High sensation seeking as a risk factor for metamphetamime dependence in late adolescence

Sookjaroen Tangwongchais* Prathan Rutchatajumroon**
Puangsoy Warakul* Nuntika Thavichachat *


Objective : This study is aimed to identify sensation seeking temperament and other psychosocial factors as the risk factors of metamphetamime dependence in late adolescence

Design : Analytical matched case-control study.

Method : 98 metamphetamime abusers randomly recruited from 5 healthcare centers were matched with 98 normal secondary school students randomly recruited from 10 secondary schools in Bangkok by multistage sampling technique for age, sex, socioeconomic status. All subjects were assessed for their demographic information: psycho-social and substance use history, sensation seeking temperament by SSS (Sensation Seeking Scale). Seekers of high sensation were defined in both groups. Univariate analysis was performed to identify other risk factors. Linear regression analysis was also done to adjust the odd ratio for high sensation seeking and other psychosocial factors.

* Department of Psychiatry, Faculty of Medicine, Chulalongkorn University
** Department of Psychiatry, King Chulalongkorn Memorial Hospital
Result: The SSS scores of methamphetamine abusers were significantly higher in Experience Seeking, Disinhibition and Boredom Susceptibility sub-scores than in the controls. The univariate analysis showed that high sensation seeking, substance use of peers, substance use of mother, substance use of sibling, substance use in community, Grade Point Average less than 2.00; all these may be risk factors for methamphetamine dependence. In multivariate analysis, high sensation seeking remained as significant risk factor in methamphetamine dependence of this population with adjusted odd ratio = 2.59 (95 % CI = 1.07-6.18). Substance uses in peer group and community, Grade Point Average < 2.00 were also demonstrated as risk factors.

Conclusion: High sensation seeking, influence of peer group, household environment and low academic achievement were risk factors for methamphetamine use of late adolescence.

Keywords: Methamphetamine, dependence, sensation, seeking.

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สุขเจริญ ตั้งวงศ์ไชย, ประธาน รัชดาภรณ์, พวงระย้า วิชญาณ, นันทิกา จันทร์ชัย. การเสริมสร้างสมทบแพทย์มีกับปัญจключ-weight ด้านความรู้สึกแสวงหาสัมพันธ์แล้วร้าใจในระดับสูงของวัยรุ่น. จุฬาลงกรณ์เวชศาสตร์ 2546 ก.ย.; 47(9): 527 – 41

วัตถุประสงค์ : เพื่อค้นหาว่าการมีความรู้สึกแสวงหาสัมพันธ์แล้วร้าใจในระดับสูงและมีปัจจัยทางจิตส่งผลใดบ้างที่อาจเป็นปัจจัยเสี่ยงในการติดยาแกรมแผลต่อสมรรถภาพของวัยรุ่น

วิธีการ : การศึกษาเปรียบเทียบแบบปัจจัย

รูปแบบการศึกษา : การศึกษาเปรียบเทียบแบบปัจจัย

วิธีการ : สุ่มเลือกผู้ป่วยติดยาแกรมแผลต่อสมรรถภาพมีปัจจัยการที่ระดับสูงเป็นต้น จำนวน 98 ราย จำปุฎจีสำคัญเกณฑ์อายุ เพศ และระดับเศรษฐกิจฐานรากที่มีความรู้สึกแสวงหาสัมพันธ์แล้วร้าใจ ดำเนินการในโรงพยาบาลจุฬาลงกรณ์มีปัจจัย 10 โรงเรียน จำนวน 98 คนผู้ป่วยจี ทุกรายได้รับการประเมินด้วยการตอบแบบสอบถามด้านตนเองเพื่อเก็บข้อมูลส่วนบุคคล ข้อมูลด้านจิตสังคม ประวัติเรื่องราวแพทย์ ความรู้สึกแสวงหาสัมพันธ์แล้วร้าใจเพื่อนๆที่มีความรู้สึกแสวงหาสัมพันธ์แล้วร้าใจระดับสูงและน่าจะถูกใช้ไปไว้ประสิทธิ์ทางสถิติเพื่อหาความสัมพันธ์และค่านิยมความเสี่ยงของ odds ratio ของตัวแปรต่างๆ บวก การวิเคราะห์การติดยาแกรมแผลต่อสมรรถภาพมีปัจจัยทางจิตสังคมที่เกี่ยวข้อง

