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Identification of *Neisseria meningitidis* Carbohydrate Fermentation Patterns in Mueller-Hinton Broth[1]

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The fermentation patterns of *Neisseria meningitidis* are described as acid from glucose and maltose and no acid from other carbohydrates (*Bergey's Manual*, 7th ed.). The two basal fermentation media used by most workers are Cystine Trypticase Agar (CTA; BBL) and Mueller-Hinton agar (MHA; Difco).

We have observed that CTA medium does not always support growth of *N. meningitidis* as it should, and that *N. meningitidis* does not consistently demonstrate accurate fermentation patterns in CTA or MHA. In an attempt to overcome these problems, 42 *N. meningitidis* strains, identified by group-specific antisera, were selected for comparison of fermentation and growth on CTA, MHA, and Mueller-Hinton broth (MHB; Difco). Glucose, maltose, lactose, sucrose, and mannitol were sterilized by Seitz filtration and were combined with the three basal media to give a final carbohydrate concentration of 1%. Phenol red, 0.025%, was used as the indicator.

The CTA and MHB cultures were incubated aerobically, whereas the MHA cultures were placed in a candle jar. All cultures were incubated at 37 C. The results of maltose fermentation were observed and recorded after 24 hr (Table 1). The data showed that, of 42 meningococcal strains grown on each medium, 41 fermented maltose in MHB, whereas 32 and 35 fermented maltose on MHA and CTA, respectively. The other carbohydrates showed various fermentation patterns on both CTA and MHA. However, in MHB the meningococci fermented these carbohydrates as expected.

The carbohydrate fermentation patterns in MHB of 561 group B, 300 group C, 39 crosses of groups B and C, and 241 nongroupable strains were examined to further document these findings. A single colony from each primary culture that had been identified serologically as a meningococcus was transferred to MHB without carbohydrate, and was incubated aerobically at 37 C overnight. A 0.1-ml amount of this culture was inoculated into each tube in the carbohydrate broth series and was incubated at 37 C. The reactions were recorded after 24 hr. The results of the fermentations with the 1,142 strains showed that only 1, a group C strain, failed to ferment maltose after 24 and 48 hr of incubation. It was also noted that an additional 14 strains fermented lactose. This observation has also been reported by M. S. Mitchell et al. (2).

TABLE 1. *Comparison of the maltose fermentation reactions of 42 Neisseria meningitidis strains in Mueller-Hinton broth (MHB), Mueller-Hinton agar (MHA), and Cystine Trypticase Agar (CTA)*

Medium	Group B	Group C	Total
MHB.....	35/36[a]	6/6	41/42
MHA	27/36	5/6	32/42
CTA.....	32/36	3/6	35/42

[a] Number fermented/total number tested.

Thirty-nine strains were agglutinated in the presence of both group B and C rabbit antisera. This apparent cross-reaction has been previously reported by others (1, 2).

Testing of an additional 1,789 meningococcal strains revealed only 2 that did not produce acid in maltose after 48 hr of incubation. One of these belonged to group B and the other was a Boshard (Bo) strain (3). In addition, 17 of these strains fermented lactose.

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