Evaluation Study for Reference Intervals of Urine Sediments Using UF-1000*i* in Medical Checkup Population

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Our healthcare center mainly provides wellness screenings. This facility, established in December 2007, utilizes the most advanced equipment, and is independent from the hospital. During this study, our goal was to establish the reference intervals of urine sediment from the specimens at this facility, by using the fully automated urine particle analyzer UF-1000i, Sysmex Corporation. In addition to analysis parameters RBC, WBC, EC, CAST, and BACT, we examined research parameters X'TAL, YLC, SRC, Path. CAST, MUCUS, and SPERM. As a result, we found out the upper limit of the reference interval by age and gender. Valuable reference data was obtained for the healthcare center.

Key Words Urine Sediment, Fully Automated Urine Particle Analyzer, UF-1000*i*, Reference Intervals

Received 23 March, 2009; Accepted 10 April, 2009

INTRODUCTION

Urine tests have major clinical significance, as they are useful in screening for, and identifying the causes of, kidney and urinary tract diseases, and assessing the therapeutic effect of drugs. Urine samples can be collected non-invasively, and repeated measurements are easy. For these reasons, they are among the most frequently used clinical laboratory tests. The urine sediment test, which differentiates the urine components in detail, is effective in understanding pathological abnormalities, as in identifying the disease site. On the other hand, some shortcomings of the test have been pointed out. These include the long time and large amount of hands on labor needed for preparing the specimens and the variation in the test results, depending on the skill level of the technician who conducts the test[1)].

With the wider use of urine particle analyzers in recent years, urine sediment tests could be made more efficient and less labor intensive. As a result, the urine sediment test has been improved in terms of the quality and speed. Information about urine particles obtained by analyzers can be used in combination with microscopic examination of urine sediments to efficiently obtain more reliable information. In using urine particle analyzers, however, it is necessary to set retest criteria, and to interpret the results properly. Retest criteria are important in deciding whether to undertake microscopic examination of urine sediments, but universally applicable values cannot be set. Each laboratory has to set its own reference intervals, taking into account the target patient population and the analyzer method.

In this study, we used a fully automated urine particle analyzer UF-1000*i* (Sysmex Corporation, Kobe, Japan. hereinafter, UF-1000*i*) installed in the healthcare center annexed to our hospital, to determine the reference intervals in population who underwent wellness screening. In this time, no subject was excluded on the basis of the interview or diagnosis, which CLSI recommends. The UF-1000*i* is based on flow cytometry, and is a urine screening device with which different urine components can be analyzed automatically. Quantitative values of analysis parameters (RBC, WBC, EC, CAST, and BACT) can be obtained using non-centrifuged urine samples. Apart from the reference intervals of these five parameters, we also determined the reference intervals of research parameters (X'TAL, YLC, SRC, Path.CAST, MUCUS, and SPERM), and examined their usefulness.

Note: This article is translated and republished from Sysmex J. 31: 82-86, 2008.

SUBJECTS AND METHODS

1. Subjects

In the present study, 2433 persons who underwent wellness screening during December 2007 to April 2008 at the health care center were included. Of these, 1319 were males and 1114 females. Their mean age was 53 (range 23 to 85). Age group-wise numbers of subjects are shown in ***Table 1***.

2. Methods

The urine samples were analyzed within one hour after collection using the UF-1000*i*. Specimens which had values outside of the analyzable limits of the instrument, were excluded from the population used for determining the reference interval. The reference values were determined with the reference range calculation program MCP-STAT (Sysmex Corporation), using the nonparametric method.

In the nonparametric method, healthy persons are used as the parent population, and the sufficiently large sample population is required. However, as it is possible to obtain the reference interval which has only one of the limits (upper or lower); the method is considered effective for parameters like urine components where the normal test value is basically zero.

Gender-wise frequency distributions were obtained in each parameter, and the 5% on the high side of the distribution was rejected to determine the reference interval.

RESULTS

1. Analysis parameters

Frequency distribution (***Fig. 1***) and the upper reference limits (***Table 2***) of the analysis parameters RBC, WBC, EC, CAST, and BACT are shown below. The upper reference limits for RBC, WBC, EC, CAST, and BACT were respectively 13.1, 9.2, 5.7, 2.25, and 11.4 /μL for males and 30.7, 39.0. 45.6, 2.40, and 385.8 /μL for females. Thus, females had higher values for all the parameters, BACT being particularly high. Age group wise, for females, BACT and EC were high in the younger groups. In males, RBC tended to become high with advancement of age.

