การศึกษาผลของการติดเมทแอมเฟตามีนต่อความเข้มข้นของเซลล์อสุจิในหนูแรทเพศผู้ (การรายงานผลขั้นต้น)

The study of sperm concentration in male rats with methamphetamine addiction: a preliminary report

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บทคัดย่อ

เมทแอมเฟตามีน (methamphetamine; METH) เป็นยาผิดกฎหมายที่ได้ถูกรายงานว่าก่อให้เกิดผลในการกระตุ้นระบบประสาทส่วนกลาง (central nervous system; CNS) และทำให้เกิดการเสื่อมของเซลล์ประสาทภายในสมอง ยิ่งไปกว่านั้นเมทแอมเฟตามีนก็ยังได้ถูกรายงานว่าก่อให้เกิดความเป็นพิษต่อระบบสืบพันธุ์ โดยการได้รับเมทแอมเฟตามีนทำให้การเคลื่อนที่ของเซลล์อสุจิลดลง รวมทั้งการได้รับเมทแอมเฟตามีนแบบเฉียบพันและกึ่งเฉียบพลันยังทำให้ความเข้มข้นของเซลล์อสุจิลดลงและรูปร่างเซลล์อสุจิผิดปกติ โดยการศึกษาครั้งนี้มีวัตถุประสงค์เพื่อศึกษาผลของการติดเมทแอมเฟตามีนต่อความเข้มข้นของเซลล์อสุจิในหนูแรทเพศผู้ ซึ่งผลของการศึกษาครั้งนี้แสดงให้เห็นว่า ความเข้มข้นของเซลล์อสุจิในหนูกลุ่มที่ได้รับเมทแอมเฟตามีนแบบค่อยๆเพิ่มความเข้มข้นของเมทแอมเฟตามีนมีการลดลงเชิงปริมาณแต่ยังไม่มีค่าความแตกต่างทางสถิติเมื่อเปรียบเทียบกับกลุ่มควบคุมถึงแม้ว่าการลดลงเชิงปริมาณในความเข้มข้นของเซลล์อสุจิไม่มีความแตกต่างทางสถิติ แต่ผลจากการศึกษาครั้งนี้ก็แสดงให้เห็นถึงผลเสียของการได้รับเมทแอมเฟตามีนต่อความเข้มข้นของเซลล์อสุจิ

คำสำคัญ : เมทแอมเฟตามีน, คุณภาพอสุจิ, ความเข้มข้นของเซลล์อสุจิ

Abstract

Methamphetamine (METH) is an unlawful drug which the effect of METH can induce central nervous system (CNS) and neurodegenerative in the brain. Moreover, METH has an effect on reproductive toxicology causing an aberrant of sperm motility, sperm morphology and sperm concentration. Thus, this preliminary study was investigated the effect of METH addiction on sperm concentration in the male rats. Three groups of METH treatment were evaluated. The sperm concentration in the ED-METH group wasnumerically decreased when compared with the control group. Although, a decrease of the sperm concentration in the ED-METH groupjust failed to reach significant, but this result show that METH has an adverse effect on sperm concentration.

Keywords : methamphetamine, sperm quality, sperm concentration

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Introduction

Methamphetamine (METH) is an unlawful drug used second most popular in worldwide (Cruickshank, C.C., and Dyer, K.R., 2009). It has been reported as a cause of neurodegeneration in the brain and central nervous system (CNS) stimulant which related to euphoria, alertness, hallucination and delirium (Derlet, R.W., and Heischober, B., 1990). Furthermore, the previous study showed that METH has not only been reported as a neurotoxicity but also reproductive toxicity.

The previous study of Yamamoto et al. demonstrated that sperm motility in male mice was decreased after treated with METH at 15mg/kg (Yamamoto, Y., Yamamoto, K., and Hayase, T., 1999). Moreover, the previous study of Nudmamud-Thanoi and Thanoi demonstrated that treatment with acute and sub-acute of METH has effects on sperm quality by decreased normal sperm morphology and sperm concentration in male rats (Nudmamud-Thanoi, S., and Thanoi, S., 2011). Therefore, the objective of the present study was to investigate the sperm concentration in male rats after METH addiction.

Material and method

The methods of this study consist of treatment with METH in the male rats, analysis of sperm concentration and statistical analysis.

D-methamphetamine hydrochloride with the permission from the Ministry of Public Health was purchased from the Lipomed AG, Arlesheim, Switzerland.

Male spraguedawley rats were divided into 4 groups compose of control group (n=14), acute dose-METH binge (AB-METH) group (n=4), escalating dose-METH (ED-METH) group (n=4) and escalating dose-METH binge (ED-METH binge) group (n=4). Intraperitoneal injection (i.p.) was used to treated with saline or METH to male rats in this study.

In the control group, the male rats were treated with 0.9% saline for 15 days before sacrificed. In the AB-METH group, the male rats were treated with 0.9% saline for 14 days and treated with METH at 6 mg/kg for 4 times every 2 hours interval on day 15 before sacrificed (table 1).In the ED-METH group, the male rats were treated with initial intensity of METH at 0.1-3.9 mg/kg on day 1-13 every 3 hours interval for 3 times per day and treated with METH at 4 mg/kg every 3 hours interval for 3 times on day 14 and treated with 0.9% saline every 2 hours interval for 4 times on day 15 before sacrificed (table 1).In the ED-METH binge group, the male rats were treated with initial intensity of METH at 0.1-3.9 mg/kg on day 1-13 every 3 hours interval for 3 times per day and treated with METH at 4 mg/kg every 3 hours interval for 3 times on day 14 and treated with METH at 6 mg/kg for 4 times every 2 hours interval on day 15 before sacrificed (table 1).

