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Original Article

Comparison of test results and performances of hitachi 7600 and beckman olympus 5800 automatic biochemical analyzers

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Abstract: Objective: The test quality and stability of the biochemical analyzer test systems are extremely important because they can affect the medical standards of an entire hospital. Therefore, the performance test and evaluation of biochemical analyzers are important for their daily use. To investigate the performances of Hitachi 7600 and Beckman AU5800 automatic biochemical analyzers, and evaluate the consistency of the test results. Materials and Methods: Collect 400 clinical serum samples, and test 50 indices using the Hitachi 7600 and Beckman AU5800 automatic biochemical analyzers. Calculate the precision, accuracy, and other performance indices, and then compare the differences in the performances of the two instruments. Results: From the test speed of the 400 blood samples, the test times of Beckman AU5800 and Hitachi are (3.6±0.4) h and (4.7±0.8) h, respectively, and the test speed of AU5800 is significantly higher than that of Hitachi 7600 ($P < 0.05$). The difference in the test results of the quality control product is not statistically significant ($P > 0.05$). For comparing the bias of the test results, the qualification rates of all the test items are > 90% with bias < ½ EQA (External Quality Assessment) as the criterion. There is a reasonable consistency between the test results of the two instruments. In terms of the sample injection speed, test, and reporting speed, AU5800 operates faster than Hitachi 7600. Conclusions: Both the automatic biochemical analyzers have a good precision and accuracy, with AU5800 having a faster test speed. Therefore, AU5800 is recommended to be used in hospitals and test centers with a large sample size, which can suitably share the pressure of emergency samples.

Keywords: Medical device, automatic biochemical analyzer, Hitachi 7600, Beckman AU5800, biochemical test

Introduction

A biochemical analyzer that is a type of analyzer used for clinical diagnosis [1, 2] is the most basic and essential medical device at all the hospitals [3]. Initially, biochemical analyzers performed tests by manual operation using a chromometer, a photometer, and other methods. Although their capacity to test samples was highly limited with a generally low efficiency [4], the development of science and technology has led to the emergence of automatic operation systems in all the fields and industries. Consequently, an automatic biochemical analyzer has completely replaced the previous manually operated analyzer, significantly enhancing the work efficiency of hospital laboratories [5]. Currently, all the clinical laboratories in hospitals have newly configured automatic biochemical analyzers [6, 7], among which Hitachi 7600 and Beckman AU5800 automatic biochemical analyzers are the most widely used series, which are easy to operate and have a high accuracy. As the number of patients visiting a doctor is rapidly increasing, and thereby expanding medical studies, diagnostic techniques, performances, and test quality and stability of the biochemical analyzer test systems is extremely important because it can directly affect the medical standards of an entire hospital [8, 9]. Although the manufacturer provides the performance data of a system for testing when each series of automatic biochemical analyzers leaves the factory, and all

Table 1. Basic clinical data of patients

Factor	Number [n (%)]
Gender	
M	287 (71.8)
F	113 (28.2)
Age	
< 18	105 (26.25)
≥18, < 45	146 (36.5)
≥45, < 60	113 (28.25)
≥60, < 90	31 (7.75)
≥90	5 (1.25)
Region	
Countryside	216 (54)
City	184 (46)
Nation	
Han	375 (93.8)
Other	21 (5.2)
Marital status	
Married	275 (68.75)
Unmarried	125 (31.25)

Table 2. Comparison of detection speed

Factor	HITACHI 7600	AU5800	P
Detection time (h)			
Each sample	0.5±0.2	0.5±0.1	0.411
100 samples	2.4±0.6	1.8±0.1	0.037
400 samples	4.7±0.8	3.6±0.4	0.018

the data and conclusions satisfy the clinical requirements, the test results of the samples will vary with the test environment after the analyzer has been operated in clinical works for a time. Therefore, the performance test and evaluation of biochemical analyzers are particularly important for their daily use. Concurrently, Because of these new and advanced instruments are expensive, the number of patients and samples is small in numerous primary hospitals, and so, it is difficult to maximize the performance of an automatic biochemical analyzer by using powerful functions. Therefore, selecting different models of the automatic biochemical analyzers according to the actual demands of a hospital is a relatively practical approach.