ผลการศึกษา : ผู้ติดยาแกรมแผลต่อสมรรถภาพมีความรู้สึกแสวงหาสัมพันธ์แล้วร้าใจสูงกว่ากลุ่มควบคุม อย่างมีนัยสำคัญทางสถิติในคะแนนรวมและคะแนนย่อยในขั้นการตอบแบบสอบถามการไข้ (Experience Seeking) การขาดความยับยั้งกังข์ (Disinhibition) และแนวโน้มในการเกิดความเบื่อยกย่อง (Boredom Susceptibility) และยังพบว่าการมีค่านิยมความรู้สึกแสวงหาสัมพันธ์แล้วร้าใจระดับสูง การใช้ยาแกรมแผลต่อสมรรถภาพมีปัจจัยและมารยาทหรือที่เป็นการใช้ยาแกรมแผลต่อสมรรถภาพในแหล่งที่พักอาศัยการมีโรคเจ็บป่วยสะสมเท่ากับ 2.00 เป็นปัจจัยเสี่ยงที่สำคัญของการติดยาแกรมแผลต่อสมรรถภาพมีปัจจัยทางจิตสังคม ขณะที่การวิเคราะห์เวกตอทุกพันว่าการมีความรู้สึกแสวงหาสัมพันธ์แล้วร้าใจระดับสูงอย่างเป็นปัจจัยเสี่ยงที่มีความสำคัญทางการติดยาแกรมแผลต่อสมรรถภาพมีปัจจัยทางจิตสังคมโดยมีค่า adjusted odd ratio เท่ากับ 2.59 (95 % CI = 1.07 – 6.18) นอกจากนี้การใช้ยาแกรมแพล์ระดับสูงและการใช้ยาแกรมแผลต่อสมรรถภาพมีปัจจัยทางจิตสังคมที่ต้องการค้นพบว่ามีความสำคัญทางการติดยาแกรมแพล์ระดับสูง

สรุป : ความรู้สึกแสวงหาสัมพันธ์แล้วร้าใจในระดับสูง การติดยาแกรมแพล์ระยะสูงมีปัจจัยทางจิตสังคมที่ต้องการค้นพบว่ามีความสำคัญทางการติดยาแกรมแพล์ระดับสูง ความรู้สึกแสวงหาสัมพันธ์แล้วร้าใจในระดับสูง การติดยาแกรมแพล์ระยะสูงมีปัจจัยทางจิตสังคมที่ต้องการค้นพบว่ามีความสำคัญทางการติดยาแกรมแพล์ระดับสูง ความรู้สึกแสวงหาสัมพันธ์แล้วร้าใจในระดับสูง การติดยาแกรมแพล์ระยะสูงมีปัจจัยทางจิตสังคมที่ต้องการค้นพบว่ามีความสำคัญทางการติดยาแกรมแพล์ระดับสูง ความรู้สึกแสวงหาสัมพันธ์แล้
Substance abuses and dependences, especially amphetamine related problems, have been one of the major health problems and concerns in Thai society. It causes individual and family dysfunction. Several national policies and strategies are launched and implemented to ameliorate the situation. In 2000, the total figure of subjects registered for drug treatment throughout the country was 41,746.\(^1\) The estimated cases of amphetamine abusers from National household survey done during March to October 2001 reported by the Office of Narcotics Control Board (ONCB) of Thailand was about 1 million cases who were exposed to amphetamine during the past 12 months. 490,300 cases were reported using amphetamine during the past 30 days and more than half of the cases, 286,300 subjects, were between 12-24 years old. One year prevalence was estimated from this survey that 2-3 hundreds thousands individuals would be cases of amphetamine dependence.\(^5\) The etiology of amphetamine dependency is cited to be multifactorial. Researches have been conducted to identify all possible risk factors for effective prevention and treatment programs. Psychosocial factors have been found to play crucial roles in amphetamine dependence.\(^3-5\) Biological attributions also show particular influences as the vulnerable factors interacting with pharmacological effects of amphetamine.

