Comparative study between using Lowenstein Jensen and Bio-FM media in identification of Mycobacterium tuberculosis

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Abstract
Aim of the work: To evaluate the detection rate and time of Mycobacterium tuberculosis by using Bio-FM system in comparison with the Lowenstein Jensen medium.

Patients and methods: A total of 50 smear AFB positive sputum samples were included in this study and received from three groups. Group I: Thirty four patients with fresh sputum smear +ve (new cases). Group II: Ten relapsed cases. Group III: Six treatment failure cases. All cases were exposed for thorough history taking, complete physical examination, routine laboratory tests including ESR, plain chest X-ray-PA and lateral view if needed, sputum smear for acid fast bacilli (Zeil Neelsen staining), tuberculin skin test using Mantoux technique, sputum culturing on Lowenstein Jensen medium and Bio-FM medium.

Results: The shortest mean detection times on the two studied isolation media were for the cases with far advanced lesion on chest X-ray. On Lowenstein Jensen, it was 17.50 ± 6.802 days and on
Bio-FM it was 10 ± 5.752 days. While the longest times were for the cases of minimal lesion, on Lowenstein Jensen, it was 24 days (± 11.449) and on Bio-FM it was 15 days (± 10.905). The mean detection times of moderately advanced cases on Lowenstein Jensen, it was 19.57 days (± 9.086) and on Bio-FM was 12.65 days (± 8.074).

**Conclusion:** Bio-FM showed greater superiority in detection time over Lowenstein Jensen with no significant difference between the two media in detection rate.

**Introduction**

Tuberculosis (T.B.) still represents a monumental problem in the world, with almost 9.4 (range 8.9–9.9) million new cases in 2008 (139 per 100,000 population) compared with 9.27 million new cases (139 per 100,000 population) in 2007 and 9.24 million new cases (140 per 100,000 population) in 2006 [29].

Although smear microscopy shows the highest rates of disease detection yearly worldwide [15], culture systems are used for isolation of tuberculous bacilli as they are more sensitive than smear microscopy. Lowenstein Jensen culture (LJ) is the most widely used in low-income countries, it is an egg based medium developed from Jensen’s modification of Lowenstein’s formula. The inoculation time of the bacilli is up to 8 weeks [1].

LJ medium is commonly used in clinical laboratories to isolate acid fast organisms from sterile and non sterile sources. Bacterial growth on cultures is considered as positive as soon as colonies appear on LJ medium and it is confirmed by Ziehl Neelsen (ZN) staining. In practice, 40–70% of patients with tuberculosis isolated in culture have positive smears [18].

Bio-FM is an enriched Middlebrook 7H9 medium, optimized for rapid mycobacterial growth whose selectivity is enhanced by a selective VCA (Vancomycin, Colistin and Amphotericin B) supplement, containing a colored indicator that allows the detection of positive cultures which turn into a dark blue to violet color. The aspect of the culture should also permit species identification (Mycobacterium tuberculosis or atypical mycobacteria). The results are confirmed by microscopy after ZN staining, then by re-inoculation on LJ medium and by identification by biochemical tests [20].

### Aim of the work

To evaluate the detection rate and time of *Mycobacterium tuberculosis* by using the Bio-FM system in comparison with the Lowenstein Jensen medium.

### Patients and methods

The study was conducted on sputum. A Total 50 of AFB smear positive sputum samples were received from three groups:

- **Group I:** 34 patients with fresh sputum smear positive (New cases).
- **Group II:** 10 Relapsed cases.
- **Group III:** 6 Treatment failure cases.