According to the requirements of ISO 15189 and CNAS-CL38 (2012), contrast data demonstrating the consistency of the results should be provided when several sets of test systems are designed by a laboratory and used to test the same test sample [10]. Therefore, we compared and analyzed the results of the routine tests performed by Beckman AU5800 and Hitachi 7600 automatic biochemical analyzers used in the clinical biochemistry laboratory of the clinical laboratory in our hospital.

We comprehensively evaluate both the biochemical analyzers through our experiment to provide clinical application references for the different standards of hospitals.

Materials and method

Samples

We randomly selected 400 fresh blood samples for the routine physical examination in the clinical laboratory of our hospital. The samples excluded the repeating samples of a patient, and those involving cases of hemolysis, jaundice, lipidemia, and other abnormalities. We collated the basic clinical data of these patients, as summarized in **Table 1**. New blood samples were included on the first day of the experiment. We also discarded the blood samples of patients refusing the test, patients with an acute disease or malignancy or infectious disease, and newborns. All the patients supplying the test samples and their family members signed informed consent forms, and the designed experiment was approved by the medical ethics committee of our hospital.

Instruments and reagents

The Hitachi 7600 automatic biochemical analyzer was provided by Hitachi Medical Device (Beijing) Co., Ltd, and the Beckman Olympus AU5800 automatic biochemical analyzer was provided by the Beckman Coulter Trade (China) Inc. The calibrators, quality products, and test reagents used by both the instruments were provided by Beijing Strong Biotechnologies, Inc. The installation and testing of the instrument were guided by an engineer directly assigned by the factory, and the reagents were stored in a -4°C medical refrigerator when not in use.

Test method

The test method is as follows: The quality product, calibrator, and blood samples are removed from the -4°C medical refrigerator 30 min prior to equilibrate to the room temperature. The

Table 3. Contrast of intra group fine density

Project	HITACHI 7600		AU5800		P
	SD	CV (%)	SD	CV (%)	
TP	61.7±0.3	0.48	60.8±0.5	0.82	0.831
ALB	36.5±0.2	0.55	37.2±0.3	0.81	0.633
TBILI	15.9±0.4	1.25	16.2±0.2	1.23	0.725
DBILI	6.15±0.1	1.62	6.24±0.2	1.60	0.656
IBILI	14.6±0.2	1.37	14.8±0.1	0.67	0.869
GLB	25.8±0.4	1.55	25.2±0.1	0.39	0.752
A/G	1.41±0.1	7.09	1.47±0.1	6.81	0.682
ALT	34.8±0.3	0.86	34.2±0.1	0.29	0.188
AST	23.5±0.8	3.41	24.1±0.7	2.91	0.226
TBA	12.2±0.7	5.73	13.1±0.2	1.52	0.631
ALP	67±1.2	1.79	64.3±0.8	1.24	0.531
GGT	39.5±0.9	2.27	38.1±0.7	1.83	0.266
5UN	11.1±0.4	3.61	10.9±0.3	2.75	0.126
PA	293±0.8	0.27	288±0.5	0.17	0.484
CHE	9206±11.8	0.12	9198±10.4	0.11	0.774
Ca	2.33±0.1	4.29	2.41±0.2	8.29	0.727
Mg	0.95±0.04	4.21	0.91±0.05	5.49	0.337
P	0.86±0.01	1.16	0.84±0.02	2.38	0.730
TCO2	21.2±1.03	4.85	20.8±0.91	4.37	0.425
K	3.92±0.21	5.35	3.81±0.15	3.93	0.121
NA	142±1.53	1.07	139±1.48	1.06	0.802
CL	107±0.85	0.79	106±0.68	0.64	0.377
BUN	3.10±0.12	3.87	3.04±0.11	3.61	0.184
Cr	57.87±1.2	2.07	59.25±0.8	1.35	0.682
UA	349±2.64	0.75	341±2.11	0.61	0.436
B-MG	1.03±0.01	0.97	1.02±0.01	0.98	0.389
RBP	52.58±0.6	1.14	53.14±0.8	1.51	0.152
Cysc	0.74±0.05	6.75	0.69±0.06	8.69	0.339
LDH	202.24±0.91	0.44	201.86±0.83	0.41	0.729
CK	115.5±0.87	0.75	114.2±0.74	0.64	0.448
CK-MB	11±0.11	1	12.1±0.09	0.74	0.257
MYO	66.9±0.54	0.08	67.6±0.31	0.45	0.404
CTnI	0.014±0.001	7.14	0.018±0.001	5.55	0.696
ACB	81.2±0.14	0.17	82.4±0.11	0.13	0.306
IMA	64.01±0.3	0.46	63.87±0.2	0.31	0.783
AMY	72.0±0.18	0.25	71.2±0.16	0.22	0.388
LPS	64.4±0.21	0.32	63.5±0.14	0.22	0.797
GLU	4.85±0.08	1.64	4.72±0.05	1.05	0.703
GSP	2.16±0.01	0.46	2.18±0.01	0.45	0.778
BHBDH	154.6±0.89	0.56	152.7±0.88	0.57	0.231
TCHOL	4.42±0.08	1.81	4.35±0.05	1.14	0.265
TG	3.17±0.02	0.63	3.15±0.01	0.31	0.703
HDL	1.02±0.02	1.96	1.01±0.03	2.97	0.351
LDL	2.09±0.09	4.31	2.14±0.04	1.86	0.694
TG/CH	1.04±0.01	0.96	1.05±0.01	0.95	0.364
APOAL	0.97±0.02	2.06	1.01±0.03	2.97	0.931
APOB	0.67±0.03	4.47	0.71±0.02	2.81	0.167
LP-A	69.4±0.14	0.21	70.1±0.16	0.22	0.349
APA/B	1.44±0.04	2.77	1.42±0.03	2.11	0.492
Hcy	11.8±0.3	2.54	12.1±0.2	1.65	0.627