Personality and temperamental variables play a salient role in substance use disorder across age, sex and culture.\(^6\) Sensation seeking was defined by Zuckerman as “the need for varies, novel and complex sensation, and the willingness to take physical and social risks for the sake of such experience” is well characterized by Sensation Seeking Scale, a self-report questionnaire.\(^7\) Sensation seeking is postulated to be a temperamental profile, a genetic attribution, rather than character trait, which is derived from childhood rearing.\(^8\) Seekers of high sensation have strong positive affective reaction to situations of novelty and risk. They are happiest and they function best at a high tonic level of arousal; and they behave in a way that would maintain their high level of arousal.\(^9\) High sensation seeking has been found to be risk factor for several kinds of illicit drug, alcohol use or dependence and smoking.\(^10-14\) Few literatures directly documented the relation between SSS and amphetamine related problems. The primary objective of this study was to compare the SSS between amphetamine abusers and normal controls in Bangkok metropolitan. We hypothesized that high sensation seeking would be one of the major risk factors for amphetamine dependence. We also controlled the possible confounding factors in our matched case-control designs. Moreover, psychosocial factors that would attribute to the risk for amphetamine dependence were also studied in this population.

**Material and method**

Subjects recruited in this study were adolescents in Bangkok metropolis. We selected this specific sample population, because this age group was found to have the highest prevalence of amphetamine-related problems in Thailand. All subjects were recruited from December 2001 to February 2002 with written informed consents. Subjects were males and females, aged between 15 – 18 years old with no previous psychiatric history.
Matched-pair case-control design was used to control age, sex, and incomes of family and educational level of father and mother as indicators for socioeconomic status in the population. The prevalence of high sensation seeker in our first pilot study done with 143 secondary school students in Bangkok was estimated to be 0.37%. 25 pairs of cases and non-cases were randomly selected and obtained for the SSS score. The estimation of odd ratio for high sensation seeking in metamphetamine dependence was found to be 3.86 (95% CI = 1.18 – 12.61). β and α values were set as 5 and 10%. The sample size was calculated to be 95 matched pairs case-control.

The cases were 98 amphetamine abusers seeking for treatment at 5 healthcare centers in Bangkok. To avoid having subjects with amphetamine withdrawal symptoms, all cases were abstinent by negative urine screening test and they had been already on treatment program for at least 1 week prior to their enrollment. Polysubstance abusers were excluded from the study, except for cigarette smoking which was common co-morbidity.

The control group composed of students enrolled by multi-stage cluster sampling technique from 10 secondary schools in Bangkok. All control subjects were screened by Drug Abuse Screening test Thai version (DAST) to exclude possible substance use; also for previous psychiatric history by self-reported screening questionnaires for psychiatric problems. 98 students were selected and matched with 98 subjects in metamphetamine abuser group.

Instruments and measurement

Before enrollment, the screening self-report questionnaire for psychiatric disorder was used to exclude subjects with possible pre-morbid major psychiatric disorder which included psychosis, manic episode, depression, anxiety disorder, obsessive-compulsive disorder. The questionnaire comprised of 24 force dichotomous items, which was validated and used in Bangkok psychiatric epidemiologic survey by Thavichachart N. et al. with good sensitivity and specificity (0.96 and 0.93, respectively).15

In the process of including the control group, short version of Drug Abuse Screening Test (DAST) was used to screen out the possible substance abusers. DAST was a 28-item screening instrument developed by Skinner for clinical screening and treatment evaluation research in the field of substance abuse to measure a dominant single dimension of problem related to substance use and abuse.16 Short version of DAST (DAST-S) was a questionnaire comprised of 10 dichotomous items that was translated and validated in clinical population. DAST-S appeared to have good reliability and validity (kappa = 0.889; sensitivity = 0.94; specificity = 0.94).