2. Research parameters

The upper reference limits of the research parameters (***Table 3***) are given below. The upper reference limits of X'TAL, YLC, SRC, Path.CAST, and MUCUS, were respectively 0.27, N.D. (0), 4.08, 0.52, and 7.14 /μL for males, and 0.30, 0.02, 5.97, 0.67, and 4.82 /μL for females. SPERM was not detected in either males or females. Females generally showed higher values of all research parameters other than MUCUS.

Table 1 *Breakdown of study subjects by sex and age group*

	Males	Females
Age ≤ 39	212	187
Age 40-49	317	291
Age 50-59	324	315
Age ≥ 60	466	321
Total	1319	1114

Table 2 *Gender-wise and age group-wise upper reference limits of analysis parameters measured by UF-1000i*

	Males					Females				
	RBC	WBC	EC	CAST	BACT	RBC	WBC	EC	CAST	BACT
Overall	13.1	9.2	5.7	2.25	11.4	30.7	39.0	45.6	2.40	385.8
Age ≤ 39	7.9	10.3	7.6	2.80	8.6	35.4	42.0	51.0	3.14	452.8
Age 40-49	13.0	9.5	5.9	2.30	13.6	25.8	43.9	52.3	2.50	454.1
Age 50-59	13.1	7.4	5.1	2.21	11.2	30.9	27.0	39.2	2.13	313.2
Age ≥ 60	15.0	9.7	5.5	1.65	11.5	34.0	36.2	24.0	2.05	139.8

(Unit: /μL)

