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Characteristics of pregnant women who use Ecstasy (3,4-methylenedioxymethamphetamine)

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Abstract

To determine the characteristics of pregnant women who use Ecstasy (3,4-methylenedioxymethamphetamine, MDMA), and to identify reproductive risk factors associated with this group of women. Prospective, observational study. Pregnant women who have contacted the Motherisk Alcohol and Substance Use Helpline at The Hospital for Sick Children, in Toronto, about exposure to drugs, chemicals, infection or radiation. All inquiries from December 1998 to October 2000 concerning pregnant women who reported use of MDMA, and control cases of women not exposed to MDMA selected within the same week of the MDMA callers. Age, maternal demographics, pregnancy characteristics, patterns of alcohol, tobacco, and illicit drug use, psychological/emotional status, sexually transmitted disease, MDMA method and pattern of use, and adverse drug reactions after ingestion of MDMA. The 132 pregnant women who used MDMA were significantly younger (mean 23.2 vs. 31.2 years, $P<.0001$), and had more unplanned pregnancies compared to 122 pregnant nonusers (84.2% vs. 54.3%, $P<.05$). MDMA users were also more likely to be single (57.0% vs. 18.3%, $P<.001$), and to be White (82.2% vs. 56.0%, $P<.05$). Comparably more MDMA users smoked cigarettes (53.8% vs. 19.7%, $P<.0001$), drank alcohol (66.4% vs. 37.3%, $P<.0001$), and had significantly more episodes of binge drinking during pregnancy (mean 2.12 vs. 0.05, $P<.001$). Illicit drugs such as cocaine, marijuana, methamphetamine, ketamine, gamma-hydroxy butyrate, and psilocybin were used more frequently among the MDMA sample. Over a third of MDMA users reported psychiatric/emotional problems, including 6.5% with a clinically diagnosed condition that was being treated with medication and/or counseling. Pregnant women who use MDMA tend to be young, single, and report psychological morbidity, and have a clustering of risk factors that may compromise the pregnancy and fetus. Smoking, heavy alcohol intake, and polydrug use, combined with a higher than expected rate of unplanned pregnancies, increases the risk of fetal exposure to potentially harmful substances. It is important to account for the range of confounding risk factors among women who use MDMA in order to define possible direct effects of MDMA in pregnancy.

1. Introduction

The term enactogen, meaning "touching within" has been used to describe the illicit drug Ecstasy (3,4-methylenedioxymethamphetamine, MDMA), an amphetamine analogue. Excitatory and enactogenic properties reportedly produce a sense of euphoria, closeness, friendliness and empathy after ingestion of this drug [15].

During the past decade there has been a sharp increase in MDMA use. A recent survey of over 45,000 American adolescents and college students reports that while the use of many illicit drugs have declined or stabilized over recent years, MDMA has steadily grown in popularity [11]. A Canadian drug use survey describes an eightfold increase in MDMA use among youth since 1993 [1]. Likewise, MDMA use in other parts of the world is increasing [10,13,21,25,27]. MDMA consumers are predominately among younger age groups and in some areas, consumption is notably rising in women [22]. Consequently, there may be a substantial risk of exposure in women of childbearing age and in pregnant women, especially since more than 50% of all pregnancies are unplanned. MDMA use may haplessly

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continue to rise as current trends suggest a false perception of safety of this chemical among users [2,14,22] and increasing availability of the drug [11]. The objective of this study was to characterize Canadian women who reported gestational exposure to MDMA with specific focus on reproductive factors in this population.

2. Methods

The Motherisk Program is a large Teratogen Information Service based at The Hospital for Sick Children in Toronto. Over 150 calls are received daily about exposure to various agents such as medications, herbal remedies, drugs of abuse, chemicals, infections, and radiation, and in some cases, women are further counseled at the Motherisk Clinic. At the time of contact, demographic data, obstetric history, medical complications, and exposure details are collected [18]. In 1998 we established within the program an Alcohol and Drug Healthline to counsel women on recreational drug use.

