CHAPTER IV

DISCUSSION

1. Reasons for selection of collecting and analysing times

The use of spot samples for urine analysis have been discussed by many investigators.[29,60,91] The evidences suggested that the errors arising from the use of spot samples were not significantly greater than when 24 hour urine specimens were used. Therefore, it was decided to use spot samples by collecting at about 10.30 a.m. in order to avoid the problems occurred when obtaining 24 hour urine samples.

From the preliminiary study on the stability of coproporphyrin and delta-aminolevulinic acid, it was found that CP disappeared markedly when storaged for 24 hours at room temperature without any preservative. Refrigeration or alkaline preservation could improve the stability of CP, but not completely; considerable loss was still noticable. Therefore, it was decided to analyse CP immediately on the day of collection. ALA showed satisfactory stability when refrigerated at 4°C and analysed within 48 hours.

2. Comparison of lead absorption between exposed group and control group

There was an evidence of increased lead absorption in the exposed group characterized by the higher values of urinary lead, coproporphyrin and delta-aminolevulinic acid excretions than those in the control group. The differences of the three parameters between exposed group and control group were statistically significant when expressed in unit per volume of

urine, but when expressed in unit per gram creatinine, only urinary lead showed significant difference. This finding was still not understood. However it is worthwhile to note here, for exposed group, that the amount expressed in unit per gram creatinine was roughly 0.6 times of the amount expressed in unit per volume of urine. The figure agreed well with that obtained in the study by Cramér & Selander[21] who found that the concentration of ALA in unit per gram creatinine was roughly 0.5 times of the figure for ALA in unit per volume of urine. However for control group, it was 0.8 although there was no significant difference of creatinine excretion between the two groups.

The mean CPU and ALAU levels in the exposed group obtained from this study were in the normal ranges according to the criteria set by Lane et al.,[50] but agreed well with the work of Lauhachinda[51] who also studied in Thai subjects. Since it is well accepted that individuals have wide variation in sensitivity to toxic agents, we may assume that perhaps Thai subjects showed lesser responses to the effect of lead on heme synthesis than those studied by Lane et al.

The mean concentration of urinary lead in control group (67.17 µg/l) obtained from this investigation was higher than an international normal level (35 µg/l) reported by Goldwater et al.[37] using the dithizone method which is less sensitive than the atomic absorption spectrophotometer.

3. Correlation between urinary parameters and durations of exposure

The exposed population who worked in battery factory were classified into three groups according to the durations of exposure (1-5 years, 6-10 years and more than 10 years). It was found that only urinary lead showed significant differences among the three groups of different durations of exposure. Urinary CP and urinary ALA showed no significant differences. This demonstrates that urinary ALA and urinary CP are not sensitive enough to be used as indicators in this point of view, particularly in the case of low or intermediate level of exposure.

4. Relationship among the three urinary parameters

The correlations among the three urinary parameters were found to be statistically significant in this study, as previously reported by Tola et al.[83] who obtained the correlation coeffients of 0.39, 0.48 and 0.48 for PbU vs ALAU, PbU vs CPU and ALAU vs CPU respectively. It was mentioned that both CPU and ALAU were useful indicators for the effect of lead upon the organism.

The difference between the correlation coefficients for the same parameters expressed in unit per volume of urine and unit per gram creatinine was not statistically significant in the exposed group. For the control group there was considerable difference, the expression in unit per gram creatinine showed greater correlation than that expressed in unit per volume of urine. This finding could not be clearly explained. It might possibly be that there was difference in lead, CP and ALA excretion mechanism between exposed group and control group. Vostal[86] demon-

strated that there were two routes of lead excretion, glomerular filtration and tubular secretion. In subjects with normal or mildly increased body lead stores, lead is excreted almost entirely by glomerular filtration,[65] but in subjects with high blood lead level or older lead workers, transtubular flow may play a greater importance.[23] The trend to lesser urinary excretion of lead in old workers was reported by Cramer et al.[23] Goyer et al.[39] found that over a wide range of lead ingestion, urinary lead excretion remained constant. These findings had been explained that they were due to the limitation of tubular excretion.

It may be concluded, from this investigation, that in the screening test to detect excessive lead absorption, expression reference to creatinine has no advantage over the simple expression in unit per volume of urine as it was found by Cramer & Selander.[21] However the expression in reference to creatinine excretion may have value in expression of lead excretion of other groups.

5. Selection of test

Correlations of CPU and ALAU with PbU were both satisfactorily significant. CPU had slightly higher correlation with PbU than ALAU, but ALAU had greater specificity. It has been observed that delta-aminolevulinic aciduria occurs only in porphyrin cutanea tarda, hypochromic anaemia after gastrectomy and hereditary tyrosinaemia, while coproporphyrinuria occurs in various forms of anaemia, particularly the diffuse haemolytic type, in jaundice due to hepatocellular damage or biliary obstruction, in some infectious diseases such as pneumonia and poliomyelitis, in various types of poisoning with substances such as mercury, bismuth and

sulfonamides, and in other diseases.[41] Since now the methods for the determination of ALA and CP in urine are both simple and quick, the selection then, would depend upon factors such as specificity and availability of chemicals. If there are evidences to exclude the other causes of coproporphyrinuria, the urinary coproporphyrin determination is preferable and if necessary, analysis by a semi-quantitative method can be effective. There appears to be good evidence for using only one of the urinary parameter in the screening since their excretions follow one another.[9] However, if it is suspected that an individual has been excessively exposed then more comprehensive test would be required.