcohol, opioids, heroin, cocaine, cannabis and marijuana related studies included.

Exclusion criteria: Review articles were not included in the study. Studies which were on premature infants, low birth infants and other related complications with infants and their dilemma on breastfeeding were not included. Methadone only related studies were not included as well. The studies which were on different other illicit or non-illicit drugs (except above mentioned list) were not included.
Fig. 3

Number of Studies selected from 2000 to 2011, according to the type of Substances used:
4.2 SELECTED STUDIES ON TOBACCO

The studies on the topic of smoking discussed the impact and association of smoking on the duration, early weaning, family history, prolactin level, and amount of breast milk. Some of them also tried to evaluate the adverse effect of tobacco on the infant.

We found two studies by Pellegrini and by Ilett, which were confirmed by reliable laboratory tests that maternal exposure of nicotine leads to significant appearance of nicotine or cotinine in breast milk. The effects were attributed to smoking in the first study and to the nicotine patch use in the second study. It was also observed that nicotine patch use can reduce the concentration of nicotine and cotinine to almost half, as compared to smoking. The sample was small (N= 45), and only 35 participants completed the study. The results were based on laboratory tests after certain intervals; therefore, the evidence seems reliable. The Ilett study also found that after smoking or use of nicotine, the amount of breast milk was reduced. This study supports the conceptual model (chapter 3), that one of the barriers for breastfeeding in mothers using substances is reduced production of breastmilk due to the effect of maternal substance use.

Liu et al. and Weiser et al. discussed the effect of smoking on initiation of breastfeeding and early weaning. Altogether, they had the survey sample of more than 3000 participants. They successfully established the association of tobacco smoking of mothers with no initiation and less duration of breastfeeding. They also explained the relationship between smoking and the reduced amount of breastfeeding and early initiation of weaning. Both studies were based on self-reported data, and no laboratory tests supported those findings.
Giglia\textsuperscript{80} and Higgins et al.\textsuperscript{81} tried to do their study from a different prospective. They added some new findings in the literature that cessation of smoking can increase the duration of breastfeeding. They did their survey study on 745 women and 384 (226 subjects in Giglia’s study, 158 subjects in Higgins et al.’s study) of them were using tobacco.

Yilmaz et al.\textsuperscript{82} and Stroud et al. recognized short term hazards of smoking, and Batstara\textsuperscript{83} mentioned the long term hazards of smoking on exposed population of infant and children. Yilmaz et al. observed that the 254 infants exposed to tobacco smoking had negative consequences on growth, and an increased rate of infection. Urinary cotinine was also measured to confirm the status of smoking. Stroud et al. have seen that tobacco exposure to breastfed infants made them more irritable and difficult to handle, as compared to non-tobacco exposed infants (study sample of both was N=28 in both study arms). In those small samples, he did not exclude the effect of abstinence syndrome, although saliva cotinine was measured to confirm the exposure in both mothers and infants. The Batstara study compared long-term scholastic performance between breastfed and bottle fed infants, and found a significant negative association in 388 bottle fed infants, as compared to 182 breastfed infants. This was a long term study of 25 years. But the follow up data was retrospectively collected, so there were chances of recall bias.

Godale’s\textsuperscript{84} study tried to examine the attitude and behavior towards breastfeeding by discussion and group interview. He found need of consistency in education and awareness about breastfeeding promotion postpartum. The interview was taken from small sample of N=44 individuals and based on self-reported data.
4.3 SELECTED STUDIES ON ALCOHOL

The studies on alcohol and breastfeeding were quite divergent, reflecting differences in behavior, family history, and correlation with income, education and prolactin level. Alvin et al.\textsuperscript{85} study concluded that mothers, who use alcohol, or their partners, were inclined toward breastfeeding if they had a higher education and higher income. Those who never breastfed, and did early weaning of their infant, seemed to reflect a lower educational and income status. This was a large study (N=3235) but the questionnaire was asked in front of partner, so the validity is unclear.

Mennella et al.\textsuperscript{86} with small sample size (N=13) found that after an hour of drinking of alcohol, milk secretion significantly decreased, but such deficit was not related to the prolactin level. It was a double-blind study and the laboratory tests were performed to measure the prolactin levels. This also supports our conceptual model of breastfeeding in mothers abusing substances.

Giglia et al.\textsuperscript{87} did a discussion survey consisting of four sessions to understand the awareness of alcohol intake risk during breastfeeding. They found that most women are ignorant about the effects of alcohol on infant or breastmilk, so they do not limit their drinking. Although the size of the study was small and based on different self-reported information, this is an area for further concern and requires additional study.