All studied subjects were asked to fill up 2 more self-reported questionnaires. Firstly, all demographic and psychosocial information were obtained by using “Psycho-social and Substance Use History Questionnaire” developed by South Suburban Council on Alcoholic, and translated into Thai by Suwannachote K.17 Finally, Sensation Seeking Scale (SSS) – form V French version modified by Carton et al. from the classical form V of Zuckerman was used to identify high sensation seekers. SSS-form V was 40 items, dichotomous self-rated questionnaire, which was translated into Thai and validated by 2,930 adolescents aged between 12-18 years old.43 The Kuder Richardson (KR 20)
internal consistency appeared to show the a coefficient = 0.83 in male and 0.89 in female. Test-retest reliability was 0.78. The upper quartile of scores obtained from subjects with the age of 15-18 years old in this population was defined as "high sensation seekers" which included any subjects who got the scores higher than 20 in male and 19 in female.

The modified SSS form V Thai version includes four sub-scales:

1. Thrill and Adventure Seeking (TAS): it involves seeking sensation through physically risky activities which provide unusual situations and novel experiences.

2. Experience Seeking (ES): it involves seeking sensation through a nonconforming lifestyle, travel, music, art, drug and unconventional friends.

3. Disinhibition (Dis): it involves seeking sensation through social stimulation, parties, social drinking and a variety of sex partners.

4. Boredom Susceptibility (BS): it involves aversion to boredom produced by unchanged conditions or person.

**Data collection and statistical analysis**

Demographic data, psychosocial information were obtained as independent variables, including income, family profile, family relationship, rearing pattern in family, history of substance use in family, substance use of girls or boyfriends and peer groups, educational history and achievement, legal and criminal history, household environment. High/low sensation seeking statuses were also obtained as independent variables. Statistical analysis was done by computer software SPSS for Windows version 10. Chi-square test and fisher exact test were performed to demonstrate the association of certain risk factors and amphetamine dependence. The odd ratios were also calculated for each risk factor. The risk factors defined by univariate method would be used in linear regression analysis for the final adjusted odd ratio.

**Result**

According to the matched case-control design, the majority of subjects included in both groups were 79.9 % male subjects with the mean age of 16.38 ± 1.02 years old. There were more Buddhist in case group than in control group. 93 cases (94.9%) and 94 control subjects (95.9 %) stayed with their families or relatives. Control subjects were found to have statistically significant higher educational level and better Grade Point Average (GPA) than in the cases (p < 0.001), as showed in table 1.

The psychosocial profile showed that 15.3 % of control subjects and 17.3 % of cases came from single-parent families. They seemed to have quite stable relationships in 74.5 % of cases and in 90.8 % of control subjects. There were significantly more family members with history of substance use in the cases than in the control group as showed in table 2. Cigarette smoking was the most frequent substance use in their families. Half of the siblings of amphetamine abusers also had history of amphetamine use. It was also found that the cases had more friends or girl/boyfriends who abused substance. They also lived in communities with more use of substance or amphetamine than the controls. Moreover, the cases had more histories of school probation, histories of being fired from school and histories of being arrested than the normal-controls as showed in table 2.
**Table 1.** Demographic characteristics of subjects.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Case (N=98)</th>
<th>Control (N=98)</th>
</tr>
</thead>
<tbody>
<tr>
<td>n (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>78 (79.6)</td>
<td>76 (79.6)</td>
</tr>
<tr>
<td>Female</td>
<td>20 (20.4)</td>
<td>20 (20.4)</td>
</tr>
<tr>
<td>Age(years)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>25 (25.5)</td>
<td>25 (25.5)</td>
</tr>
<tr>
<td>16</td>
<td>25 (25.5)</td>
<td>25 (25.5)</td>
</tr>
<tr>
<td>17</td>
<td>34 (34.7)</td>
<td>34 (34.7)</td>
</tr>
<tr>
<td>18</td>
<td>14 (14.3)</td>
<td>14 (14.3)</td>
</tr>
<tr>
<td>Religious *</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Buddhism</td>
<td>95 (96.9)</td>
<td>88 (89.8)</td>
</tr>
<tr>
<td>Others</td>
<td>3 (3.1)</td>
<td>10 (10.2)</td>
</tr>
<tr>
<td>Education level**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤ Grade 10</td>
<td>54 (55.2)</td>
<td>36 (36.7)</td>
</tr>
<tr>
<td>Grade 11</td>
<td>19 (19.4)</td>
<td>23 (23.5)</td>
</tr>
<tr>
<td>Grade 12</td>
<td>25 (25.4)</td>
<td>39 (39.8)</td>
</tr>
<tr>
<td>Grade point average (G.P.A) **</td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤ 2.00</td>
<td>57 (58.2)</td>
<td>25 (25.5)</td>
</tr>
<tr>
<td>2.01-2.99</td>
<td>37 (37.8)</td>
<td>45 (45.9)</td>
</tr>
</tbody>
</table>
| ≥3.00                        | 4 (4.0)     | 28 (28.6)      *