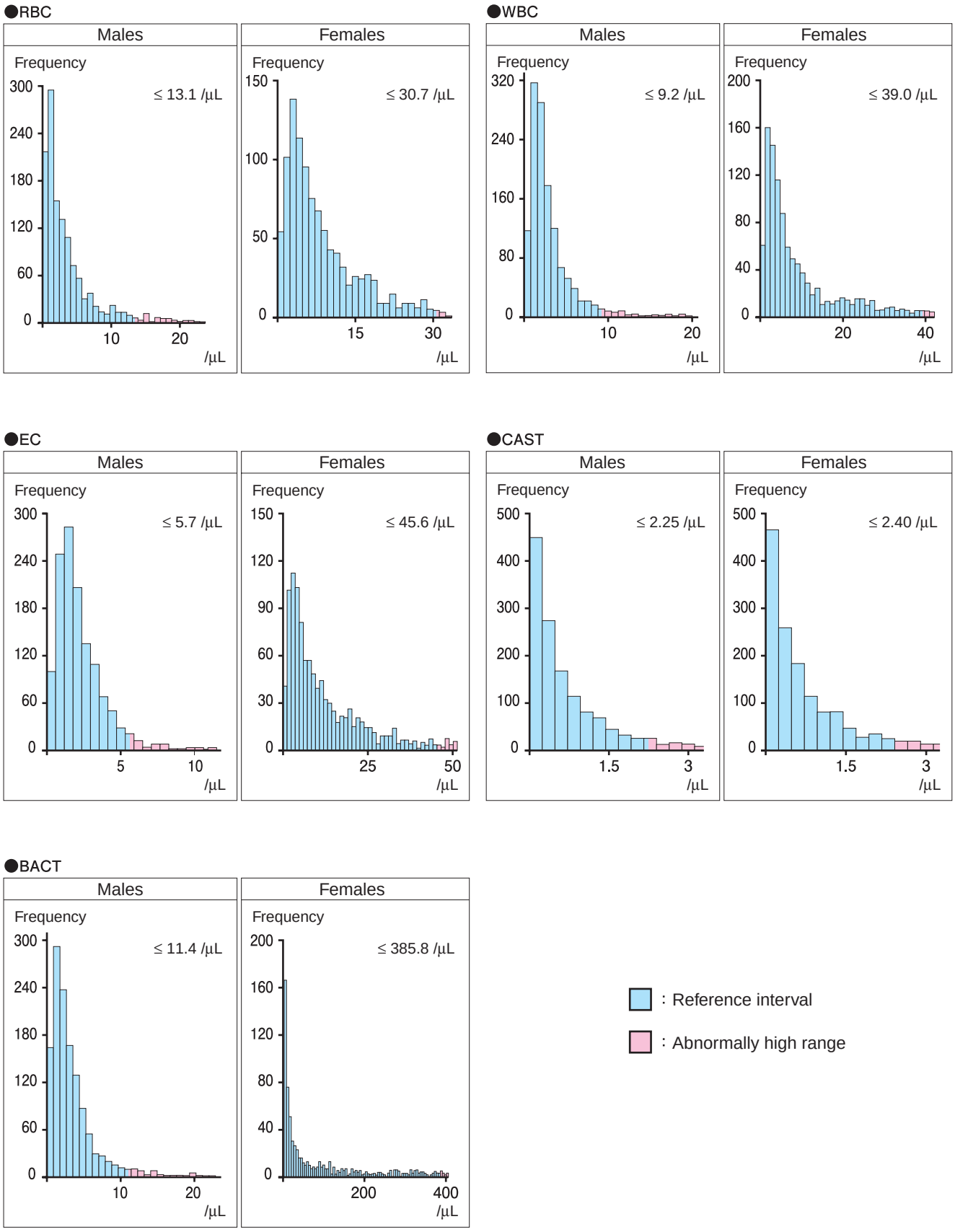

Fig. 1 *Gender-wise frequency distribution of the values of analysis parameters measured by UF-1000i*

Table 3 *Gender-wise upper reference limits of research parameters measured by UF-1000i*

	Males					Females				
	X'TAL	YLC	SRC	Path.CAST	MUCUS	X'TAL	YLC	SRC	Path.CAST	MUCUS
Overall	0.270	__*	4.080	0.523	7.140	0.304	0.019	5.970	0.667	4.820

*: Not Detectable (Unit: /μL)

DISCUSSION

1. Analysis parameters

Although the reference values of almost all the parameters matched with clinical knowledge, some parameters showed slightly higher values than expected. Patients undergoing wellness screening were the target population of the present study. So, it was expected that a fewer number of subjects would show abnormal values compared to samples collected from patients in a hospital. Nevertheless, the fact that no subject was excluded on the basis of the interview or diagnosis may probably have affected the results.

Another possibility is that some foreign component or vaginal excretion got intermixed at the time of urine sampling. Ideally, midstream urine should be used for males and catheter urine (bladder urine) for females. But here, for the sake of convenience, midstream urine was used for females also. The guidelines for diagnosis of hematuria specifies an RBC count of 20 /μL as the criterion[2]. In our present results, males showed an upper limit of 13.1 /μL, which is less than this criterion, and females 30.7 /μL, which is higher than the criterion. Females tended to show similarly high values for BACT, WBC, and EC also. Even if midstream urine is sampled, the intermixing of external components such as epithelial cells are often detected in females. Besides, it is difficult to completely prevent the intermixing of RBC from the menstrual cycle, and WBC and EC originating from vaginal secretions. Moreover, vaginal secretions contain large numbers of indigenous lactobacilli. The results of the present study also suggest some intermixing of indigenous bacteria. The higher vales of BACT in females of the younger age groups also seem to support this, as younger women have more of vaginal secretions. It is not easy to make persons coming for wellness screening clean the region around the urethral opening before collecting the urine sample. Therefore, the clinical reference values for WBC and BACT for female obtained in this study are not close to the values specified by guidelines. Nevertheless, they reflect the values obtained in routine measurement.

The urine sample collection method is a major factor that affects the test results significantly. Therefore, there must be constant effort to examine and improve it, and to guide test subjects suitably. At the same time, it is also necessary to keep in mind that some parameters might show high values when tested at healthcare centers, and to identify the abnormal values actually caused by disease.

2. Research parameters

Research parameters are investigative parameters measured by UF-1000*i* for detecting the pathological components. X'TAL, YLC, Path.CAST, and SPERM should not normally be present in urine. The clinical reference values of these parameters obtained in the present study were all near zero. Thus, we believe that these reference values were properly determined. MUCUS is found at some frequency even in the urine of healthy persons and the value found here can be used for reference purpose. SRC stands for small round cells. Some leukocytes and epithelial cells are counted as SRC by this analyzer. Therefore, the measured values for SRC were a little high, which was expected.

We have to keep in mind that the results obtained here are for parameters for the investigative use of UF-1000*i*. But they could be useful as reference information.

CONCLUSION

In the present study, we determined the reference intervals of wellness screening data measured by UF-1000*i*. As a result, we could obtain values that reflected the results of routine measurement at a health care center, although some parameters gave values that were not close to those specified in guidelines. The results obtained here are very useful in the analysis of wellness screening data and as reference information for setting retest criteria in the use of the UF-1000*i* analyzer. In addition to the results obtained with the analyzer, patient information, such as the results of interviews, other test findings, the conditions at the time of the urine sampling, etc, should be comprehensively taken into account before finally deciding whether the subject had a particular disease.

References

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