The study sample consisted of all women who were pregnant and had reported use of MDMA. These women called us regarding the fetal safety of MDMA they were exposed to in pregnancy. The counselors indicated to them that there was no sufficient human experience on the safety of MDMA. These women were counseled either through the telephone or in clinic. There were no differences in characteristics between those who visited the clinic and those counseled through the telephone. All such records between December 1998 and October 2000 were retrieved and data were extracted including maternal age, marital status, education, current employment, gravidity, parity, number of past spontaneous abortions and therapeutic abortions, medical complications, psychiatric diseases, infectious diseases, smoking and alcohol consumption habits, illicit drug use, and other exposures. For the MDMA sample, additional data about method and pattern of MDMA use were exam-

Table 1
Comparison of pregnancy characteristics between MDMA users and controls

Characteristic	MDMA women	Clinic women	*P* value
Age	23.16 ± 4.63	31.18 ± 5.07	< .0001
Gravidity	2.01 ± 1.26	2.40 ± 1.61	.03
Parity	0.24 ± 0.56	0.86 ± 1.14	< .0001
Spontaneous abortions	0.20 ± 0.51	0.33 ± 0.66	.09
Therapeutic abortions	0.57 ± 0.85	0.20 ± 0.59	< .0001
Gestational age (weeks)[a]	9.55 ± 5.62	11.62 ± 6.82	< .05
Maternal weight (kg)[a]	60.29 ± 11.60	66.15 ± 14.54	< .05
Infectious diseases (STD)			
Yes	15	7	.08
No	106	113	
Pregnancy planned			
Yes	5	32	< .05
No	27	38	
Marital status			
Single	45	20	< .001
Married	13	73	
Common law	16	12	
Divorced/Separated	5	4	
Ethnic background			
White	60	61	< .05
Black	2	13	
Oriental	9	17	
East Indian	0	11	
Hispanic	0	3	
Other	2	4	
Employment status			
Employed	62	103	.075
Unemployed	13	16	
Social assistance	3	0	
Education			
Grade school	12	9	.233
High school	24	34	
University/College	40	73	
Professional degree	0	1	

Number of responders differs for each item in this and subsequent tables because not all women answered all questions.
[a] At the time of call.

ined, including timing and route of exposure, dose and frequency of use, concurrent drug exposures, and adverse drug effects.

The control group consisted of randomly selected pregnant women who visited the Motherisk Clinic to receive detailed counseling within the same week of a patient in the MDMA group, but for any exposure other than MDMA. This selection criterion controlled for the timing that counseling was received.

For our analyses, consumption of alcohol and tobacco were divided into amounts used: none, light, moderate, and heavy. Light drinking was defined as consuming less than an average of 2 drinks/week; moderate use was > 2 drinks/week and less than an average of 2 drinks/day; heavy drinking constituted consuming an average of 2 or more drinks/day and/or binge drinking at least once a week. Binge drinking is defined as consuming 5 or more drinks on one occasion. The TWEAK scale is a validated tool [19] used by us routinely to identify heavy or problem drinking, and was administered to some of the cases. Smoking patterns were also separated by amounts used: those that used < 10 cigarettes/day was considered light smoking; moderate smokers consumed 10–19 cigarettes/day; and heavy smokers were women that smoked 20 or more cigarettes/day.

Continuous variables were compared using the unpaired, two-tailed Student's t test and χ^2 test was used for categorical variables. It was not possible to retrieve the same number of control clinic cases that fit the selection criterion (i.e., many cases were planning a pregnancy and therefore could not be included) and therefore the control group consists of only 122 cases.

3. Results

3.1. Pregnancy characteristics and maternal demographics

The 132 MDMA-exposed women were significantly younger (mean 23.2 vs. 31.2, $P < .0001$), earlier in their gestational age (mean 9.6 vs. 11.6 weeks, $P < .05$) and weighed less (60.3 vs. 66.2 kg, $P < .05$) compared to the nonexposed controls (Table 1).

