Comparison of the Quantitative Formalin Ethyl Acetate Concentration Technique and Agar Plate Culture for Diagnosis of Human Strongyloidiasis

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Agar plate culture (APC) is a highly effective technique for the coprological diagnosis of human strongyloidiasis (1, 5-8, 10). But despite its high sensitivity, there are several disadvantages to APC. It is expensive, it takes a long time before results can be provided, and there is also a risk of infection for the technicians. The quantitative formalin ethyl acetate concentration technique (QFEC) is another effective and more rapid method to detect and quantify intestinal helminths, e.g., hookworm larvae. QFEC could substitute for APC only when the parasite load was higher than 50 larvae per g of stool. This study serves as a good reminder to those conducting stool exams about the sensitivity and specificity limitations of both techniques.

The quantitative formalin ethyl acetate concentration technique (QFEC) was compared to agar plate culture (APC) for the detection of Strongyloides stercoralis larvae. QFEC could substitute for APC only when the parasite load was higher than 50 larvae per g of stool. This study serves as a good reminder to those conducting stool exams about the sensitivity and specificity limitations of both techniques.

Of the 1,233 stool samples, 303 (24.57%) were found to be positive by at least one of the two methods: 130 (10.54%) by QFEC and 290 (23.52%) by APC (Table 1). As expected, APC’s superior sensitivity was demonstrated with 173 specimens that were negative by QFEC but positive by APC. Only 13 QFEC-positive specimens were negative by APC. Compared to APC, QFEC had a statistically significantly lower positivity rate (P < 0.001) (Pearson chi-square test, SPSS for Windows version 11.0, SPSS Inc., Chicago, Ill.). When we classified QFEC results into 10 lpg intervals, 45 (97.8%) out of 46 samples with more than 50 lpg by QFEC gave positive results by APC. This fact seems to indicate similar diagnostic values at that level of infection.

APC has consistently been found to be 1.6 to 6.0 times more effective than the formalin-ether concentration technique (1, 7). In addition, it has been found to be more sensitive than QFEC (9). Even though it is less expensive and more rapid than APC, QFEC can substitute for APC only when the stool parasite load is higher than 50 lpg. In the present study, those instances constituted only 35.38% (46 of 130 specimens) of QFEC-positive stools. Thus, in community surveys for ascariasis and opisthorchiasis, where QFEC is a useful tool for the quantification of infections, it cannot be relied upon for a determination of the prevalence of strongyloidiasis. The low detection rate by QFEC may be attributed to several factors. One is that filtration of the fecal suspension through layers of gauze may remove feces containing larvae, resulting in the loss of larvae in the final sediment, but we have no data on this issue.

Although it is widely accepted that formalin-ether sedimen-
tation and related techniques are less sensitive than APC, one should bear in mind that a substantial portion of stools positive by these techniques were negative by APC. In the present study, 10% of QFEC-positive samples were negative by APC, while Sukhavat et al. (10) found that 20% of *Strongyloides*-positive stools examined by the formalin-ether sedimentation technique were negative by APC. No explanation was provided, and it remains to be explored which factors cause *Strongyloides* larvae not to grow and multiply under the sensitive APC technique.

This study is based upon screening a population in a field survey; thus, the subjects were not symptomatic patients. QFEC is expected to be more sensitive for symptomatic individuals, who, presumably, would have a much higher parasite burden. Thus, QFEC may be sufficient for clinical purposes, while APC can be added as a second-tier laboratory test. In conclusion, this study shows clearly that for epidemiologic purposes APC is preferable and QFEC should be used for confirming clinical diagnoses of strongyloidiasis.

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**REFERENCES**


**TABLE 1. Comparative efficacies of APC and QFEC for the detection of S. stercoralis**

<table>
<thead>
<tr>
<th>QFEC result (larval intensity) a</th>
<th>APC result</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. of positive specimens</td>
</tr>
<tr>
<td>0</td>
<td>173</td>
</tr>
<tr>
<td>1–50</td>
<td>72</td>
</tr>
<tr>
<td>&gt;50</td>
<td>45</td>
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</table>

a The intensity of *S. stercoralis* larvae expressed as numbers of larvae per gram of stool. "0" indicates that the stool specimens were negative by QFEC.