instrument is started as usual and the corresponding maintenance procedure is performed automatically. Subsequently, the sample needle, reagent needle, and stirring rod are checked for any water drops or bloodstains. Further, it is examined whether they are bent or blocked. The rinse tanks are examined for blockages or smudginess after starting. Refill the modules with the reagents and cleaning fluids if they are found to be insufficient after checking, and then the liquid waste is discarded, the liquid water bucket is cleaned, and the cleaning program is performed. Tests for a normal data transmission between the computer port and biochemical analyzer is conducted, and this is followed by testing five different batches of the quality control products, and calibration with a calibrator. The blood samples are centrifuged at a speed of 5000 rpm for 10 min after quality control. 500 μL of the serum is drawn to sample cup, and placed on the sample shelf of the biochemical analyzer. The relevant indices are tested after sample-loading in turns; specifically, all the samples are loaded on AU5800 in turn after the completion of the test on Hitachi 7600. Each index is continuously tested ten times for five days, the index values tested by both the instruments are recorded, and contrastive analysis is performed.

Reference standard

Based on the requirements of ISO 15189, the precision was represented by the standard deviation (SD) and coefficient of variation (CV). Based on the EP15-A2 document of the Clinical and Laboratory Standards Institute, different batches of the quality control products are tested, and the relative bias (SE%) between the test and target values is calculated. The results are acceptable if the precision is ≤ ½ of the CLIA'88 total allowable error.

Statistical method

All the test results and enumeration data were represented by ($\bar{x}$ ± s) and