* p < 0.05 ** p < 0.001

**Table 2.** Psychosocial characteristics of subjects.

<table>
<thead>
<tr>
<th>Psychosocial Characteristic</th>
<th>Case (N=98)</th>
<th>Control (N=98)</th>
</tr>
</thead>
<tbody>
<tr>
<td>n (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Family profile</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single parent</td>
<td>17 (17.3)</td>
<td>15 (15.3)</td>
</tr>
<tr>
<td>Stable relationship with family</td>
<td>73 (74.5)</td>
<td>89 (90.8)</td>
</tr>
<tr>
<td>Substance use of father *</td>
<td>64 (65.3)</td>
<td>50 (51.0)</td>
</tr>
<tr>
<td>Substance use of mother *</td>
<td>16 (16.3)</td>
<td>5 (5.10)</td>
</tr>
<tr>
<td>Substance use of sibling *</td>
<td>29 (33.0)</td>
<td>10 (11.9)</td>
</tr>
<tr>
<td>Girl/boy friend, Peer group</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Have any girl/boy friend</td>
<td>56 (57.1)</td>
<td>15 (15.3)</td>
</tr>
<tr>
<td>Substance use of girl/boy friend</td>
<td>20 (20.4)</td>
<td>3 (3.06)</td>
</tr>
<tr>
<td>Substance use of peer **</td>
<td>94 (95.9)</td>
<td>28 (28.6)</td>
</tr>
</tbody>
</table>
Table 2. Continuous.

<table>
<thead>
<tr>
<th>Psychosocial Characteristic</th>
<th>Case (N=98)</th>
<th>Control (N=98)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n (%)</td>
<td>n (%)</td>
</tr>
<tr>
<td>Substance use in community **</td>
<td>82 (83.67)</td>
<td>52 (53.10)</td>
</tr>
<tr>
<td>Metamphetamine use in community</td>
<td>82 (83.67)</td>
<td>39 (39.79)</td>
</tr>
<tr>
<td>Other psychostimulant use in community</td>
<td>8 (8.16)</td>
<td>3 (3.06)</td>
</tr>
<tr>
<td>Opiate substance use in community</td>
<td>13 (13.26)</td>
<td>5 (5.10)</td>
</tr>
<tr>
<td>Marihuana use in community</td>
<td>31 (31.63)</td>
<td>7 (7.14)</td>
</tr>
<tr>
<td>Volatile substance use in community</td>
<td>19 (19.39)</td>
<td>16 (16.33)</td>
</tr>
<tr>
<td>History of penalty and criminality</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Probation from school **</td>
<td>20 (20.4)</td>
<td>2 (2)</td>
</tr>
<tr>
<td>Being Fired from school **</td>
<td>11 (11.2)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Being arrested **</td>
<td>31 (31.6)</td>
<td>0 (0)</td>
</tr>
</tbody>
</table>