All cases were exposed for: Thorough history taking, complete physical examination, routine laboratory tests including ESR, Plain chest X-ray-PA and lateral view if needed, sputum smear for acid fast bacilli (Ziehl–Neelsen staining). Sputum collection was done in the early morning, patients were instructed to expectorate a deep respiratory specimen with no nasal secretions or saliva. Ideally, the sputum was obtained on 3 consecutive days. 5–10 ml of sample each time was appropriate. For patients who were unable to produce sputum, hypertonic saline (5–15%) was nebulized for induction [19]. Tuberculin skin test was applied using Mantoux technique, by intra-dermal injection of 0.1 ml of PPD tuberculin (5 TU) into the skin of the volar aspect of the forearm and the results were detected after 48–72 h. Test significance depends on the presence or absence of indurations which was expressed in millimeters. Sputum culturing was done on two slopes of Lowenstein Jensen medium per specimen, with 0.25–0.5 mL of each specimen and incubated at 37 °C for 8 weeks. The LJ slants were inspected weekly. Growth on the LJ slants resembling mycobacterial colonies (i.e., rough, tough and buff-colored) was subjected to ZN staining to confirm the presence of AFB [28]. Sputum culturing was done on Bio-FM medium which was formed of (ammonium sulfate (NH₄SO₄), magnesium sulfate, monopotassium phosphate (KH₂PO₄), zinc sulfate (ZnSO₄), disodium hydrogen phosphate (Na₂HPO₄), copper (II) sulfate (CuSO₄), calcium chloride (CaCl₂), sodium chloride (NaCl), ammoniacal iron citrate, sodium citrate, pyridoxine (Vit.B₆), biotin (Vit.B₇), amino acids, fatty acid, pancreatic digest of casein, bovine albumin, glyceral, glucose, distilled water, catalase and growth indicator. Bio-FM V.C.A. supplement is formed of Vancomycin, Colistin and Amphotericin B. Samples were incubated for 5–6 weeks at 37 °C. Reading cycle was performed by the following way: 2–4 weekly readings for 3–4 weeks, then twice a week for another 2 weeks.

Reading of Bio-FM medium generally was in 2 phases:

1. **1st phase:** examination of the sediment and liquid medium without shaking the tube
   - The bottom of the tubes and the liquid medium were carefully examined:
     - If no signs of growth were present (no cloudiness, turbidity, dark blue/violet grains or flakes): the 2nd phase of reading was done.
     - If signs of growth were present:
       - Dark blue/violet grains or small flakes that have settled at the bottom of the tube: presumption of MTB.
       - Cloudiness or turbidity, with a color ranging from dark blue to violet, and tending to partially settle at the bottom of the tube: suspicion of atypical mycobacteria. This possibly was confirmed by the 2nd phase of reading.

2. **2nd phase:** examination of the sediment after shaking the tube
The tube was placed at eye level (preferably examined in daylight) and the sedimentation pellet situated in the bottom of the tube was re-suspended by a gentle to-and-fro movement of the tube:

- If no signs of growth (no cloudiness, turbidity, dark blue/violet grains or flakes): negative culture, incubation of the medium continued.
- If signs of growth were present:
  - Dark blue/violet grains or small flakes: presumption of MTB.
  - Cloudiness or turbidity, with color dark blue/violet color: suspicion of atypical mycobacteria.
- The presence of a homogeneous cloudiness (possibly with very slight blue color of the medium), observed after 3 days of incubation, was suggestive of contamination.
- The dark blue color, indicative of growth of mycobacteria, was visible even in the presence of cellular debris or insoluble particles.
- Counting and a morphological study of colonies were done between the 2nd and the 8th week after inoculation (as recommended).

Identification

When bacterial growth was detected in Bio-FM medium, the colored particles were taken with a Pasteur pipette and presence of AFB was looked for. The presence of mycobacteria in the medium was confirmed by AFB microscopy after ZN staining, then by re-inoculation of bacteria onto LJ medium and identification by biochemical tests. The results were tabulated and statistically analyzed.

