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## Breastfeeding may protect against heroin addiction

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### Summary

**Background:** Heroin addiction is a biopsychosocial disorder and the role of some early environmental factors has also been suggested. The aim of the study was to assess whether breastfeeding may or may not affect the development of heroin addiction in adult life. **Methods:** We compared the incidence of breastfeeding in the first four months of life and the duration of breastfeeding in patients suffering from heroin addiction with the results for the control group. We also compared the timing of the introduction of complementary foods between the two groups. The addicted group consisted of 88 patients (27 females/61 males; mean age  $22 \pm 4$  years) suffering from heroin addiction, while the control group included a group of 57 healthy individuals (22 females/35 males; mean age  $23 \pm 5$  years). The breastfeeding history was obtained retrospectively by means of face-to-face interviews with the mothers of patients and controls. **Results:** The incidence of breastfeeding between 0 and 4 months was 73% ( $n=64$ ) in patients with heroin addiction and 88% ( $n=50$ ) in the control group. Weaning within the first 4 months of life (OR; 0.33; CI, 0.13-0.85;  $p=0.02$ ) was associated with a high risk of heroin addiction in later life. Duration of breastfeeding, and the timing of the introduction of complementary foods were found to be similar in the two groups ( $p > 0.05$ ). **Conclusions:** This study suggests that early weaning (i.e. weaning during the first 4 months) may be associated with an increased risk in adult life to be faced by the offspring of parents showing heroin addiction. Duration of breastfeeding and the timing of the introduction of complementary foods (solid foods and cow's milk) might not have any effect on the development of heroin addiction.

**Key Words:** heroin addiction; breastfeeding; risk factor; infant.

### 1. Introduction

Mental illness is a biopsychosocial disorder. Multiple factors, including genetic, pathological, environmental, personal and psychosocial ones, play a role in its development, and these factors interact with each other. It has been suggested that early environmental factors are particularly important; these factors, whether positive or negative, can influence biopsychosocial development in unique ways [23,24]. Breastfeeding is a key environmental factor in determining development in early life both for infants and their mothers by preventing diseases and promoting health in the short and long term [38]; it also has a positive effect on the infant-mother relationship [22,29]. It has been shown that breastfeeding

enhances the emotional bond between mother and infant via close physical contact [26,34]. A positive effect of breastfeeding on infant-mother attachment has often been assumed, the main consequence being that the lack of breastfeeding might lead to insecure attachment [16,26]. Substance use disorders including heroin addiction have been associated with insecure attachment, and it has been hypothesized that insecure individuals may run a higher risk of substance use disorders [31,37].

Despite various environmental, maternal, or genetic confounds several studies have shown that breastfeeding predicts better neurological and cognitive competence in the offspring, beginning in early childhood and continuing throughout adulthood [12,27]. The importance of breastfeeding has been

documented in some psychiatric disorders, including anxiety, attention deficit hyperactivity disorder and alcoholism [2,19,25]. Some studies have reported that early weaning might be associated with a greater risk of alcohol dependence later in life [2,13,33].

To the best of our knowledge, the association between breastfeeding history and the development of heroin addiction has not yet been investigated. The aim of the study was to assess whether breastfeeding affects the development of heroin addiction in adult life. For this purpose, we compared the frequency and duration of breastfeeding in patients with heroin addiction with the data found in the control group. We also compared the timing of the introduction of complementary foods in the two groups.

## 2. Methods

### 2.1. Data collection and sample

The addicted group included 88 patients (27 females and 61 males; mean age  $22 \pm 4$  years) with a diagnosis of heroin addiction according to DSM IV-TR criteria. We relied on a clinical sample from the outpatient and inpatient drug units. Addicted patients were selected randomly from patients attending addiction treatment programmes. The healthy control group consisted of 57 healthy individuals (22 females, 35 males; mean age  $23 \pm 5$  years) who did not have any alcohol problem, drug abuse or dependence. They were recruited from groups of hospital staff workers, blood donors and students who had been matched for age, gender, educational and economic status. Their breastfeeding history was obtained retrospectively by means of face-to-face interviews with the mothers of patients and controls. The impossibility of interviewing the mother (death of the mother, low intellectual capacity, inability to reach the mother) and the presence of other drug and alcohol use disorders, were considered exclusion criteria. Written informed consents were obtained from all participants. The Institutional Ethics Committee approved the study protocol.

