Changes in growth conditions affect the structure of mannan in C. albicans

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Abstract
Several studies have investigated the general structure of mannans, but little is known about the variation in the cell wall of C. albicans. Data of the current paper support the conclusion of earlier work that the cell wall assembly of C. albicans is dependent upon the growth conditions and strain used. C. albicans was isolated and grown in three growth media: YPD, Blood and Serum. NMR analysis of these cell wall mannans was accomplished by examining 1D and 2D spectra and NOE correlations to identify structural order and variability. In this study, strain SC5314 was inoculated from frozen stock onto YPD, Blood and 5% Serum agar plates. The samples were incubated at 30°C and 37°C. The samples were taken from cultures grown on YPD, Blood, and Serum agar plates. These samples were dissolved at 20 mg of mannan and subjected to a modified extraction method as described previously (Li et al, 2009). Carbohydrate analysis was carried out in order to isolate structural changes of mannans grown at 30°C and 37°C. Table 1 illustrates the structural changes observed for mannan grown at 30°C on YPD, Blood, and Serum agar plates. The structural changes were observed by comparing the spectra of mannan grown at 30°C on YPD, Blood, and Serum agar plates. The results of this study demonstrate that C. albicans modulates the complexity of its mannan component when grown under different conditions. How these cell wall structural changes benefit the C. albicans growth condition is dynamic and dramatic. How these cell wall structural changes benefit the C. albicans growth condition is dynamic and dramatic.

Results and Discussion

Table 1: Changes in growth conditions affect the structure of mannan in C. albicans.

<table>
<thead>
<tr>
<th>Growth Condition</th>
<th>No. of Chains</th>
</tr>
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<tbody>
<tr>
<td>YPD</td>
<td>1</td>
</tr>
<tr>
<td>Blood</td>
<td>2</td>
</tr>
<tr>
<td>Serum</td>
<td>3</td>
</tr>
</tbody>
</table>

Figure 1: Comparison of structural changes observed for mannan grown at 30°C on YPD, Blood, and Serum agar plates.

Figure 2: 950 MHz COSY (left) and NOESY (right) 2D NMR showing the entire carbohydrate spectral region.

Figure 3: 1D NMR spectra (left) and NOESY spectrum showing the entire carbohydrate spectral region.

Figure 4: Assignment of anomeric H resonances to specific structural features using the 900 MHz NOESY 2D NMR spectrum and a schematic representation of the mannan mannose underlaid to show the NOESY correlations.

Figure 5: Comparison of structural changes observed for mannan grown at 30°C on YPD, Blood, and Serum agar plates.

Figure 6: Assignment of anomeric H resonances to specific structural features using the 900 MHz NOESY 2D NMR spectrum and a schematic representation of the mannan mannose underlaid to show the NOESY correlations.

Figure 7: Comparison of structural changes observed for mannan grown at 30°C on YPD, Blood, and Serum agar plates.

Conclusions

1. Our data indicate that C. albicans modulates the structural changes of mannans grown at different growth conditions including temperature (30°C versus 37°C) and growth media (YPD, Blood, and Serum).

2. The structural differences exist both at the quantitative and qualitative level of the structural studies. C. albicans modulates the complexity of its mannan component when grown under different conditions.

3. How these cell wall structural changes benefit the C. albicans growth condition is dynamic and dramatic. How these cell wall structural changes benefit the C. albicans growth condition is dynamic and dramatic.

Materials and Methods

Strains and media: C. albicans strain 586 was obtained from the lab of Dr. John Turk and propagated in YPD (1% Bacto peptone, 2% Bacto yeast extract, 1% dextrose) broth, conidia (yeast phase) and YPD (1% Bacto peptone, 2% Bacto yeast extract, 1% dextrose) plates. Strain SHC was propagated in YPD (1% Bacto peptone, 2% Bacto yeast extract, 1% dextrose) broth, conidia (yeast phase) and YPD (1% Bacto peptone, 2% Bacto yeast extract, 1% dextrose) plates. YPD plates were grown at 37°C while YPD broth was grown at 30°C. YPD broth was grown at 30°C and 37°C.

Mannan isolation: Mannan was isolated from C. albicans using a modified extraction method as described previously (Li et al, 2009). The samples were dissolved at 20 mg of mannan and subjected to a modified extraction method as described previously (Li et al, 2009).

Carbohydrate analysis: Carbohydrate analysis was accomplished by examining 1D and 2D spectra and NOE correlations to identify structural order and variability. In this study, strain SC5314 was inoculated from frozen stock onto YPD, Blood and 5% Serum agar plates. The samples were incubated at 30°C and 37°C. The samples were taken from cultures grown on YPD, Blood, and Serum agar plates. These samples were dissolved at 20 mg of mannan and subjected to a modified extraction method as described previously (Li et al, 2009). Carbohydrate analysis was accomplished by examining 1D and 2D spectra and NOE correlations to identify structural order and variability.