The MDMA users had significantly fewer pregnancies (2.01 vs. 2.40, $P < .03$) and live births (0.24 vs. 0.86, $P < .0001$); in contrast, they had a higher rate of therapeutic abortions (0.57 vs. 0.20, $P < .0001$). No statistical difference was found when comparing rates of spontaneous abortions. Significantly more MDMA users reported unplanned pregnancies (84.4% vs. 54.3%, $P < .05$). MDMA users were also more likely to be single (57.0% vs. 18.3%, $P < .001$) and to be White (82.2% vs. 56.0%, $P < .05$). There was no significant difference in employment status or highest education attained, between the two groups.

3.2. Alcohol-intake patterns

Alcohol-exposure patterns differed greatly between MDMA users and controls (Table 2). The MDMA users

Table 2
Comparison of alcohol use between pregnant MDMA users and controls

Characteristic	MDMA women	Clinic women	P value
Alcohol use before pregnancy			
Yes	78	31	< .0001
No	9	9	
Alcohol use before pregnancy amounts			
None	8	8	.035
Light	17	10	
Moderate	17	10	
Heavy	17	1	
Alcohol use in pregnancy			
Yes	87	38	< .0001
No	44	84	
Alcohol use in pregnancy amounts			
None	45	85	< .0001
Light	14	21	
Moderate	21	11	
Heavy	25	1	
Binge drinking before pregnancy			
Yes	30	2	< .05
No	36	25	
Binge drinking in pregnancy			
Yes	45	2	< .0001
No	78	117	
Number of alcohol binges in pregnancy	2.12 ± 5.80	0.05 ± 0.41	< .001
Alcohol in pregnancy discontinued			
Yes	67	21	< .05
No	4	9	

were more likely to have had any alcohol exposure in pregnancy (66.4% vs. 31.1%, $P<.0001$), with a significantly greater number of women drinking heavily (23.8% vs. 0.83%, $P<.001$) compared to controls. Binge alcohol consumption, defined as ingesting five or more drinks on one occasion, occurred more often in pregnancies of MDMA-exposed women (36.6% vs. 1.68%, $P<.0001$). Among MDMA users, 44 were administered the TWEAK scale and 50% received a positive score, indicating possible high-risk drinking habits.

3.3. Cigarette use

Comparison of cigarette use is presented in Table 3. Women who reported MDMA use were more likely to smoke cigarettes compared to the control group (53.8% vs. 19.7%, $P<.0001$). There were also significantly more heavy smokers in the MDMA-exposed cohort (6.30% vs. 1.67%, $P<.001$). Rates of cutting down use of cigarettes or quitting in pregnancy did not differ significantly between the two groups.

3.4. Illicit drug use

Table 4 describes the comparison of illicit substances used. MDMA consumers had a greater tendency to also use marijuana (37.9% vs. 1.65%, $P<.001$), cocaine (21.4% vs. 1.65%, $P<.001$), amphetamines (10.6% vs. 0.00%, $P<.001$), ketamine, a dissociative anesthetic (9.92% vs. 0.00%, $P=.002$), gamma hydroxy butyrate, a salt of a GABA neurotransmitter metabolite with hallucinogenic properties (7.58% vs. 0.00%, $P=.007$), and psilocybin, "magic mushrooms" (4.5% vs. 0.00%, $P<.05$). Although some women in the MDMA cohort reported the use of other recreational drugs including LSD, phencyclidine, and mescaline, it was not significant when compared to the control group.