Table 4. Comparison of precision between groups

Project	HITACHI 7600		AU5800	
	SD	CV (%)	SD	CV (%)
TP	62.7±0.2	0.32	61.8±0.3	0.48
ALB	36.4±0.3	0.82	36.1±0.4	1.11
TBILI	13.5±0.3	2.22	14.6±0.4	2.73
DBILI	6.12±0.2	3.26	6.21±0.1	1.61
IBILI	14.2±0.3	2.11	15.1±0.2	1.32
GLB	25.4±0.2	0.78	25.1±0.1	0.41
A/G	1.43±0.1	6.99	1.43±0.1	6.99
ALT	33.9±0.3	0.88	34.4±0.2	0.59
AST	22.6±0.4	1.76	23.1±0.5	2.16
TBA	11.9±0.3	2.52	12.1±0.1	0.82
ALP	65.4±0.7	1.07	64.5±0.3	0.46
GGT	38.9±0.3	0.77	38.4±0.2	0.52
5UN	10.8±0.5	4.62	10.6±0.1	0.94
PA	296±0.3	0.11	291±0.7	0.24
CHE	9210±10.5	0.11	9196±10.9	0.12
Ca	2.41±0.2	8.29	2.37±0.1	4.21
Mg	0.93±0.01	1.07	0.94±0.03	3.19
P	0.83±0.02	2.41	0.87±0.03	3.44
TCO2	21.5±0.92	4.27	21.1±0.84	3.98
K	3.87±0.19	4.91	3.95±0.22	5.57
NA	137±1.29	0.94	135±1.13	0.83
CL	112±0.93	0.83	109±0.37	0.33
BUN	3.08±0.09	2.92	3.12±0.21	6.73
Cr	54.26±0.95	1.75	57.91±0.42	0.72
UA	328±1.78	0.54	334±1.52	0.45
B-MG	1.41±0.13	9.21	1.38±0.18	13.04
RBP	51.81±0.81	1.56	52.41±0.62	1.82
Cysc	0.67±0.02	2.98	0.75±0.03	3.94
LDH	211.08±1.32	0.63	207.67±1.61	0.77
CK	124.1±1.35	1.08	118.4±0.96	0.81
CK-MB	12.4±0.23	1.85	12.7±0.18	1.42
MYO	67.2±0.29	0.43	68.1±0.41	0.61
CTnI	0.017±0.001	5.88	0.016±0.001	6.25
ACB	79.8±0.23	0.29	81.6±0.18	0.22
IMA	62.84±0.51	0.81	61.96±0.36	0.58
AMY	69.5±0.23	0.33	70.6±0.11	0.55
LPS	67.2±0.49	0.72	68.1±0.15	0.22
GLU	4.27±0.12	2.81	4.56±0.09	1.97
GSP	2.24±0.03	1.33	2.12±0.02	0.94
BHBDH	156.1±0.72	0.46	154.3±0.48	0.31
TCHOL	4.39±0.06	1.36	4.26±0.03	0.71
TG	3.21±0.02	0.62	3.23±0.01	0.31
HDL	1.13±0.04	3.53	1.21±0.02	1.65
LDL	2.13±0.11	5.16	2.21±0.02	0.91
TG/CH	0.73±0.01	1.36	0.75±0.01	1.33
APOAL	1.21±0.03	2.47	1.15±0.06	5.21
APOB	0.71±0.02	2.81	0.84±0.03	3.57
LP-A	73.6±0.23	0.31	72.4±0.27	0.37
APA/B	1.70±0.02	1.17	1.36±0.01	0.73
Hcy	12.1±0.4	3.31	11.5±0.3	2.61

rate, respectively. The t-test and ks-test were used for the normal and non-normal data, respectively, whereas SPSS 20.0 (Beijing Strong Vinda Information Technology Co., Ltd.) and R software were used for the data analysis.

Results

Comparison of basis performances of the two instruments

As the test speed of an automatic biochemical analyzer is an important aspect to embody its performance, we compare the test speeds of the two instruments. There were certain differences in the sample test speeds of Hitachi 7600 and AU5800 after the test of 400 blood samples for five days. For the test speed of a single sample, the test times of Hitachi 7600 and AU5800 were (0.5±0.2) h and (0.5±0.1) h, respectively, and there was no significant difference between them ($P > 0.05$). For the tests of 100 samples, the corresponding test times were (2.4±0.6) h and (1.8±0.1) h, respectively, and the differences in both these cases are not statistically significant ($P > 0.05$). However, for the test of 400 blood samples, the test times of AU5800 and Hitachi 7600 were (3.6±0.4) h, and (4.7±0.8) h, respectively, and the test speed of AU5800 was significantly higher than Hitachi 7600 ($P < 0.05$). (See **Table 2**).