Mennella\textsuperscript{88} conducted another study about two years after above mentioned study. This new study was an experimental study, recruited 28 women with family history of alcohol use, and observed the patterns of breastfeeding among them. Their main conclusion was that there were blunted prolactin levels in these women, possibly due to the alcohol use.
4.4 SELECTED STUDIES ON COCAINE, HEROIN AND OTHER SUBSTANCES

Wachman concluded in a retrospective study that the initiation and continuation of breastfeeding rate was very low in opioid-dependent mothers. The sample size was of fairly large (N= 276) and study comprised of six years of data collection.

Goel collected retrospective data, and mentioned the high prevalence rate of hepatitis C in substance using, breastfeeding women. They concluded that the initiation of breastfeeding in women who use heroin, cannabis and other substance was more than three times less, than the general population of non-substance using women. This also supports our conceptual mode; substance use is a barrier to breastfeeding among mothers.

The Wallace study collected data in both breastfeeding and non-breastfeeding women (N=979) and found high prevalence of alcohol use in pregnant and breastfeeding women, who were highly educated, English speaking older mothers as compare to non pregnant and non breastfed women. He found lower cannabis use in these women than the general population, while the rate of smoking was almost the same in breastfeeding and non-breastfeeding women.

4.5 SUMMARY

We can see in the literature that there is an ever increasing volume of evidence highlighting the importance of breastfeeding in infancy, as well as in later life. There are international recommendations available to promote exclusive breastfeeding as the most advantageous method of infant feeding for the first six months of life. Despite all this, there are certain groups of mothers, including those using substances, for whom
breastfeeding practices remain controversial. Evidence shows that either they do not breastfeed, or stop after a brief period of time. To understand the barriers and dilemmas for breastfeeding in substance abusing mothers, we conducted this literature review and assessed seventeen studies.

It is quite interesting that we found ten studies in the last eleven years of literature review on smoking and tobacco use during breastfeeding, which emphasized rate, initiation and duration of breastfeeding, while studies on alcohol, opioids and other substance abuse were much fewer. (Figure 1).

A probable reason for under reporting of maternal use of substances is that the mothers who are using substances to the point of abusing substances often become involved with the child welfare system, and are more likely to lose their parental rights, compared with mothers who do not use substances.92 The fear of losing the child custody, the fear of problems with the law and the fear of potential harm to infant are the main issues which can hinder mothers who use substances from participating in a research study.93

Evidence from our literature review about smoking revealed that researchers concur on known hazards of smoking on breastfeeding, but no study exclusively could describe the barriers for breastfeeding in tobacco smokers. According to the above review, it is known that reduced breastfeeding frequency lowers the breast milk volume and supply. Nicotine also makes the infant irritable, and difficult to handle and console.

In this review, the literature is limited about effects of alcohol use on infants during breastfeeding. Alcohol use is a legally accepted practice during breastfeeding despite its known adverse effects of alcohol during pregnancy. There are still chances of under-
reporting, as legal issues are always a concern. Variation of laws across states and between countries further complicates this issue.

There is limited literature about any safe amount of substances which could be taken by mothers without any potential harm to infant or the breastfeeding initiation, duration or exclusivity. As with any experimental study on substance use, there are legal and ethical issues that could hinder the availability of randomized studies on substance abuse and breastfeeding in humans; therefore, we must rely on evidence from observational studies.

We found large gaps in the literature and therefore could not answer all our questions about breastfeeding barriers and dilemmas in mothers using substances. There is a need for more studies in this area, using better data collection methods to measure the risk of not breastfeeding versus breastfeeding among mothers who use substances. Identifying the determinants of breastfeeding practices among mothers who use substances will improve the design of targeted interventions, determine the absolute contraindications of substance use on infant health and help to formulate national public health policy.

4.6 CONCLUSION

Human milk is considered the ideal milk for infants. This literature review tried to capture the barriers and potential contraindications to breastfeeding in mothers abusing substances (tobacco, alcohol, marijuana, cocaine and heroin). Our literature review found that using substances has an influence on breastmilk and maternal/infant feeding patterns. Tobacco smoking has negative impact on initiation, duration and exclusivity of breastfeeding, as well as risks for infant’s own health and behavior, while alcohol has the
same effects on breastfeeding, but further study of the short and long term effects of alcohol on infants is required. Counseling and education are needed to raise awareness of the effects of these legally permissible substances while breastfeeding. It is also recommended to include them as contraindicated in health professional’s guidelines, since there is no quantification of a safe limit.