Results

Tables 1–5 This study included 50 sputum smear positive tuberculous patients, who were classified into 34 cases (group I) representing 68% of the total cases, 10 relapsed cases (group II) and 6 treatment failure cases (group III) representing 20% and 12% of the total cases respectively. The results showed the age distribution among the studied groups and it was noticed that the range of age in group I was from 19 to 67 years with the mean age 39.47 ± 15.122 years and in group II it was from 22 to 63 years with the mean age 41.60 ± 11.983 years, while

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Comparison between Lowenstein Jensen and Bio-FM as regards mean detection times and duration ranges in days classified according to radiological extent of T.B lesions.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lesion</td>
<td>Media</td>
</tr>
<tr>
<td>Minimal</td>
<td>Lowenstein Jensen</td>
</tr>
<tr>
<td></td>
<td>Bio-FM</td>
</tr>
<tr>
<td>Moderately advanced</td>
<td>Lowenstein Jensen</td>
</tr>
<tr>
<td></td>
<td>Bio-FM</td>
</tr>
<tr>
<td>Far advanced</td>
<td>Lowenstein Jensen</td>
</tr>
<tr>
<td></td>
<td>Bio-FM</td>
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</table>

<table>
<thead>
<tr>
<th>Table 2</th>
<th>Comparison between Lowenstein Jensen and Bio-FM as regards mean detection times and duration ranges in days classified according to presence or absence of cavitary lesion.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Media</td>
<td>Lesion</td>
</tr>
<tr>
<td>Lowenstein Jensen</td>
<td>Cavitary</td>
</tr>
<tr>
<td></td>
<td>Non-cavitary</td>
</tr>
<tr>
<td>Bio-FM</td>
<td>Cavitary</td>
</tr>
<tr>
<td></td>
<td>Non-cavitary</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 3</th>
<th>Comparison between Lowenstein Jensen and Bio-FM as regards number and percentage of positive cases classified according to duration ranges in days.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duration range</td>
<td>Positive cases on LJ</td>
</tr>
<tr>
<td>No.</td>
<td>%</td>
</tr>
<tr>
<td>1–7 days</td>
<td>0</td>
</tr>
<tr>
<td>&gt;7–14 days</td>
<td>15</td>
</tr>
<tr>
<td>&gt;14–21 days</td>
<td>19</td>
</tr>
<tr>
<td>&gt;21–28 days</td>
<td>5</td>
</tr>
<tr>
<td>&gt;28–35 days</td>
<td>3</td>
</tr>
<tr>
<td>&gt;35–42 days</td>
<td>3</td>
</tr>
<tr>
<td>&gt;42–49 days</td>
<td>1</td>
</tr>
<tr>
<td>&gt;49–56 days</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>47</td>
</tr>
</tbody>
</table>
in group III it was from 19 to 54 years with the mean age 37.50 ± 12.518 years.

The results showed also the sex distribution among the studied groups, 39 males were included in this study distributed as 26 in group I, 8 in group II and 5 in group III, 11 females were included in this study distributed as 8 in group I, 2 in group II and only one female was in group III.

Discussion

Figs. 1 and 2 Although considerable efforts have been made to improve the sensitivity of sputum smear microscopy in the diagnosis of pulmonary tuberculosis, it still lacks sensitivity, especially in children and HIV positive people [24], so culturing of MTB has become increasingly important in the last decades.

<table>
<thead>
<tr>
<th>Patient group</th>
<th>No.</th>
<th>Media</th>
<th>Positive</th>
<th></th>
<th>Negative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group I (new cases)</td>
<td>34</td>
<td>Lowenstein Jensen</td>
<td>34</td>
<td>100</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bio-FM</td>
<td>33</td>
<td>97.1</td>
<td>1</td>
</tr>
<tr>
<td>Group II (relapse)</td>
<td>10</td>
<td>Lowenstein Jensen</td>
<td>8</td>
<td>80</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bio-FM</td>
<td>8</td>
<td>80</td>
<td>2</td>
</tr>
<tr>
<td>Group III (treatment failure)</td>
<td>6</td>
<td>Lowenstein Jensen</td>
<td>5</td>
<td>83.33</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bio-FM</td>
<td>5</td>
<td>83.33</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>50</td>
<td>Lowenstein Jensen</td>
<td>47</td>
<td>92</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bio-FM</td>
<td>46</td>
<td>94</td>
<td>4</td>
</tr>
</tbody>
</table>

Table 5 Comparison between Lowenstein Jensen and Bio-FM as regards mean detection times in days.