Table 3
Comparison of cigarette use between pregnant MDMA users and controls

Characteristic	MDMA women	Clinic women	*P* value
Cigarette use before pregnancy			
Yes	74	26	<.0001
No	52	92	
Cigarette use before pregnancy amounts			
None	51	92	<.0001
Light	25	7	
Moderate	29	6	
Heavy	14	6	
Cigarette use in pregnancy			
Yes	70	24	<.0001
No	60	98	
Cigarette use in pregnancy amounts			
None	58	96	<.001
Light	39	16	
Moderate	22	6	
Heavy	8	2	
Cigarette use in pregnancy cut down			
Yes	18	8	.557
No	30	8	
Cigarette use in pregnancy quit			
Yes	31	5	.077
No	42	20	

Table 4
Comparison of substance use between pregnant MDMA users and controls

Characteristic	MDMA women	Clinic women	*P* value
THC use before pregnancy			
Yes	47	2	<.001
No	78	118	
THC use in pregnancy			
Yes	50	2	<.001
No	82	119	
THC use in pregnancy discontinued			
Yes	35	1	.268
No	5	1	
Cocaine use before pregnancy			
Yes	27	2	<.001
No	99	119	
Cocaine use in pregnancy			
Yes	32	1	<.001
No	100	121	
Cocaine use in pregnancy discontinued			
Yes	23	1	1
No	0	0	
Amphetamine use before pregnancy			
Yes	11	0	.002
No	115	122	
Amphetamine use in pregnancy			
Yes	15	0	<.001
No	117	122	
Amphetamine use in pregnancy discontinued			
Yes	12	0	1
No	0	0	
Ketamine use in pregnancy			
Yes	12	0	.001
No	109	122	
GHB use in pregnancy			
Yes	10	0	.005
No	122	122	
Psilocybin use in pregnancy			
Yes	6	0	<.05
No	126	122	
LSD use in pregnancy			
Yes	4	0	.152
No	128	122	
Mescaline use in pregnancy			
Yes	1	0	.969
No	131	122	
Phencyclidine use in pregnancy			
Yes	1	0	.969
No	131	122	

3.5. MDMA method and pattern of use

Of the 132 women that reported MDMA use, 129 (97.7%) had exposure during the pregnancy (Table 5). The remaining 3 cases were exposed prior to becoming pregnant. Over 78% reported previous use of MDMA before their pregnancy. Out of 101 respondents, all reported discontinuation of the drug. The mean gestational age of last MDMA exposure was 5.0 weeks (range 1–24 weeks). The

Table 5
Method and pattern of MDMA use among pregnant women

Measurement	*n*	(%)/range
Number of MDMA cases in the study	132	
Previous user of MDMA before pregnancy ($n=85$)		
Yes	67	(78.8)
No	18	(21.2)
MDMA timing of exposure ($n=132$)		
In pregnancy	129	(97.7)
Before pregnancy	3	(2.3)
Use of MDMA discontinued		
Yes	101	(76.5)
Data not available	31	(23.5)
Mean gestational age of last MDMA exposure	5.0	(range 1–24)
Route of exposure ($n=104$)		
Tablet	101	(97.1)
Powder	2	(1.92)
Liquid	1	(0.96)
Mean number of tablets ingested per dose ($n=101$)	1.24	(range 0.125–5)
Number of times used in pregnancy ($n=122$)		
One time	69	(56.6)
2–5 times	43	(35.2)
>5 times	10	(8.2)
Median number of times used in pregnancy ($n=122$)	1	(range 1–672)
Concurrent recreational drug use when taking MDMA ($n=52$)		
Yes	44	(84.6)
No	8	(15.4)
Type of drug used concurrently with MDMA ($n=44$)		
Alcohol	16	(36.4)
Cocaine	12	(27.3)
Methamphetamine ("crystal" and "speed)	10	(22.7)
Marijuana	9	(20.5)
Ketamine	6	(13.6)
Gamma hydroxy butyrate	3	(6.8)
LSD	2	(4.5)
Methylphenidate (abuse)	1	(2.3)
Phencyclidine	1	(2.3)
Psilocybin	1	(2.3)

common route of exposure was tablets (97.7%). Two women reported snorting MDMA in powder form and one reported use of liquid MDMA. Of those that ingested MDMA tablets ($n=101$), the mean dose taken on one occasion was 1.24 tablets (range 0.125–5 tablets), and 28.6% of the subjects used more that 1 tablet per occasion.