Other substances, including marijuana, cocaine, and heroin, all have hazardous effects on breastfeeding and on infants as well. Further, we did not find any new studies from the last eleven years that revised those hazards. Due to ethical issues, these drugs are difficult to study in humans, so their use should be a contraindication to breastfeeding due to a lack of contrary evidence.
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## APPENDIX

### SELECTED STUDIES FOR LITERATURE REVIEW OF BREASTFEEDING BARRIERS IN MOTHERS WHO USE SUBSTANCES!

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<tr>
<td>2-Research Questions Addressed</td>
<td>How BF duration and Maternal smoking pattern related, before during and after pregnancy?</td>
<td>what is the association of maternal Smoking status (as a risk factor) with breastfeeding practices (initiation and Duration) in 2005 in Missouri?</td>
<td>what is the association between Family History of Alcoholism, prolactin level and BF behavior in lactating women?</td>
<td>What knowledge, assumptions and attitude were there about safe level of Alcohol taking during lactation in Australian mothers?</td>
<td>What was perinatal outcome of illicit substance use in pregnancy—comparative and contemporary socio-clinical profile in the UK. Eur J Pediatr. 2011; 170:199–205</td>
<td>What are the breastfeeding rates among mothers of infants with neonatal abstinence syndrome?</td>
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<tr>
<td>3-Data Source/ Sample</td>
<td>USA 2006, Statewide, Georgia</td>
<td>Clinical and translational research center at the University of Pennsylvania, US</td>
<td>Perth metropolitan area of Western Australia between 2002-2003</td>
<td>2003-2007 data was recognized by retrospective from medical and lab record. (UK)</td>
<td>Boston medical Center opioid, Boston, MA, from July, 2003 to June 2009. USA</td>
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<td>4-Key Measures</td>
<td>N=3047, 2000-2001 data, state wide Georgia, survey data</td>
<td>N=3000, 1789 were responded (61%)</td>
<td>N=28, 7 were family history positive for Alcohol dependence and 21 with negative F. history</td>
<td>N=17, discussion with groups done and qualitative content analysis was applied.</td>
<td>N=168</td>
<td>N=276</td>
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<td>5-Analytic Process</td>
<td>Consists of Random Stratification Random Analysis, used Kaplan Meier life table.</td>
<td>Stratified Sample, Pop. based survey, multivariable binomial regression analysis, data analysis by cox proportional analysis.</td>
<td>Two days experimental study. Serum measurement of Prolactin level</td>
<td>systematically summarizing different themes established</td>
<td>Data was collected on mother—infant pair from medical notes and laboratory records. Chi-square and Mann- Whitney U tests were used</td>
<td>Retrospective Chart review. BF eligibility was determined by urine toxicology screening at admission.</td>
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<td>6-Major Findings</td>
<td>Women who smoked 10 or more cigarette more likely Not to fed 10 weeks as compared to non smoker with increased risk of early weaning.</td>
<td>Moderate/ heavy and light smoking during the post partum period were associated with failure to initiate breastfeeding and weaning sooner.</td>
<td>Women with family hist. +ve, showed blunted Prolactin level to breast stimulation.</td>
<td>women were not aware of the risk of drinking alcohol and lack of knowledge may limit the control that women have over this behavior.</td>
<td>Besides controlled use of methadone, heroin, cannabis and benzodiazepines were the most commonly used drugs. Hep-C. prevalence was about 30%. Only 14.3% were BF at discharge as comp to 50% in G. Population.</td>
<td>Due to unknown reason BF rates among opioid dependent women were very low. Minority of women stated and half of them stopped at 5.5 days.</td>
</tr>
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<td>7-Additional Notes</td>
<td>-Based on self revealed data. No lab test done. Chances of over or under reporting.</td>
<td>-Based on self reported data. Retrospective analysis.</td>
<td>-First experimental evidence of its kind -small sample size -lab. Tested Prolactin level measurement.</td>
<td>-Any significant research was not done before in this area. -data was just gathered via discussion, self descriptive -shows specific social-class</td>
<td>Retrospective data No follow up done No reason for low BF feeding mentioned</td>
<td>-Long duration study -Retrospective chart review.</td>
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**Smoking** Smoking | **Alcohol** Alcohol | **Other substances** Opioids |
## Findings

### Process

- **Sample Source/Study**: Population based study with relatively higher response rate. Used different levels of Alcohol and smoking consumption. The questionnaire asked in OPClinic in presence of Partners.

### Measures

- **Addressed Question(s)**: What are the effects of maternal smoking in newborn behavior at 10-27 days.

- **Key Measures**:
  - N=1873 (1873 out of 3235 actually asked the questions)
  - N=13, a 4 session study. Pumping increases Prolactin level.
  - N=56, 28 Smoked exposed and 28 Non-exposed, maternal and infants saliva cotinine measured. Neurobehavior was measured with NICU Network NB scale.
  - N=138, self reported smoking entry. Completed a brief questionnaire with history of continuous cigarette smoking for past 7 days. Assessment done at 2, 4, 8, 12 and 24 PP week. N=44, Each woman inter-viewed 9 times. (6 times during pregnancy and 3 times postpartum.), using semi-structured questionnaire, taped, transcribed and analyzed.