<table>
<thead>
<tr>
<th>Media</th>
<th>No.</th>
<th>Range</th>
<th>Mean ± SD</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lowenstein Jensen</td>
<td>45</td>
<td>11–52</td>
<td>20.62 ± 9.640</td>
<td>23.816</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Bio-FM</td>
<td>45</td>
<td>5–43</td>
<td>12.58 ± 8.622</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 1 Comparison between positive and negative results on Lowenstein Jensen. Yellow colonies of Mycobacterium tuberculosis representing positive growth are clearly seen in (A) which are absent in (B).

Figure 2 Comparison between positive and negative results on Bio-FM. Cloudiness and turbidity with dark violet dots demonstrating positive growth are clearly seen in (A). Clear aspect with no turbidity, cloudiness or dark violet dots is seen in (B) reflecting negative results.

Culture is used to detect cases with low mycobacterial loads and is also requested in cases at risk of drug-resistant TB for drug susceptibility testing or in cases where disease due to another member of the mycobacterium genus is suspected.

Different culture media are in use for the isolation of mycobacteria. The most common are based on egg and also contain high concentrations of malachite green to overcome contamination with other bacteria. In general, only solid Lowenstein Jensen medium is available in many low-income countries, as it is made on site. However, culture on Lowenstein Jensen is long (3 weeks to 3 months for MTB) and time consuming. The Bio-FM broth is an enriched Middlebrook medium that has been in the market for several years, but it has never been evaluated in low-income countries. The only study published on the evaluation of this medium in a high TB incidence country was made by Ramarokoto et al. [20].
Lowenstein Jensen and bio-fm media in identification of Mycobacterial TB

This study included 50 sputum smear positive tuberculous patients, who were classified into 34 new cases (group I) representing 68% of the total cases, 10 relapsed cases (group II) and 6 treatment failure cases (group III) representing 20% and 12% of the total cases respectively.

The shortest mean detection times on the two studied isolation media were for the cases with far advanced lesion on chest X-ray. On Lowenstein Jensen, it was 17.50 ± 6.802 days, and on Bio-FM it was 10 ± 5.752 days. The longest times were for the cases of minimal lesion. On Lowenstein Jensen, it was 24 ± 11.449 days, and on Bio-FM it was 15 ± 10.905 days. The mean detection times of moderately advanced cases on Lowenstein Jensen was 19.57 ± 9.086 days, and on Bio-FM was 12.65 ± 8.074 days.

The mean detection time on Bio-FM was significantly shorter than that on Lowenstein Jensen in cases of moderately advanced tuberculous lesions on chest X-ray (P-value < 0.05), while in cases with minimal and far advanced radiological lesion, it was highly significant (P-value < 0.001).

In this study, patients represented by cavitary lesion on chest X-ray formed 26% of the total cases reviewed in this study (13 cases of total 50 cases). A previous study made by Leung et al. [10] showed that the incidence of cavitary lesion ranged between 13–24%. Gómez et al. [8] showed incidence about 19% and 34% in 2 studied groups.

It was also noted from that the mean detection times on both media in cases with cavitary lesion on chest X-ray were highly significantly shorter than the cases without cavitary lesions (P-value < 0.001). The mean detection time on Lowenstein Jensen for cases with cavitary lesions was 14.39 ± 1.938 days, compared with that for cases with non-cavitary lesion which was 22.65 ± 10.259 days, and on Bio-FM mean detection time was 7.62 ± 2.219 days for cases with cavitary lesion and 14.36 ± 9.384 days for cases with non cavitary lesion.