Test results of precision between the two instruments

A quality control serum was used to test the two different models of the automatic biochemical analyzers. The results from the tests showed that both the between-run precision and within-run precision of the two instruments satisfy the requirements of ISO 15189. The within-run and between-run CVs of Hitachi 7600 were < 8% and < 10%, respectively, whereas the within-run and between-run CVs of AU5800 were < 8% and < 10%, respectively. Within-run CVs were less than a quarter of the CLIA'88

Table 5. Qualified rate and correlation coefficient

Project	HITACHI 7600			AU5800		
	Bias (%)	Percent of pass (%)	Correlation coefficient (r^2)	Bias (%)	Percent of pass (%)	Correlation coefficient (r^2)
TP	-2.43~1.91	96	0.996	-0.87~9.83	98	1
ALB	-0.26~2.52	93	0.998	0.67~9.01	91	0.996
TBILI	-1.35~4.23	95	0.998	-1.8~7.97	94	0.998
DBILI	-0.43~8.15	99	1	-0.57~2.99	93	0.995
IBILI	-1.29~3.45	95	0.997	-2.99~8.60	96	0.999
GLB	-2~4.53	91	0.995	-0.01~3.24	97	0.997
A/G	-0.88~5.83	93	0.999	0.23~3.17	93	0.997
ALT	-2.19~6.00	91	0.995	1.06~2.33	100	0.929
AST	-0.18~3.53	92	1	0.33~7.26	94	0.996
TBA	-1.25~4.27	98	0.995	-0.4~5.49	99	1
ALP	-2.59~2.29	97	0.999	1.08~9.54	91	1
GGT	0.63~2.34	91	0.996	-2.22~2.84	91	0.999
5UN	-1.94~1.12	98	0.995	0.17~8.96	94	0.998
PA	0.72~8.54	97	0.997	-2.67~8.11	92	1
CHE	-1.79~5.84	93	0.996	1.1~6.30	95	1
Ca	-1.4~1.18	98	0.997	0.49~4.09	99	0.997
Mg	0.3~2.12	94	0.995	-0.76~9.10	94	1
P	-1.44~7.83	95	0.997	-2.14~6.34	94	0.999
TCO2	-1.58~7.00	93	0.997	-1.09~9.56	97	0.996
K	0.49~6.85	95	0.998	-0.7~5.65	94	0.999
NA	-3.17~6.55	99	0.999	-3.07~10.04	95	0.999
CL	0.94~8.18	100	0.999	0.34~3.65	100	1
BUN	-1.89~7.86	100	0.995	0.83~10.16	96	0.999
Cr	-0.49~2.36	98	1	-1~8.28	98	0.999
UA	-1.29~9.22	97	0.995	0.67~6.40	97	0.996
B-MG	-0.15~1.75	95	0.999	-2.48~3.25	92	0.999
RBP	-0.51~7.67	100	0.998	-1.84~7.33	96	0.997
Cysc	0.78~7.36	99	0.996	1.54~3.41	92	1
LDH	-0.28~2.21	92	0.995	-0.71~7.56	90	0.999
CK	0.83~7.93	93	0.999	-2.86~3.26	99	0.998
CK-MB	0.39~7.41	98	0.996	-2.89~7.13	99	0.996
MYO	-0.2~6.68	93	0.999	0.37~9.64	99	0.999
CTnI	-1.57~3.27	94	0.998	1.08~3.39	97	0.995
ACB	-0.04~5.73	95	0.996	-2.05~5.93	93	0.999
IMA	-1.77~7.07	93	0.995	-0.07~4.05	100	0.995
AMY	-2.88~3.90	94	0.995	-0.59~8.64	92	0.999
LPS	0.54~4.42	93	1	0.93~4.71	96	0.997
GLU	0.61~3.89	92	0.997	-0.48~5.09	98	0.996
GSP	-1.69~1.30	95	0.999	1.34~9.22	97	0.995
BHBDH	-0.35~7.14	99	0.998	-2.27~2.37	97	0.995
TCHOL	-0.43~1.61	91	0.996	-1.46~2.85	92	0.995
TG	0.4~1.27	100	1	-0.2~3.79	93	0.998
HDL	-1.83~8.53	94	0.995	1.27~3.47	97	0.997
LDL	0.57~5.84	96	0.996	0.87~7.35	99	0.998
TG/CH	-0.51~7.82	92	0.999	-1.71~9.73	97	0.997
APOAL	-0.69~7.05	99	1	-1.73~10.34	100	1
APOB	-0.198.46	92	0.999	-0.32~9.06	94	0.996
LP-A	-3.09~3.96	99	0.997	-1.12~4.54	99	0.999
APA/B	-1.9~1.68	91	0.997	1.35~5.51	100	0.998
Hcy	-0.94~8.66	99	0.999	-1.47~9.42	91	1