*p < 0.05  ** p < 0.01

The metamphetamine abusers also had significantly higher scores in the total sum score of SSS and 3 out of 4 subscale scores, except for Thrill and Adventure subscales as seen in table 3. 50 metamphetamine abusers compared to 22 normal controls were found to be high sensation seekers. The odd ratio was calculated to determine the related risk factors and the result was found that 6 variables, as showed in table 4, remained the risk factors for subjects with metamphetamine dependence. We performed linear regression analysis to keep all the significant risk factors in account for metamphetamine dependence in analysis of adjusted odd ratio. The result showed that only high sensation seeker, substance use of peers, living in community with widely use of metamphetamine, Grade Point Average under 2.00 remained statistically significant as risk factors for metamphetamine dependence.

Table 3. Sensation Seeking score of cases and controls.

<table>
<thead>
<tr>
<th>Sensation Seeking Scale</th>
<th>Case (N=98) (mean ± SD)</th>
<th>Control (N=98) (mean ± SD)</th>
<th>Paired t-test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thrill and adventure</td>
<td>5.19 ± 2.46</td>
<td>5.56 ± 2.58</td>
<td>0.983</td>
</tr>
<tr>
<td>Experience seeking*</td>
<td>4.52 ± 1.84</td>
<td>3.47 ± 1.72</td>
<td>4.09</td>
</tr>
<tr>
<td>Disinhibition*</td>
<td>5.04 ± 2.13</td>
<td>2.65 ± 1.92</td>
<td>8.28</td>
</tr>
<tr>
<td>Boredom susceptibility*</td>
<td>4.18 ± 1.99</td>
<td>2.79 ± 1.59</td>
<td>5.7</td>
</tr>
<tr>
<td>Total score*</td>
<td>18.93 ± 5.52</td>
<td>14.47 ± 5.37</td>
<td>5.79</td>
</tr>
</tbody>
</table>

*p < 0.001
Table 4. Univariate analysis of selected risk factors for Metamphetamine Dependence.

<table>
<thead>
<tr>
<th>Risk factors</th>
<th>Matchd Odds ratio</th>
<th>95% CI</th>
<th>McNemar’s Chi-square</th>
</tr>
</thead>
<tbody>
<tr>
<td>High sensation seeking **</td>
<td>3.63</td>
<td>1.83-7.86</td>
<td>16.49</td>
</tr>
<tr>
<td>Substance use of peer group **</td>
<td>34.00</td>
<td>9.06-286.43</td>
<td>62.23</td>
</tr>
<tr>
<td>Substance use of mother *</td>
<td>3.20</td>
<td>1.12-11.17</td>
<td>5.76</td>
</tr>
<tr>
<td>Substance use of sibling **</td>
<td>3.50</td>
<td>1.55-8.89</td>
<td>11.11</td>
</tr>
<tr>
<td>Substance use in community **</td>
<td>4.33</td>
<td>2.06-10.17</td>
<td>18.75</td>
</tr>
<tr>
<td>Grade point average &lt; 2.00 **</td>
<td>5.57</td>
<td>2.46-14.76</td>
<td>22.26</td>
</tr>
</tbody>
</table>

* p < 0.05, ** p < 0.001

Table 5. Multivariate linear regression analysis of selected risk factors for Metamphetamine Dependence.

<table>
<thead>
<tr>
<th>Risk factors</th>
<th>Adjusted Odds ratio</th>
<th>95% CI</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>High sensation seeking</td>
<td>2.57</td>
<td>1.07-6.18</td>
<td>0.035</td>
</tr>
<tr>
<td>Substance use of peer group</td>
<td>51.73</td>
<td>15.82-169.16</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Substance use in community</td>
<td>4.59</td>
<td>1.81-11.67</td>
<td>0.001</td>
</tr>
<tr>
<td>Grade Point Average &lt; 2.00</td>
<td>4.12</td>
<td>1.67-10.05</td>
<td>0.002</td>
</tr>
</tbody>
</table>