Palaci et al. [14] demonstrated the relationship between quantitative sputum bacillary load and the radiological extent of tuberculous lesions as well as presence or absence of cavitary lesion in chest X-ray. In their study there was a positive correlation between radiological extent of pulmonary tuberculous lesions and the sputum bacterial loads (more advanced lesions associated with more sputum bacterial loads), also they demonstrated that tuberculous cavitary lesions were associated with more sputum bacterial loads.

Cavitary disease also has been shown to be an important risk factor for treatment failure and relapse and possibly for development of drug resistance during treatment [3].

According to Rathman et al. [21] and Matsuoka et al. [12], higher bacterial loads were found in sputum samples associated with a shorter detection time. Another study made by Perrin et al. [16], investigated the relationship between detection time of MTB and presence or absence of cavitary disease by using the Bact/ALERT culture system. The mean detection time was significantly lower in patients with cavities (8.4 days) than in those without cavitation (16.2 days). In patients with four to five cavities, the mean detection time was lower (5.3 days) than those with one to three cavities (13.4 days) and without cavities (17.5 days). A similar study was made by Palaci et al. [14], in which BACTEC 460 system was used for culture of MTB instead of Bact/ALERT system. In the later study, shorter mean detection time (3.5 days) was associated with cavitary disease and longer mean detection time (9.0 days) was associated with non cavitary disease. These detection time values were lower than those reported by Perrin et al. [16] suggesting that growth in the BACTEC 460 is more rapid than in the Bact/ALERT and/or the overall mycobacterial loads of their patients were much higher.

The study clearly follows these conclusions; we reported relationship between detection time of MTB and radiological extent of tuberculous lesion as well as the presence or absence of cavitary disease but by culturing on Lowenstein Jensen and Bio-FM media in comparative manner.

From above results, we can also conclude that the detection time values on Bio-FM are lower than those on Lowenstein Jensen either in cases with or without cavitary lesion and whatever the radiological extent of the tuberculous lesions is.

Diabetic patients represented 14% of the total cases in this study (7 cases of total 50 cases), similar to those rates reported by Yamagishi et al. [30] which was 14.1% but slightly more than those reported by Yamagishi et al. [31] and much more than that reported by Aktogu et al. [2] which was 7.8%. The incidence was only 1% in the study made by Lienhardt et al. [11], in which only 9 cases were diabetic among 647 pulmonary tuberculous cases.

All 7 tuberculous patients having DM gave positive growth on Bio-FM compared with only 6 patients on Lowenstein Jensen. These patients also showed significant shorter mean detection time (P-value < 0.05) on Bio-FM (12 ± 5.292 days) compared with that of on Lowenstein Jensen (20.67 ± 6.947 days).

In this study, diabetic patients had shorter mean detection times on either Lowenstein Jensen or Bio-FM than those of non diabetic patients. This may be contributed to higher bacillary burden at presentation of tuberculosis in diabetic patients [5] or to the prevalence of cavitary disease in diabetics which was supported by Umut et al. [26] and Ekim et al. [6], and so higher bacterial loads found in their sputum were associated with shorter detection times [21,12].

Five patients under anticancer chemotherapy having tuberculosis were present in this study, representing 10% of the total studied groups. The mean detection time of these patients was shorter than that of patients who have nothing besides pulmonary tuberculosis, on either Lowenstein Jensen (21.2 ± 4.382 days versus 23.63 ± 12.937 days) or Bio-FM (11.4 ± 0.548 days versus 16.29 ± 12.221 days). These Patients also showed significant shorter mean detection time (P-value < 0.05) on Bio-FM (11.4 ± 0.548 days) compared with that on Lowenstein Jensen (21.2 ± 4.382 days).

