Introduction
As an important industry chemical, Vinyl chloride monomer (VCM) is mainly used in the production of plastics, insulating materials, adhesives and coatings. In the past years, many epidemiological surveys showed that occupational exposure of VCM could result in increasing incidences of fetal losses, birth defects, congenital malformations and so on. VCM is known as a risk factor to pregnancy-induced syndrome of pregnant women who and/ or whose husbands occupationally expose to VCM. Furthermore, some studies suggested that VCM is permeable to placenta and thus has toxic effects on embryo development.

But most above studies focused on embryo-fetal toxicity and female reproductive toxicity. Little attention has been paid to its toxicity effects on the male reproductive system. In fact, in China male young adults are main exposure population to VCM as workers. Potential hazard of VCM on male has became one hot spot to evaluate adverse effects of VCM on reproductive system.

In the current study, experimental studies and a cross-sectional epidemiological survey were designed and carried out. The relationship between VCM concentration in male workers and levels of several serum sex hormones, including testosterone (T), inhibin B, luteinizing hormone (LH), follicle stimulating hormone (FSH), estradiol (E2) were investigated in the epidemiological study.

Objective
To investigate the effect of vinyl chloride exposure on the damage of male reproductive endocrine system.

Method
(1) Experimental survey: male rats were randomly divided into high-dose and low-dose treatment groups, and control group. 28 days after exposure, serum and testis samples were collected for testing testosterone (T), follicle-stimulating hormone (FSH), luteinizing hormone (LH), estradiol (E2) and inhibin (InhB) levels.

(2) Epidemiological studies: 22 TCE exposed workers and 22 non-exposed controlled subjects were enrolled in the study. The serum levels of FSH, LH, E2, T and InhB were analyzed using enzyme-linked-immunosorbent-assay (ELISA).

Results
(1) Experimental survey: Compared with the control group, after 14-day exposure serum levels of T and InhB were decreased (P<0.05), E2 and LH levels were increased (P<0.05), and testis level of T was decreased (P<0.05); after 28-day exposure, serum levels of T and InhB were decreased (P<0.05), FSH was increased (P<0.05), testis level of T and InhB were decreased (P<0.05). It was found that Leydig cell and Sertoli cell were damaged according to histopathological examinations.

(2) Epidemiological studies: Adjusted by age, work age, gender, smoke and drink adjusted, serum E2 levels were decreased (P<0.05) in of VCM-exposed workers, whereas FSH and LH levels were increased (P<0.05) compared with unexposed workers. In addition, E2 level in exposed workers younger than 38 yr-old was lower than that of unexposed workers at the comparable age (P<0.05). FSH and LH levels of exposed workers older than 38 yr-old were higher than those of unexposed workers older than 38 yr-old (P<0.05).

Growing Development and Poisoning Symptoms

Discussion
This study combined the animal tests with the population survey. We observed that changes of serum effect indexes in the two stages were not uniformly the same. The levels of T and InhB of exposed group were decreased significantly and no marked variation of E2 was observed in animal experiments while in population survey the former indexes had no obvious changes and the latter one was significantly reduced. The discrepancy may caused by the following reasons: ① species variation, ② difference of exposure time, and ③ difference of exposure scenarios and doses. However, it is worth noting that variation tendency of serum FSH in exposed animals and people was consistent. As a gonadotropin secreted by basophil of glandular pituitary, FSH regulates the development, growth, pubertal maturation, and reproductive processes of the body. In males, FSH induces Sertoli cells to secrete Androgen-binding proteins (ABPs) and its secretion is being regulated by inhibin's negative feedback mechanism on Anterior Pituitary gland. High levels of FSH may indicate that the normal restricting feedback from the gonad is absent, leading to an unrestricted pituitary FSH production. This study suggested that FSH might be a sensitive and effective early warning indicator for reproductive function damage.

In previous studies about reproductive toxicity, usually parts of T, E2, LH and FSH were chosen, which could not entirely reflect the status of reproductive endocrine. In this study, we have tested all 5 hormones of HPTA, which were very comprehensive on all hormones that secreted by or directly act on testes and reproductive endocrine system, hoping to provide a more comprehensive and reliable picture to understand reproductive toxicity of vinyl chloride in male animals or human subjects.

Conclusion
Both results of experimental studies and occupational epidemiological survey indicated that VCM had reproductive and endocrine toxicity on male rats and male human subjects.