Discussion

To examine the relation of metamphetamine dependence with high sensation seeking and certain psychosocial factors in this study, we conducted matched case-control study of 98 pair of adolescents in Bangkok metropolis. The SSS scores of metamphetamine abusers were significantly higher in Experience Seeking, Disinhibition and Boredom Susceptibility sub-scores than in the controls. The univariate analysis showed that high sensation seeking, substance use of peers, substance use of mother, substance use of sibling, living in community with widely uses of substance, having Grade Point Average less than 2.00 may be risk factors for metamphetamine dependence. By performing linear regression analysis, high sensation seeking and certain psychosocial factors still remained significant risk factors in metamphetamine dependence of this population. This finding confirmed our hypothesis that temperamental profile of high sensation seeking may be one of the vulnerable factors for metamphetamine dependence in Bangkok adolescence.

Our finding was consistent with Zuckerman’s report (19) that found high sensation seeking significantly correlated with uses of amphetamine and 3 more illicit drugs in college students. Simon TR
et al. also found this correlation in 120 high school students in California by using 11 items sensation seeking portion of Zuckerman Kuhlman Personality Questionnaire. Most documented literature that reviewed the association between high sensation seeking and substance use and several other risk behaviors, as can be found in the reports of the following authors, namely: Comeau, Wagner, Zuckerman and Kuhlman, Framques, Bamea, Ball, Andrucci, Galizia, and Forthun et al. The majority of these reports were about alcohol and marijuana, and they were done in non-clinical population. None of the above was designed to demonstrate the relation between sensation seeking and amphetamine use.

Sensation Seeking Scale (SSS) was one of the most widely used instrument to assess novelty seeking or sensation seeking. Jaffe and Archer also found that Sensation Seeking Scale of Zuckerman was one of the most sensitive predictor of the pattern of drug use. Thus SSS was suitable instrument to be used in addressing individual susceptibility for drug dependence. Since SSS may be influenced by age and gender that would be essential confounders of previous studies, the period of adolescence and male gender would show tendency to have higher scores of SSS. By matched case-control design of the present study, it would yield more confidence in correcting methodological confounder from other studies. Our study showed that high sensation seeking was one dominant risk factor that proved our prior hypothesis, but question still remains: in which way this temperament would associate with amphetamine use? Moreover, is high sensation seeking a state marker that pre-existing before the onset of metamphetamine use or trait marker resulting from abusing the substance?

For Zuckerman’s Sensation Seeking Scale was developed under biological basis, it was found to be quite stable temperamental profile in both normal individuals and drug abusers with high retest reliability from Zuckerman’s original works. The stability was also observed in Thai adolescence that 4-week test/re-test reliability coefficients for Thai-version Sensation Seeking Scale was 0.785. Thus the high sensation seeking in our population would represented the trait marker rather than the effects from uses of metamphetamine. However, this hypothesis could not be definitely conclusive by our study design. Cohort study or repeated measurement for high sensation seeking in these samples would more accurately confirm this finding.

The relationship between high sensation seeking and metamphetamine abuse/dependence is actually under investigation. Although sensation seeking had been hypothesized, according to the Optimal level of Arousal theory as reviewed by Zuckerman, several efforts failed to demonstrate the specific preference of substances of high sensation seeker who should theoretically preferred to use CNS stimulants than CNS depressants or hallucinogens. But high sensation seeking would rather be one vulnerable trait marker that related with any kind of substance to a specific kind of drug of abuse. Recent researches also found that the high sensation seeking is genetically inherited temperament in both animal model and human subjects. There were two theoretical formulations which attempted to explain the root of drug abuse known as “exposure” and “adaptive” theories. The exposure theory presumes that merely
exposing someone to a drug is a critical risk factor
and emphasizes the role of drugs as rewarding
stimuli resulting in stimulation of mesolimbic
dopamine-reward circuit in the brain. Adaptive theory
postulated that individual differences exist prior to
the first drug exposure; both of them are genetically
and environmentally determined.\textsuperscript{(32)} High sensation
seekers are found to be more sensitive to the euphoric
effect of amphetamine administration\textsuperscript{(33)} and to have
more certain functional defects in the mesolimbic
dopamine-reward circuit. The latter phenomenon was
cited as "reward deficiency syndrome"\textsuperscript{(34)} that made
the high sensation seekers respond robustly to all
novel stimulations and substances which activate the
reward center in the brain. There were also indirect
supports from peripheral marker that high sensation
seekers had lower level of monoamine oxidase (MAO)
in blood platelets.\textsuperscript{(35, 36)}