Most women (56.5%) had only one exposure of MDMA during their pregnancy. There were 10 women (8.2%) with more than five episodes of MDMA use in pregnancy. The median number of times the women used MDMA in their pregnancy was 1 (range 1–672). On the extreme, there was a 15-year-old individual in our sample who did not realize she was pregnant until 24 weeks gestation. Until she became aware of her pregnancy, she was using two tablets of MDMA four times a day. Other exposures included marijuana use (three joints/day) until 24 weeks, methylphenidate abuse (7–8 tablets/day) and heavy alcohol use until 4 weeks gestation, as well as daily ibuprofen and acetaminophen (2 tablets/day, each) exposure for the first 12 weeks. She suffered from depression and mood changes, and upon contact with the Motherisk Program, had discontinued all drug use while receiving treatment at a teen crisis center.

The majority of women (94.7%) who reported MDMA exposure in pregnancy also reported exposures to other recreational drugs. Only seven cases (5.3%) of the total MDMA cohort reported MDMA exposure alone. Thirteen women (9.85%) were considered to be polydrug users at the time of consultation. In addition to MDMA, these women were also smoking cigarettes, drinking moderate to heavy amounts of alcohol, using cocaine, and in some cases, other recreational drugs. To further identify if there were any demographic differences in each extreme, their characteristics were compared to the rest of the MDMA cohort. Other than the aspect of recreational drug use, there were no demographic differences between women who used MDMA alone, compared to the rest of the MDMA cohort, and similarly, no differences between MDMA polydrug users and the remaining MDMA cohort.

From 51 respondents about the question of concurrent drug use, 84.6% ($n=44$) reported that on the occasion of MDMA use, at least one other recreational drug was used, including alcohol (36.4%), cocaine (27.3%), methamphetamine (22.7%), marijuana (20.5%), ketamine (13.6%), gamma hydroxy butyrate (6.8%), LSD (4.5%), phencyclidine (2.3%), psilocybin (2.3%), and methylphenidate (2.3%). When asked about adverse drug effects attributed to ingestion of MDMA (Table 6), out of 77 responses, 42.9% ($n=33$) reported either physical (vomiting, sweating,

Table 6
Adverse effects attributed to ingestion of MDMA among pregnant women

Measurement	*n*	(%)
Adverse effects attributed to MDMA ingestion ($n=78$)		
Yes	34	(43.6)
No	44	(56.4)
Type of adverse effects noted		
Vomiting	18	(23.1)
Sweating	3	(3.8)
Depression	3	(3.8)
Nausea	2	(2.6)
Diarrhea	1	(1.3)
Trouble sleeping	1	(1.3)
Jaw cramp	1	(1.3)
Abdominal discomfort	1	(1.3)
Headache	1	(1.3)
Blacking out	1	(1.3)
Vertigo	1	(1.3)
Felt sluggish	1	(1.3)
Bad mood	1	(1.3)
Cold	1	(1.3)
Felt sick	1	(1.3)
Increased heart rate	1	(1.3)
"Felt crappy, no vibe"	1	(1.3)
Could not move	1	(1.3)
Hospitalization	1	(1.3)

increased heart rate) or psychological symptoms (depression, bad mood, "felt crappy, no vibe").

4. Discussion

This is the first study describing the characteristics of pregnant Canadian women that use MDMA. By collecting these data prospectively, and in most cases shortly after the exposure occurred, we sought to avoid reporting and recall bias. Reporting bias is further reduced since individuals contact the Motherisk Program voluntarily. The control group was comprised of women who contacted the Motherisk Program about exposures other than MDMA. We have previously shown that women who contact the Motherisk Program have characteristics similar to those of the general population of women in Toronto [10].