allowable error, and the between-run CVs were less than one-third of the CLIA'88 allowable error. For liver function, renal function, and other single indices and in the biochemical test, both the within-run and between-run precisions between the two instruments had no significant statistical difference ($P > 0.05$) for specific values, see **Tables 3** and **4**.

Comparison of test results between the two instruments

Fifty test results were obtained to compare the two automatic biochemical analyzers, and the comparison results showed that there was no significant difference between them ($P > 0.05$). Moreover, the test results of the two instruments satisfied the consistency criteria, and the test qualification rate was 90-100%. The indices of both the instruments exhibited a better correlation with correlation coefficient r^2 of 0.995-1 (see **Table 5** for details).

Discussion

The automatic biochemical analyzer has become an indispensable auxiliary diagnosis instrument in laboratories and clinical laboratories of hospitals [11, 12]. It is common for a department or laboratory to simultaneously have several biochemical analyzers because automatic chemical analyzers of different models or produced by different factories have differences in their test methods and technology. Furthermore, even instruments manufactured by the same factory may have key components with different precisions, causing the different instruments simultaneously testing the same sample to yield different results [13]. According to the requirements of ISO 15189, to minimize the effect of this difference on clinical application and provide a better criterion to clinicians, we compared and verified the performance of the two automatic biochemical analyzers used in our hospital.

In this experiment, all the blood samples selected by us were fresh and were screened strictly based on the inclusion and exclusion criteria. The samples were strictly handled according to the requirements, and biochemical test indices were comprehensively tested to ensure the reliability of the test results.

Our study finds that both the sample-loading speed and result-reporting speed of AU5800 are faster than those of Hitachi 7600 ($P < 0.05$). Both AU5800 and Hitachi 7600 belong to the new generation of automatic biochemical analyzers, and the causes for their differences are mainly owing to the differences in the sample-loading and test processes. AU5800 adopts a sample storage-taking approach by using three independent sample operation tracks. After the serum samples are placed on the sample shelf, the sampling needle draws sufficient serum into the sample storage cup contained within the instrument for the following test. The Hitachi 7600 pushes the samples out only after the experiment is completed, causing the time difference in the sample-loading and off-shelving. The differences in the reporting-speed are mainly caused by the experiment reaction time within the instrument. Hitachi 7600 starts the temperature elevation device only after the samples are poured in the reaction cups to heat the liquid to a proper temperature, whereas the AU5800 starts to prewarm after startup [14, 15], which shortens the incubation time of the experiment. The data report in AU5800 uses a direct input approach, and the extent of the reaction can be checked on the linked computer. The report will be output on the computer after the completion of the reaction and result calculation. Hitachi 7600 provides the test report only after repeated calculations are executed by the data processor. Although the time difference in this process can be ignored, an additional step will have a certain effect on the experiment speed and results. The report that the experimental results will not be affected by simplifying the transmission mode and experimental procedure of Hitachi 7600 automatic biochemical analyzer [16], and its work efficiency will be promoted. Because we have no relevant technical support for this conclusion, such a substitution experiment cannot be performed. In terms of the precision, qualification rate, and correlation of the test results, there is no significant difference between the two instruments ($P > 0.05$), and both the instruments meet the standards recognized internationally. The study showed that the precision of AU5800 was higher than that of Hitachi 7600, whereas the qualification rate and correlation of the test results were not significantly different [17]. Some of their conclusions are different from those of our experiment, possibly because of the larger sample size and longer experiment selected by them. All the precision instruments will have some

