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# Examination of the Fungus (1-3)-β-D-Glucan Assay (Chemiluminescence) in Serum for Diagnosing Invasive Fungal Disease

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## BACKGROUND

At present, the (1-3)-β-D-Glucan (BDG) measurement kits are mainly based on Limulus amoebocyte lysate (LAL) cascade reaction. However, horseshoe crab populations are in decline, making it difficult to obtain. In order to explore sustainable methods and alternatives to the LAL test, we developed the Fungus (1-3)-β-D-Glucan Assay (Chemiluminescence), a novel BDG measuring kit based on magnetic particle chemiluminescence immunoassay using self-made fungal (1-3)-β-D-Glucan antibody. Based on the above background, the primary objective of this study was to conduct a comprehensive comparison of the diagnostic performances of BDG measurement kit, including the Dynamiker Fungus (1-3)-β-D-Glucan Assay (Chemiluminescence) and the Dynamiker Fungus (1-3)-β-D-Glucan Assay (Chromogenic) (Figure 1 A-C).

## METHOD

According to relevant documents of the Clinical and Laboratory Standards Institute (CLSI), the performance (the limit of blank (LOB), limit of detection (LOD), limit of quantitation (LOQ), precision, linear range, sample stability, specificity) of the streptavidin-magnetic particle-based chemiluminescence immunoassay for the detection of BDG in samples by a double antibody sandwich method was evaluated. Serum samples from 212 patients with probable IFD were collected and the concordance rate of the two methods.

## RESULT

The LOB for detection of BDG by the chemiluminescence immunoassay was 5.00 pg/mL, the LOD was 10.00 pg/mL, and the LOQ was 20.00 pg/mL; the reproducibility was 3.35% and 3.53% for high and low value samples, respectively, and the between-run precision was 4.13% and 4.25%; the linear range was 20.00~1000.00 mg/L ($r > 0.990$). The samples were stable for 3 days at 2~8℃ and 12 months at -20℃. The validation results of specificity showed that endotoxin concentration≤1 EU/mL, hemoglobin concentration≤7 mg/mL, bilirubin concentration≤ 300 mg/L, and triglyceride concentration≤7.5 mmoL/L had no effect on the assay results. The positive percent agreement, negative percent agreement and total coincidence rate of the two methods, were 95.83%, 91.18% and 94.34%. The kappa statistic value was 0.870, representing good agreement (Table 1-2).

## CONCLUSION

As an alternative to the LAL test, the Dynamiker Fungus (1-3)-β-D-Glucan Assay (Chemiluminescence) has good detection performance and can be completed within 30 minutes, providing a basis for the early diagnosis and screening of invasive fungal infection.