### 2.2. Data analysis

Categorical variables were compared by means of the chi-square test. Student's T test was used to compare the groups on continuous variables. For all statistical analyses,  $p < 0.05$  was considered significant. Predictors of heroin addiction were determined by logistic regression analysis. The strength of association between variables and the occurrence of heroin

addiction were represented by odds ratios (ORs) and their accompanying 95% confidence intervals (CIs).

## 3. Results

There was no significant difference with respect to the occupations of the mothers, having a twin, preterm babies at birth, mode of delivery, parental divorce or death of the father between patients with heroin addiction and the control group (All  $p$  values  $>0.05$ ). For mothers with a good education the incidence was 80% (n: 70) in patients with heroin addiction and 95% (n: 54) in the control group. There were more mothers with a good educational level in the control group than in the heroin addiction group ( $p=0.01$ ) (Table 1).

Age of the mother at subjects' birth, duration of breastfeeding, the timing of the introduction of complementary foods (cow's milk and additional supplementary foods) were found to be similar between the two groups (All  $p$  values  $>0.05$ ).

The incidence of breastfeeding between 0 and 4 months was 73% (n=64) in patients with heroin addiction and 88% (n=50) in the control group. The incidence of breastfeeding was significantly lower in patients with heroin addiction ( $p=0.02$ ) (Table 2).

Multiple regression analysis showed that weaning within the first 4 months of life in infants (OR; 0.33; CI, 0.13-0.85;  $p=0.02$ ) and a low educational level of the mother (OR; 0.19; CI, 0.05-0.70;  $p=0.01$ ) were associated with a high risk of developing heroin addiction.

## 4. Discussion

Previous studies suggested that breastfeeding might bring with it protection against infectious diseases and with the later occurrence of obesity, hypercholesterolemia, type 1 diabetes, inflammatory bowel diseases and childhood cancers [4,18]. Breastfeeding may also be associated with a lower risk of psychopathology, including attention deficit hyperactivity disorder, anxiety and alcoholism in future life [2,19,25].

The main finding of the present study is that the incidence of early weaning (i.e. weaning within the first 4 months after birth) in patients with heroin addiction proved to be significantly higher than in the healthy control group. In addition, having an educated mother could turn out to provide protection from heroin addiction as well. On the other hand, the duration of breastfeeding and the timing of the introduction of complementary foods during the years of

**Table 1:** Baseline characteristics

	Heroin Group (n = 88)	Control Group (n = 57)	p
Age	22 ± 4	23 ± 5	0.30
Gender			
Female	27 (31)	22 (39)	0.30
Male	61 (69)	35 (61)	
Education			
Middle School	56 (64)	32 (56)	0.60
High School	26 (30)	21 (37)	
University	6 (6)	4 (7)	
Economic Status			
High	15 (17)	9 (16)	0.70
Middle	57 (65)	40 (70)	
Low	16 (18)	8 (14)	
Twins	2 (2)	2 (4)	0.60
Preterm babies at birth	10 (11)	7 (12)	0.90
Low birth weight	13 (15)	13 (22)	0.50
Mode of Delivery			
Vaginal Birth	74 (84)	48 (84)	1.00
Caesarean section	14 (16)	9 (16)	
Parents' divorce in infancy	2 (2)	1 (2)	0.80
Father's death in infancy	1 (1)	0 (0)	0.90
Mother's Education			
Uneducated	18 (20)	3 (5)	0.01
Educated	70 (80)	54 (95)	
Mother's Occupation			
Housewife	59 (67)	35 (61)	0.50
Working	29 (33)	22 (39)	
Age of mother at subjects' birth	23 ± 5	23 ± 5	0.80

Data were given as a number (expressed as a %), or a mean ± SD.

infancy were found to be similar in patients in the heroin addiction group and in the members of the healthy control group.