Drug users having pulmonary tuberculosis had shorter mean detection time than non-drug users, on either Lowenstein Jensen (17.6 ± 5.983 days versus 23.63 ± 12.937 days) or Bio-FM (10.4 ± 5.225 days versus 16.29 ± 12.221 days). These patients also showed highly significant shorter mean detection time (P-value < 0.001) on Bio-FM (10.4 ± 5.225 days) compared with that on Lowenstein Jensen (17.6 ± 5.983 days). Patients having chronic obstructive pulmonary disease represented 8% of the total cases reviewed in this study (4 cases of total 50 cases), more than the percentage present in the study made by Leung et al. [10] which was 5.8%. Patients having COPD besides pulmonary tuberculosis have a shorter mean detection time than those who have nothing besides pulmonary tuberculosis, on either Lowenstein Jensen (18.75 ± 6.292 days versus 23.63 ± 12.937 days) or Bio-FM (11 ± 6.272 days versus 16.29 ± 12.221 days). These Patients also showed significant shorter mean detection time (P-value < 0.005) on Bio-FM (11 ± 6.272 days) compared with that on Lowenstein Jensen (18.75 ± 6.292 days).
In this study, the incidence of patients having CRF among pulmonary tuberculosis cases reviewed in this study was 8% (4 cases of total 50 cases). It was noted that tuberculous patients with CRF have a shorter mean detection time than those who have nothing besides pulmonary tuberculosis, on either Lowenstein Jensen (15 ± 2.449 days versus 23.63 ± 12.937 days) or Bio-FM (7.5 ± 2.082 days versus 16.29 ± 12.221 days). These Patients also show significant shorter mean detection time (P-value < 0.001) on Bio-FM (7.5 ± 2.082 days) compared with those on Lowenstein Jensen (15 ± 2.449 days). Patients with chronic renal failure and/or renal transplants are known to be a high-risk group for tuberculosis. The risk of developing tuberculosis in these patients is about 6.9–52.5-fold compared to risk in the general population [13].

In this study, patients on corticosteroid therapy represented 8% of the total cases reviewed in this study (4 cases of total 50 cases), more than the percentage present in two studies made by Kobashi and Matsushima [9] which was 2.1% in the study made between 1991 and 1996 and 4.3% in the study made between 1996 and 2001. In a more recent multi-location study made by Falagas et al. [7] the percentage ranged from 0% to 13.8%. In this study, tuberculous patients under corticosteroid therapy had the shortest mean detection time among the studied groups who either having another underlying disease or receiving other medical treatment besides having pulmonary tuberculosis, on either Lowenstein Jensen (13.75 ± 1.258 days) or Bio-FM (7.25 ± 1.708 days). These Patients also showed a highly significant shorter mean detection time (P-value < 0.001) on Bio-FM (7.25 ± 1.708 days) compared with that on Lowenstein Jensen (13.75 ± 1.258 days). It is widely accepted that corticosteroid therapy may reactivate a latent TB infection or increase the risk of new infection by suppressing cell-mediated immune responses thus causing a reduction in resistance to infections. It is also known that large doses of corticosteroids suppress antibody formation. Several studies have shown an emergence/reactivation of TB in patients treated with systemic corticosteroids; the percentage varies from 0% to 3% [22].

Patients who have nothing besides pulmonary tuberculosis have statistically insignificant shorter mean detection time of growth (P-value > 0.05) on Bio-FM (16.29 ± 12.221 days) compared with that on Lowenstein Jensen (23.63 ± 12.937 days).