reduction in their precision owing to the factors of long time, big data, large sample, and high load [18, 19]. We fixed both the experiment time and sample size after the data comparison. The daily sample size handled by biochemical laboratories is approximately 400 samples, except for high-profile and large general hospitals [20]. Because a precise instrument shall need to be overhauled, maintained, and serviced within a week, a long duration and high workload are not necessary. The test methods for obtaining the general biochemical indexes in Hitachi 7600 and AU5800 are turbidimetric immunoassay, spectrophotometry, and potentiometry [21, 22], which have no difference in the test principles, and therefore, yield similar results for each index tested by both the instruments. Concurrently, these test methods are also relatively simple in comparison with the high-sensitivity experimental methods performed in numerous experiments. The report shows that if the same index is tested by an automatic biochemical analyzer using different test methods, the results obtained may be different [23], and even false positive results may occur, though rarely. Though we cannot deny these conclusions, each index has a default experimental method in a biochemical analyzer that has the highest reliability and a higher sensitivity and specificity for the recent test of the index [24, 25], and this problem will not affect the experimental results of the two instruments.

The two instruments used in our experiment not being state-of-the-art, the small sample size, and the continuous experiment time being only 5 d, are some of the major shortcomings of our experiment. Perhaps automatic biochemical analyzer may become easy-to-use in the future with the inclusion of centrifuge, allowing the operators to only place the samples on the sample shelf, thereby enhancing the work efficiency and reducing experimental errors caused by the incorrect operation by the technical staff.

Conclusion

In this experiment, we compare the test results and performances of the Hitachi 7600 and AU5800 automatic biochemical analyzers. We believe that the qualification rate of the results and precision of the two instruments are not significantly different for the conditions under which the 400 samples are tested for 5 d; the only difference is in the work efficiency. In those hospitals and laboratories that have more patients and require fast results, AU5800 may be used, and in the opposite case, Hitachi 7600 may be used.

Disclosure of conflict of interest

None.

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References

[1] Han JI, Jang HJ, Na KJ. Hematologic and serum biochemical reference intervals of the Oriental white stork (Ciconia boyciana) and the application of an automatic hematologic analyzer. J Vet Sci 2016; 17: 399-405.

[2] Zhu Y, Dong J, Wang P, Huang H, Jin X, Zhou J, Shi J, Gu G, Chen J, Xu J, Song Y. Serum lipase as clinical laboratory index for chronic renal failure diagnosis. Clin Lab 2016; 62: 1265-1270.

[3] Guang Y, Feng D, Li YZ, Hui L. Theoretical and experimental evidence in mixed serum samples as natural reference materials for measuring activity of biomacromolecules in serum. Clin Lab 2016; 62: 2429-2436.

[4] Zang RS, Zhang H, Xu Y, Zhang SM, Liu X, Wang J, Gao YZ, Shu M, Mei B, Li HG. Serum C-reactive protein, fibrinogen and D-dimer in patients with progressive cerebral infarction. Transl Neurosci 2016 ;7: 84-88.

[5] Shen T, Wu WM, Du WH, Wang L, He LG, Tan L, Wang Z, Chen R, Hu M, Ren YP. Positive association between serum apolipoprotein M levels and hepatitis B virus DNA load in HBeAg-negative chronic hepatitis B. Lipids Health Dis 2016; 15: 210.

[6] Dong XM, Cai R, Yang F, Zhang YY, Wang XG, Fu SL, Zhang JR. Predictive value of plasma beta 2-microglobulin on human body function and senescence. Eur Rev Med Pharmacol Sci 2016; 20: 2350-2356.

[7] Zhao YF, Zhu L, Liu LJ, Shi SF, Lv JC, Zhang H. Measures of urinary protein and albumin in the prediction of progression of IgA nephropathy. Clin J Am Soc Nephrol 2016; 11: 947-955.

[8] Li H, Liu YY, Wang L, Shen T, Du WH, Liu ZJ, Chen R, Hu M. High apolipoprotein M serum levels correlate with chronic obstructive pul-