Several possible factors may explain the relationship detected between weaning in the first 4 months after birth and an increased risk of the development of heroin addiction in later life. Firstly, close physical contact with breastfeeding may contribute to maternal attunement to the infant's physical and mental needs [16,26], and inadequate breastfeeding in this period may cause psychological and emotional derangements that may be associated with the development of

heroin addiction. Secondly, the infant-mother attachment relationship is the most important system regulating the emotions [7]. Early experiences including close contact with the mother through breastfeeding may cause secure or insecure attachments [3,8]. Lack of breastfeeding in this period may lead to insecure attachments [16,26]. The opioid system is emotionally and neurochemically associated with attachment; besides this, attachment-related distress can be relieved by opioid consumption [31]. A lack of breastfeeding could reveal a sort of opioid system deficiency, genetically transmitted by a mother to her child, and repre-

**Table 2:** Breastfeeding and supplementary foods

	Heroin Group (n = 88)	Control Group (n = 57)	p
Duration of breastfeeding (in months)	11.1 ± 7.9	12.3 ± 7.9	0.40
Initiation of cow's milk (month)	9.9 ± 6.7	8.4 ± 6.4	0.20
Initiation of supplementary foods	4.6 ± 5.1	4.6 ± 5.3	0.90
Incidence of breastfeeding after first 4 months of life	64 (73)	50 (88)	0.03

sent a diathesis for the future development of heroin addiction. [15,36]. Thirdly, lack of breastfeeding in this period could reveal stress in infants. Early stress in this period initiates a cascade that may potentially alter brain development [35]. Inadequate brain development may be a risk factor for substance abuse and other psychiatric disorders [32,35]. Early stress in infancy may affect the hypothalamic–pituitary–adrenal (HPA) axis and noradrenergic systems [5]. HPA axis dysfunction may raise the risk of drug dependence [35]. We have speculated that weaning during the first 4 months of life may induce stress in these infants and may therefore predispose that person to the development of heroin addiction. Fourthly, breast milk is the only source of omega-3 fatty acids to support growth and development in infancy [21]. Deficiencies in levels of omega-3 fatty acid lead to a fall in the mean cell body size of neurons in the hippocampus, hypothalamus and parietal cortex, and decrease the complexity of cortical dendritic arborization [1]. The decreased docosahexaenoic acid in the brain of rats fed on an omega-3 deficient diet was accompanied by an altered metabolism of several neurotransmitters such as dopamine, serotonin and receptor activities in a previous study [9,20]. We speculated that lack of breast milk in this early period of life may cause permanent deficiencies in neural functions and neurotransmitters that may prove to be a risk factor for heroin addiction. Fifthly, skin-to-skin contact and early sucking is reported to influence mother-infant interaction [6]. We therefore inferred that the probability of skin-to-skin contact and early sucking would probably be higher in infants receiving breast milk in the first 4 months of life; as a result, that early experience could act as a protective factor against the development of heroin addiction.

Complementary foods are important in reducing and preventing morbidity and mortality [28]. In the present study, the timing of the introduction of complementary foods (solid foods and cow's milk) were found to be similar in the two groups. Similarly, the duration of breastfeeding was found to be similar in the patients with heroin addiction and the members of the control group in this study. In accordance with our study, several earlier studies failed to show a significant relationship between the duration of breastfeeding and mental disorders, including alcohol dependence [10], schizophrenia [30] and autism [17].

The educational levels of the mothers may have an effect on substance abuse, but no clear pattern has yet emerged. The educational levels of the mothers may affect their maternal style, including breastfeed-

ing. Glavak et al. reported that the educational level of mothers was similar in patients with substance addiction and in healthy controls [11]. By contrast, the percentage of educated mothers in this study was higher in the healthy controls than in patients suffering from heroin addiction.

### Limitations

A major limitation in our study is that the breastfeeding history was based on retrospective reports by the mothers. Indeed, as in every retrospective study, there is a risk of faulty recollection, which may add a degree of uncertainty in assessing the exact duration of breastfeeding. Another limitation of our study resides in issues related to causality. Indeed, lack of breastfeeding in the first four months of life might be the result, rather than the cause, of heroin addiction. We did not have any precise knowledge of how breastfeeding and dependence might interact in the course of development. A further limitation is the small size of the sample and the control group. However, the results of the present study could raise the level of awareness in future studies that may aim to test this hypothesis in a larger population of patients.

### 5. Conclusions

This study suggests that early weaning (i.e. occurring in first 4 months after birth) could be associated with an increased risk that offspring may develop heroin addiction in adult life. In addition, a mother's educational level, if high, may exert a protective effect against heroin addiction as well. The duration of breast-feeding and the timing of the introduction of complementary foods (solid foods and cow's milk) may not imply high risks of the development of heroin addiction. More detailed studies are now required to clarify the association between breastfeeding and heroin addiction.

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