Heavy alcohol consumption, cigarette use, and experimentation with other illicit drugs was evident in the MDMA sample. Focusing on alcohol consumption habits, the MDMA group had a tendency to drink heavily and also consume alcohol in a binge pattern, both before and during pregnancy. Because most of these pregnancies were unplanned, these women are at an increased risk for the teratogenic effects of alcohol. In a recent population based study, alcohol problems were found to be highly associated with MDMA use, with about half of the sample identified as being at risk for alcohol abuse or dependence [18]. We also detected a risk of problem drinking in 50% of our sample of pregnant MDMA users, after administration of the TWEAK questionnaire.

In our study, the women who were using MDMA also reported use of a wide range of illicit drugs, specifically stimulants and hallucinogens. Other studies have described experimental use of other mind-altering substances, as well as higher rates of alcohol and nicotine intake among individuals that consume MDMA [17,22,28]. As seen in our sample of MDMA users, the majority of women were also exposed to at least one other recreational drug in their pregnancy. Polydrug use among MDMA consumers appears to be the norm. The role of polydrug exposures in pregnancy risk must be addressed among women who consume MDMA, specifically additive or synergistic effects that may result from concurrent drug use [12]. Over 80% of respondents from our sample reported concurrent drug use on the occasion of MDMA intake. Synergistic effects of combining MDMA and LSD have already been documented anecdotally on internet sites and demonstrated through observation in animals. The practice is common enough that users have adopted the term "candyflipping" to describe such intake [20]. Additive effects have been demonstrated when MDMA is used in combination with alcohol to produce suppression of the immune system [16], and deleterious effects are known to occur when MDMA is used in combination with monoamine oxidase inhibitors [24].

Use of MDMA is strongly associated with music preference and attending raves [6,17,19], where thousands of individuals gather in large venues and dance vigorously to synthesized, electronic music [23]. A common effect of MDMA is elevating body temperature [26], and use while ceaselessly dancing in a hot, crowded, environment may induce hyperthermia, which, in pregnancy, is known to be teratogenic [5,8]. Future studies should address this potential mechanism.

The women in our MDMA sample were comparably younger than the control group. Reported adverse effects have been documented to differ according to gender and age. As reported in another study, females were more sensitive to the physical and psychological side effects resulting from ingestion of MDMA, especially if they were also young and polydrug users [28]. A high proportion of the MDMA users in our study reported psychiatric concerns including depression, anxiety, insomnia, and social phobia. This adds another risk factor for long-term well-being among children of MDMA users.

With the exception of one case where there was clearly excessive use, most women in our cohort generally described self-limiting and moderate use of MDMA that was discontinued once pregnancy was known. Previous studies have shown that pregnant women who use cocaine [9] and those that engage in binge alcohol consumption in pregnancy [7] share similar risks such as alcohol intake, cigarette use, and illicit drug use, as seen in our pregnant MDMA cohort.

The generalizability of these results should be addressed. The women who contacted us were self-selected and motivated to find out potential fetal risk. It is conceivable, therefore, that women who did not contact us represent an even higher risk subgroup.

Animal studies document high risk of intrauterine growth retardation and adverse neurobehavioral changed caused by MDMA in rats and chicken embryo [3,4,26].

In summary, pregnant MDMA users have a clustering of reproductive risk factors that may result in compromising the pregnancy and fetus. They tend to be younger, single, have more therapeutic abortions, and report frequent psychological morbidity. A relatively high rate of unplanned pregnancies combined with heavy alcohol consumption, cigarette use, and concurrent illicit drug use increases the risk of fetal exposure to potentially harmful substances. Consideration of these unique factors while taking into account the place and pattern of MDMA consumption are important when interpreting possible risks and effects associated with exposure in pregnancy.

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