monary disease. Lipids Health Dis 2016; 15: 59.
[9] Zhang HY, Lu JC, Feng RX. [Correlations of 24 biochemical markers in seminal plasma with routine semen parameters]. Zhonghua Nan Ke Xue 2015; 21: 1087-1092.
[10] Sharifi Z. Natural history of chronic hepatitis B virus infection based on laboratory testing. Iran J Public Health 2014; 43: 990-993.
[11] Zhang GM, Xia YJ, Guo XX, Zhu BL, Zhang GM, Ma XB, Yu H, Wang HJ, Wang GS, Yang L, Zhou YT. Reference intervals for total bilirubin, ALT, AST and creatinine in healthy Chinese elderly. Med Sci Monit 2014; 20: 1778-1782.
[12] Du J, Zhang J, Zou D, Ye L, Chen GG, Yang C. Effects of interleukin-10 gene deficiency on hepatic biochemical metabolism in mice. Clin Exp Med 2015; 15: 321-325.
[13] Yang S, Qiao R, Li Z, Wu Y, Yao B, Wang H, Cui L, Yang Y, Zhang J. Establishment of reference intervals of 24 chemistries in apparently healthy adult Han population of Northern China. Clinical Biochemistry 2012; 45: 1213-1218.
[14] Huang FF, Lin XM. [Comparison of daily intake of lutein+zeaxanthin, serum concentration of lutein/zeaxanthin and lipids profile between age-related macular degeneration patients and controls]. Beijing Da Xue Xue Bao Yi Xue Ban 2014; 46: 237-241.
[15] Bo X. Correlation Between Serum high sensitive C-reactive proteins and acute coronary syndrome. Circulation 2010; 122: E242-E242.
[16] Newsome PN, Cramb R, Davison SM, Dillon JF, Foulerton M, Godfrey EM, Hall R, Harrower U, Hudson M, Langford A, Mackie A, Mitchell-Thain R, Sennett K, Sheron NC, Verne J, Walmsley M, Yeoman A. Gut 2018; 67: 6-19.
[17] Pizzolo F, Salvagno G, Caruso B, Cocco C, Zorzi F, Zaltron C, Castagna A, Bertolone L, Morandini F, Lippi G, Olivieri O. Fully automated chemiluminescence vs RIA aldosterone assay in primary aldosteronism work-up. J Hum Hypertens 2017; 31: 826-830.
[18] Russell L, Madsen MB, Dahl M, Kampmann P, Perner A. Prediction of bleeding and thrombosis by standard biochemical coagulation variables in haematological intensive care patients. Acta Anaesthesiol Scand 2018; 62: 196-206.
[19] Straub J, Paula H, Mayr M, Kasper D, Assadian O, Berger A, Rittenschober-Böhm J. Diagnostic accuracy of the ROCHE septifast PCR system for the rapid detection of blood pathogens in neonatal sepsis-A prospective clinical trial. PLoS One 2017; 12: e0187688.
[20] Everett BM. Cardiac troponin: the next tool for cardiovascular disease prevention in ambulatory patients? Heart 2017.
[21] Wang S, Yin P, Quan C, Khan K, Wang G, Wang L, Cui L, Zhang L, Zhang L, Tang P. Evaluating the use of serum inflammatory markers for preoperative diagnosis of infection in patients with nonunions. Biomed Res Int 2017; 2017: 9146317.
[22] Li JJ, Chen YQ, Fan LL, Jin JY, Guo S, Xiang R. Microduplication of 10q26.3 in a Chinese hypertriglyceridemia patient. Mol Cell Probes 2018; 37: 28-31.
[23] Giannitsis E, Kurz K, Hallermayer K, Jarausch J, Jaffe AS, Katus HA. Analytical validation of a high-sensitivity cardiac troponin T assay. Clin Chem 2010; 56: 254-261.
[24] de Swart L, Reiniers C, Bagguley T, van Marrewijk C, Bowen D, Hellstrom-Lindberg E, Tatic A, Symeonidis A, Huls G, Cermak J, van de Loosdrecht AA, Garelius H, Culligan D, Macheta M, Spanoudakis M, Panagiotidis P, Krejci M, Blijlevens N, Langemeijer S, Droste J, Swinkels DW, Smith A, de Witte T. ; EUMDS Steering Committee. Labile plasma iron levels predict survival in patients with lower-risk Myelodysplastic syndromes. Haematologica 2018; 103: 69-79.
[25] Kesztyus T, Simonsmeier U, Kesztyus D. Developing a classification system for haemoglobin management in patients with end-stage renal disease on haemodialysis: a secondary data analysis. BMJ Open 2017; 7: e017423.