More evidences demonstrated the role of
genetics in the expression of sensation seeking. Fulker
\textit{et al.}\textsuperscript{(37)} studied the character of sensation seeking
in pairs of monozygotic and dizygotic adult twins
and found that genetics factors were accounted for
58 \% of the variances in SSS scores. The genetic
was influential in determining the vulnerability to drug
abuse, such as in animal model using selective
breeding and standard inbred mice and rats which
provided a conclusion that behavioral sensitivity to
various drug of abuse is under the effects of certain
genes.\textsuperscript{(38)} In human studies, in particular, the genetic
link to alcoholism was proved the strongest\textsuperscript{(39)} and
its candidate genes would relate to dopamine receptor
gene, especially D2 receptor gene.\textsuperscript{(40)}

When comparing the sub-scores from the
present study, our result found that amphetamine
abuser scored high in the General sum scale and
all sub-scores, except for Thrill and Adventure (TA)
which were consistently compatible with the original
conceptual construct of Zuckerman’s SSS that
Experience Seeking (ES) factor seemed to involve
the seeking of arousal through non-conforming life-
style and Disinhibition (Dis) which sought release
through drinking, gambling and sex.\textsuperscript{(9)} This may be
confirmed by the report of the original work of
Zuckerman\textsuperscript{(19)} that showed the highest correlation
of subscale scores and drug abuse was Experience
Seeking (ES) and the General sum scale. Another
finding of Pederson \textit{et al.}\textsuperscript{(41)} also showed positive
correlation between Experience Seeking (ES),
Disinhibition (Dis) and illicit drug abuse in Norwegian
adolescence.

The peer group influences demonstrated in
our study were almost similar with the study of the
risk factors related to the use of amphetamines in
Chinese adolescent students conducted by Ko
\textit{et al.}\textsuperscript{(42)} This may correlate with the availability
of amphetamine that made abusers easily exposed to
the drug. Although several studies found that family
influence was a major risk factor, however, we could
not identify similar significant effect in the multivariate
analysis. It may be due to our cases and controls
were already matched for socioeconomic status which
would link to other family factor or family pattern of
drug abuse which was genetically determined through
high sensation seeking phenomenon. By all means,
the family influence on amphetamine dependence may
be much more complicated and need more precise
methodological design to draw a reliable conclusion.

One questionable finding in our study was
that the academic achievement which was found
to have an important effect on amphetamine dependence in this population. It was probable that it causes more than the consequence of drug dependence, because we asked GPA of all amphetamine abusers prior to the first exposure of metamphetamine. The low academic achievement may be related to the intellectual ability of metamphetamine abusers and linked to their poor life skills which have not been investigated in this study. Thus low academic achievement prior to the exposure of metamphetamine may relate to other factors that have not been investigated in this study or it may result from the direct effect of temperamental profile.

Because the etiology of amphetamine dependence is much more complicated, risk factors other than high sensation seeking—which were not demonstrated here—should not be definitely excluded. The present result represented only late adolescence in Bangkok metropolis and generalization should be done with caution.

To enrich more knowledge from our study, one can find other biological marker, which would correlate with high sensation seeking trait and proceed to postulate its etiological model in explaining the relation of biological and psychosocial determinants. Furthermore, high sensation seeking may be used as a screening method to identify for high risk adolescents who would prone to abuse metamphetamine and other substance. Specifically, preventive strategies may be needed for these individuals.

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