## KEY WORDS

Invasive Fungal Disease; Chemiluminescence; Fungus (1-3)-β-D-Glucan Assay

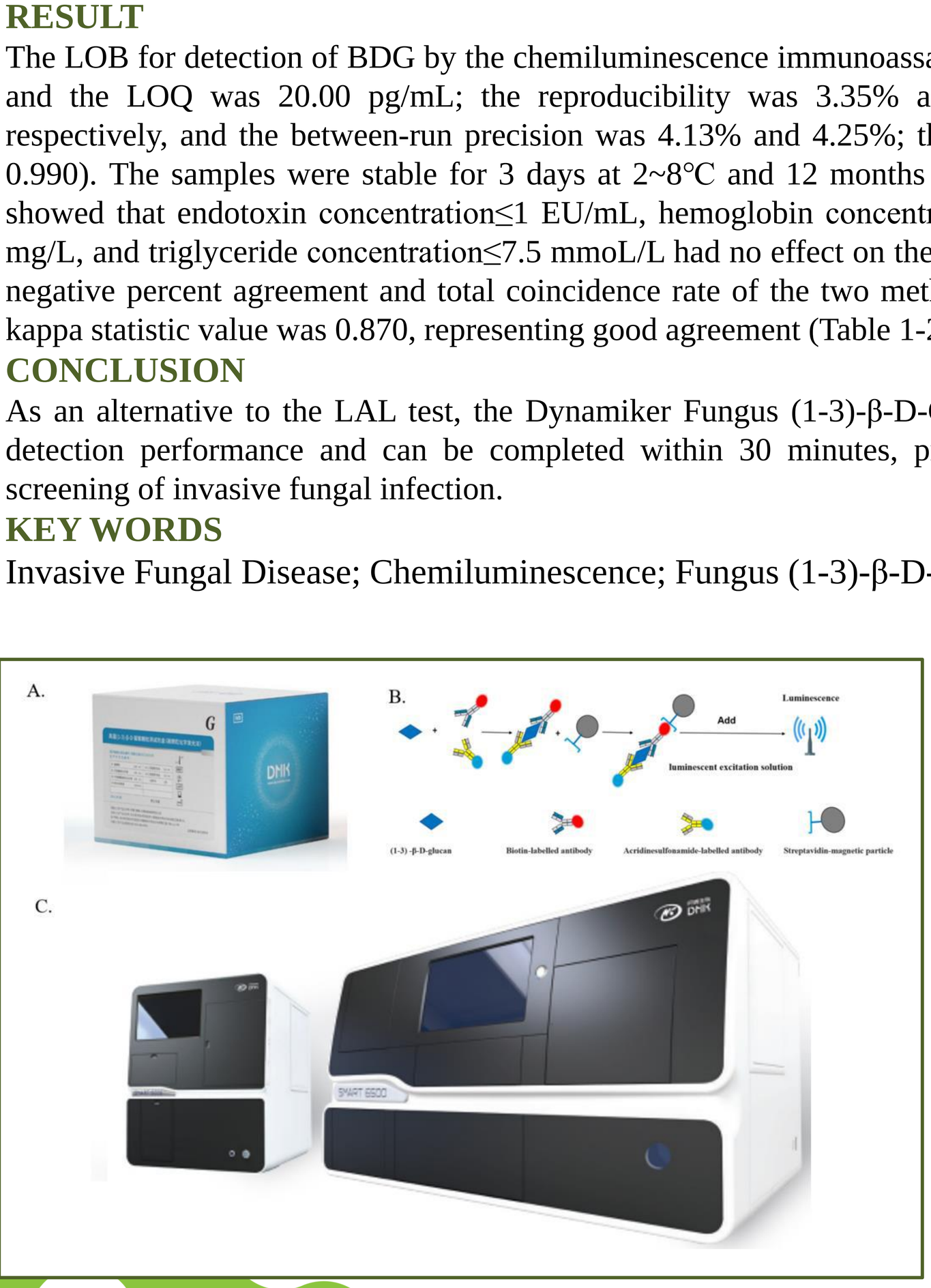


Figure 1 A. The Dynamiker Fungus (1-3)-β-D-Glucan Assay (Chemiluminescence); B. Detection principle of the Dynamiker Fungus (1-3)-β-D-Glucan Assay (Chemiluminescence); C. Fully Automated Chemiluminescence Analyzer

## Table 1 The contingency table

| | | Chromogenic method | | |
|---|---|---|---|---|
| | | positive | negative | Total |
| Chemiluminescence | positive | a=138 | b=6 | a+b=144 |
| | negative | c=6 | d=62 | c+d=68 |
| | Total | n1=144 | n2=68 | n=212 |

**Positive percent agreement (PPA) = [a/n1] × 100% = 138/144 × 100% = 95.83% (95% CI, 91.21 to 98.08%)**

**Negative percent agreement (NPA) = [ d/n2] × 100% = 62/68 × 100% = 91.18% (95% CI, 82.06 to 95.89%)**

**Total coincidence rate = [(a+d) /n] × 100% = (138 + 62) /212 × 100% = 94.34% (95% CI, 90.37 to 96.73%)**

## Table 2 Results of detection performance of the Dynamiker Fungus (1-3)-β-D-Glucan Assay (Chemiluminescence)

| Index | Concentration standard（pg/mL） | Determination results（pg/mL） |
|---|---|---|
| LOB | ≤ 5 pg/mL | 5.00 pg/mL |
| LOD | 10 ± 2 pg/mL | 10.00 pg/mL |
| LOQ | 20 ± 4 pg/mL | 20.00 pg/mL |
| Low value samples | | |
| Reproducibility | CV ≤ 10 % | 3.53% |
| Between-run precision | CV ≤ 15 % | 4.25% |
| High value samples | | |
| Reproducibility | CV ≤ 10 % | 3.35% |
| Between-run precision | CV ≤ 15 % | 4.13% |
| The linear range | $r \geq 0.990$ | 20.00~1000.00 mg/L<br>$r > 0.990$ |