The male rats were sacrificed by cervical dislocation. After that, cauda epididymis was immediately dissected, placed and minced into phosphate buffer saline (PBS) to release spermatozoa. Then, spermatozoa were collected and fixed in 10% formaldehyde. Hemocytometer

was used to count spermatozoa under bright field microscope. The counted spermatozoa were calculated into the epididymal sperm number (x10^6 cells/ml).

The sperm concentration was analyzed by one-way ANOVA following by LSD test. The data was showed as mean±SEM. The significant was determined as P-value less than 0.05.

Days	Methamphetamine dose (mg/kg)			
	7.30 (a.m.)	10.30 (a.m.)	13.30 (p.m.)	
1	0.1	0.2	0.3	
2	0.4	0.5	0.6	
3	0.7	0.8	0.9	
4	1.0	1.1	1.2	
5	1.3	1.4	1.5	
6	1.6	1.7	1.8	
7	1.9	2.0	2.1	
8	2.2	2.3	2.4	
9	2.5	2.6	2.7	
10	2.8	2.9	3.0	
11	3.1	3.2	3.3	
12	3.4	3.5	3.6	
13	3.7	3.8	3.9	
14	4.0	4.0	4.0	
Day	**7.30 (a.m.)**	**9.30 (a.m.)**	**11.30 (a.m.)**	**13.30 (p.m.)**
15	6	6	6	6

Table 1. The schedule of METH administration for AB-METH group on day 15, ED-METH group on day 1-14 and ED-METH binge group on day 1-15 (adapted from Segal, et al., 2003).

Result

The result of the present study showed that the sperm concentration was numerically decreased in the ED-METH group (231.82±43.61x10^6 cells/ml) when compared with the control group (240.22±23.39x10^6 cells/ml) but it just failed to reach significant (figure 1).

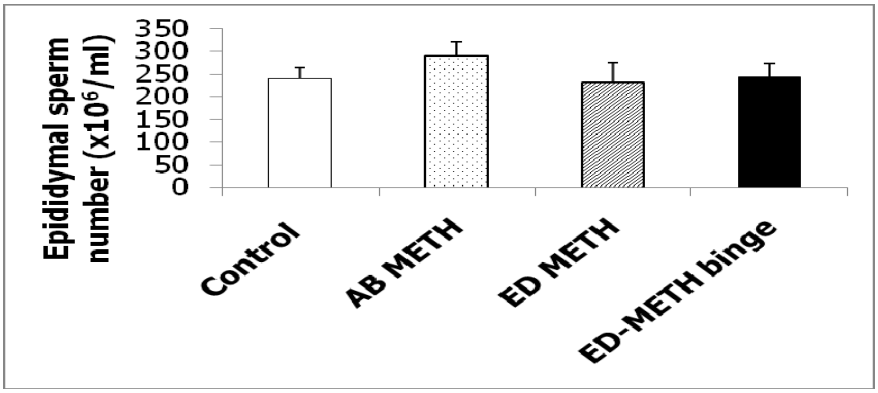

Figure 1.Epididymal sperm number (x10^6 cells/ml) in the treated with METH groups compared with the control group. Data were showed as mean±SEM (ANOVA post-hoc LSD).

Discussion

The result of the sperm concentration in the present study was numerically decreased in the ED-METH group. This result was consistent with the previous study of Nudmamud-Thanoi and Thanoi which indicated that acute and sub-acute treated with METH can decrease the sperm concentration (Nudmamud-Thanoi, S., and Thanoi, S., 2011). However, a decrease of sperm concentration in this study just fails to reach significant. This may due to doses and times of treated with METH in this study were differentiated from the previous study. The sperm concentration in this study may significantly decrease if the male rats were treated with METH at the higher dose and/or the longer time.

Conclusion

Although, a decrease of sperm concentration in this studyjust failed to reach significantbut this result shows that METH has adverse effect on sperm concentration.

Acknowledgement

This research was carried out at Neuroscience and Reproductive Biology Research Group, Department of Anatomy, Faculty of Medical Science, Naresuan University and supported by Naresuan University Research Fund.

References

Cruickshank, C.C., and Dyer, K.R. (2009). A review of the clinical pharmacology of methamphetamine.**Addiction,** 104(7), 1085-1099.

Derlet, R.W., and Heischober, B. (1990). Methamphetamine Stimulant of the 1990s?.,**The Western Journal of Medicine,** 153, 625-628.

Nudmamud-Thanoi, S., and Thanoi, S. (2011). Methamphetamine induces abnormal sperm morphology, low sperm concentration and apoptosis in the testis of male rats. **Andrologia,** 43(4), 278-282.

Segal, D.S., Kuczenski, R., O'Neil, M.L., Melega, W.P., and Cho, A.K. (2003). Escalating Dose Methamphetamine Pretreatment Alters the Behavioral and Neurochemical Profiles Associated with Exposure to a High-Dose Methamphetamine Binge. **Neuropsychopharmacology,** 28, 1730–1740.

Yamamoto, Y., Yamamoto, K., and Hayase, T. (1999).Effect of Methamphetamine on Male Mice Fertility.**Journal of Obstetrics and Gynaecology Research**, 25(5), 353