- **Analytic Process**:
  - Longitudinal, pop. based, questionnaire based survey. Codes used for questionnaire.
  - 4 Session, 2x2 within subject study, double blinded.
  - Maternal interview were taken and lab test were done.
  - Smoking status was verified by Uric Cotinine testing by using Enzyme Immunoassay. t-test and chi-sq test was used for analysis.
  - Maternal reports of BF collected 2, 4, 8, 12 and 24 PP week.

- **Analytical Key Data**: Smoked exposed infants were more excitable, hypertonic, and required more handling compared with unexposed infants.

- **Analytical Key Data**: Smoking cessation increases BF duration.

- **Analytical Key Data**: Maternal smoking during breastfeeding duration. Results of a Longitudinal Qualitative Study. BIRTH; 2008 35:230-240

- **Additional Notes**: Smoked exposed infants were more excitable, hypertonic, and required more handling compared with unexposed infants.

## Additional Information

- **Citation**: Alcohol, Alcohol, Smoking, Smoking, Smoking
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<td>2-Research Question(s) Addressed</td>
<td>What were the hazards of passive smoking on BF and if there is any protective effect of Breast feeding?</td>
<td>What was population prevalence and demographic characteristics of pregnant and/or breastfeeding Australian women who use illicit and illicit substances and their experience of psychological distress and violence?</td>
<td>Is there any association between women’s stop smoking and BF duration? With socio-demographic characteristics.</td>
<td>What was the extent of exposure to Nicotine and Cotinine to BF infants during maternal smoking and later during maternal use of nicotine trans-dermal patch to achieve smoking cessation?</td>
<td>Whether adverse effect of maternal smoking can be modified by breastfeeding?</td>
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<td>3-Data Source/Sample</td>
<td>A cross-sectional study in 2006 in Ankara, Turkey</td>
<td>Random stratified multistage area sampling of private households across all Australian States</td>
<td>Longitudinal study, of 12 month duration from mid Sep. 2002 to mid July 2003. In 2 public maternity hospitals of Perith, Australia</td>
<td>At university of west Australia. Maternal and infant blood sample was taken for Nicotine and Cotinine level.</td>
<td>Cohort study.</td>
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<td>4- Key Measures</td>
<td>No254 A questionnaire was given to 6 -7, month old infants mother , Multivariate analysis was done. Urinary cotinine was measured.</td>
<td>No 976 Data source was the 2004 NDSHS, approached to complete a self administered Questionnaire. Psychological distress was assessed on the Kessler Scale</td>
<td>No587, 226 mothers reported smoking during preg. And 77% of them stopped smoking during preg.</td>
<td>No25, 15 completed the study. Only 5 initiated BF</td>
<td>No570, Born in 1975 to 1978(when born). And then retrospective data collected from their mother in 1993(at 9 yrs age) and in 2000(at age 25)</td>
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<td>5-Analytic Process</td>
<td>6 –7-month-old infants who were brought to the healthy child outpatient clinic of Dr Sami Ulus Children’s Hospital. Hacettepe University Faculty of Medicine Ethics Committee approved the study</td>
<td>The statistical analyses were conducted using the complex samples package of SPSS version 1. Self reported data so chances of under reporting</td>
<td>Self administer base line questionnaire with follow up telephonic interview. At 4, 10, 16, 22, 32 and 52 weeks</td>
<td>Baby was weighted before and after each breastfeeding. Nicotine and Cotinine concentration in Plasma was measures in both mother and infant..</td>
<td>Lake hood ratio tests indicated highly interaction between effects of maternal smoking and breastfeeding on reading, spelling, and asthmatic performance as analyzed in least Sq. Reg. model.</td>
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<tr>
<td>6-Major Findings</td>
<td>Tobacco smoke exposure of infants has negative consequences on growth and increases the rate of infection (otitis media, and upper and lower respiratory tract infections)</td>
<td>The prevalence of Cannabis in Preg. and BF women were low vs gen. popul. Smoking use was almost same and the Alcohol use was high in Preg. and BF women, who were more older, highly educated English spoken.</td>
<td>Quitting smoking during pregnancy was significantly associated with breast feeding for longer than 6 months. No relation between age or income shown.</td>
<td>Fagerstrom Tolerance Questionnaire was used. The conc. of Nicotine and Cotinine was decreased in breast milk by about 50 and 80%. The use of Nicotine patches were safer as compare to smoking.</td>
<td>Significant negative link between maternal smoking and scholastic performance existed only in children that had been bottle fed(n=388).</td>
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<td>7-Additional Notes</td>
<td>Good sample size and lab test was done to measure urinary Cotinine.</td>
<td>Self reported data. No lab test done.</td>
<td>Very small sample.</td>
<td>Long follow up done for 25 years. Retrospective data collected for follow up.</td>
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Smoking | All | Smoking | Smoking | Smoking