In this study, we compare between both media as regards detection rate. No cases gave positive results on Lowenstein Jensen with duration up to 7 days compared with 14 cases who gave positive results on Bio-FM representing 30.43% of the total number of cases. Regarding duration range of 8–14 days, 15 cases gave positive results on Lowenstein Jensen representing 31.91% of the total number of cases, compared with 20 cases on Bio-FM representing 43.48% of the total cases. The total number of cases that gave positive results on Bio-FM with duration range up to 14 days was 34 cases representing 73.91% compared with 15 cases on Lowenstein Jensen representing only 31.91% of the total number of cases. With duration range of 14–21 days, 19 cases gave positive results on Lowenstein Jensen representing 40.43% of the total number of cases compared with 7 cases on Bio-FM representing 15.23% of the total number of cases. With duration range beyond 14 days up to 56 days, only 5 cases gave positive results on Bio-FM representing 10.86% of the total number of cases compared with 13 cases on Lowenstein Jensen representing 27.65% of the total number of cases. It was noted that no cases gave positive results on Bio-FM after 49 days.

In this study, there was no significant difference between the two media in detection rate (94% of the total cases gave positive results on Lowenstein Jensen compared with 92% on Bio-FM). All cases of group I gave positive results on Lowenstein Jensen (100%) compared with 33 cases on Bio-FM (97.1%). Patients of group II and III have the same results on both media. 8 cases gave positive results in group II and 5 cases in group III. The mean detection time of cases on Bio-FM was highly significantly shorter than that of cases on Lowenstein Jensen (12.58 ± 8.622 days for Bio-FM versus 20.62 ± 9.640 days for Lowenstein Jensen – P-value < 0.001).

Lowenstein Jensen was incorporated in many studies in comparison with other media for culturing of MTB. Van Grie- thuyzen et al. [27] compared culturing of respiratory specimens on Lowenstein Jensen in comparison with Fluorescent BACTEC 9000 MB System and Septi-Chek AFB System. In their study, 76 smear AFB positive samples were cultured on the three media, 67 cases only gave positive results on Lowenstein Jensen with a detection rate of about 88.2% and the mean detection time was 22.5 ± 8.8 days. Two years later, in 1998, 2 studies were published. The first was made by Chew et al. [4] who cultured 149 sputum samples on Lowenstein Jensen in comparison with MGIT and Bactec systems, only 68 samples were AFB positive, of which 51 samples gave positive results on Lowenstein Jensen with a detection rate of 75% and the mean detection time was 25 days. The second was made by Tortoli et al. [25] who cultured 179 respiratory samples on Lowenstein Jensen in comparison with ESP Culture System II (now named Ver-saTREK) and BACTEC 460 TB. 116 samples gave positive results on Lowenstein Jensen with a detection rate of 64.8% and the mean detection time was 28.56 ± 10.8 days.

Somoskovi et al. [23] cultured 55 smear AFB positive sputum samples on Lowenstein Jensen in comparison with BACTEC MGIT 960 System and BACTEC 460 TB System. 45 cases gave positive results on Lowenstein Jensen with a detection rate of about 81.8% and the mean detection time was 20.1 days.

Piersimoni et al. [17] cultured 67 cases on Lowenstein Jensen in comparison MB/BacT ALERT 3D System with Radiometric BACTEC System. 62 cases gave positive results on Lowenstein Jensen with a detection rate of about 92.53% and the mean detection time was 20.6 days.

Only one previous study compared the use of Lowenstein Jensen with Bio-FM. In this study, Ramarokoto et al. [20] found no significant difference in detection rate between Lowenstein Jensen compared with that on Bio-FM. It was 93.15% and 97.9% for Lowenstein Jensen and Bio-FM respectively. In accordance with our study, the mean detection time of cases on Bio-FM was highly significantly shorter than that of cases on Lowenstein Jensen (12.42 days versus 20.7 days – P-value < 0.001).

**Conclusion**

Bio-FM showed greater superiority in detection time over Lowenstein Jensen with no significant difference between the two media in detection rate. This superiority occurs in both patients groups who had nothing besides tuberculosis and in patients who had additional morbidity variables (like DM, COPD) or receiving treatment (such as corticosteroids or anticancer chemotherapy), so Bio-FM broth may replace Lowenstein Jensen medium in the future for its better performance.
References


