Antibiotic Residues in Milk Supplies in Zimbabwe

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ABSTRACT

Raw milk samples from 73 individual milk producers were obtained at the three main Dairy Marketing Board (DMB) collection centers in Zimbabwe during the period of January to February, 1988. The samples were examined for the presence of antibiotics using the Delvotest-P (Gist-Brocades) ampoule test method with a sensitivity of 0.002 I.U. of penicillin per ml of milk. Four samples (5.5%) contained more than 0.005 I.U. of penicillin per ml or equivalent. Two (2.8%) samples contained antibiotics other than penicillin. An antibiotic depletion study using 23 cows treated with a multiple antibiotic intramammary infusion product, streptomycin - penicillin mixture (Dispolac RX4 B®; Coopers, South Africa), indicated a withholding period of 7-8 d was necessary to obtain milk free of detectable residues. The sensitivity of the Delvotest-P for streptomycin was determined by the manufacturers and found to be 4-6 µg/ml.

Antibiotics are widely used in dairy cows for the treatment and prevention of mastitis, in reproductive tract infections, and for the treatment of other infections. This may lead to the excretion of antibiotic residues into the milk and to their accumulation in animal tissues (1,3,5,12,14). The presence of antibiotic residues in raw milk is prohibited (6,9,15,16). Allergic reactions to antibiotic residues especially to people sensitive to penicillin is a major health concern. The development of antibiotic resistant bacteria may also result from exposure to antibiotic residues in food and in milk (9,15,16). Antibiotic residues in raw milk can cause considerable problems in the manufacture of cultured milk products. Microbiological assays using Streptococcus and Bacillus species are still commonly used for detecting antibiotic residues in milk. Bacillus species are more commonly used because of their higher sensitivity to the majority of antibiotics found in milk (2,6,7,8,10,11,14). The use of Bacillus stearothermophilus var. calidolactis has been refined and promoted as Delvotest-P multi and Delvotest-P test by Gist-Brocades nv Delft, Holland. The procedure recommended by the manufacturer was followed. The ampoules were incubated at 64°C in a water bath for 2 1/2 h and examined for color change. A yellow color over the entire solid indicated a sample free of detectable residues. A purple color over the entire solid indicated a penicillin concentration of at least 0.005 I.U. per ml of milk, and partly yellow and partly purple color of the solid medium indicated a penicillin concentration of between 0.002 - 0.005 I.U. per ml of milk. Some of the samples giving a positive result for penicillin at 0.005 I.U. per ml were treated with penicillinase before repeating the test.

RESULTS AND DISCUSSION

Of the 73 individual producer samples, 44 (60%) and 29 (40%) were from can and bulk tank milk suppliers,
TABLE 1. Screening test results on 73 individual raw cow milk samples delivered to the three main collection depots.

<table>
<thead>
<tr>
<th>Center</th>
<th>Total samples Tested</th>
<th>Can milk samples</th>
<th>Bulk tank samples</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>+</td>
<td>±</td>
</tr>
<tr>
<td>Bulawayo</td>
<td>20</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Gweru</td>
<td>25</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Harare</td>
<td>28</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>73</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

- Negative; < 0.002 I.U./ml of penicillin or "equivalent."
± Doubtful: between 0.002 - 0.005 I.U./ml "equivalent."
+ Positive; > 0.005 I.U./ml "equivalent."

respectively. Four (5.5%) samples contained at least 0.005 I.U. of penicillin per ml with 3 (75%) of these samples representing bulk tank milk (Table 1). Three (4.1%) samples were doubtful with residue levels between 0.002 - 0.005 I.U. of penicillin or "equivalent" antibiotic per ml.

Two (50%) of the four samples positive for antibiotic residues at 0.005 I.U. of penicillinase. The inhibitors in the other two samples were not identified. Only one can milk sample with antibiotic residues of between 0.002 - 0.005 I.U./ml was analysed and found to be negative after treatment with penicillinase. Samples which remained positive after treatment with penicillinase indicates the presence of other antibiotic residues such as tetracycline, cephalosporin, or other semi-synthetic penicillins.

Residues were detected for up to 8 d in cows infused with Dispolac RX4 B® (Table 2). A similar study with five cows found the residues to persist beyond 180 h (7.5 d) after treatment with a penicillin/streptomycin/neomycin mixture. The withholding time for Streptopen® using a Bromocresol purple (BCP) test with a detection limit of 0.01 I.U. of penicillin per ml was given as 4 1/2 d for milk in England and Wales (4).

The terms of sale for milk sold by milk producers to the DMB in Zimbabwe conforms with other countries; i.e. the proper withholding times for milk from cows under antibiotic treatment should be observed. The main reasons for the detection of antibiotic residues were due to not observing withholding times for milk at all or for the full recommended time, poor or absence of records for cows on treatment, and the lack of knowledge of the importance of withholding times for health and for the dairy industry. The limited and approved veterinary drug list for Zimbabwe reveals that most intramammary preparations on it are based on penicillin, ampicillin, or cloxacillin. Oxytetracycline is also used. However, other preparations not on the list are used by some farmers. A selected number of preparations is desirable since no single test has the sensitivity to detect residues from all preparations to acceptable levels. Even locally available products should be properly analysed for withholding times.

CONCLUSION

The primary concern over the presence of antibiotic residues in cow milk leading to the emergence of bacterial resistance and allergy has not been proven (1,9,15), however, protection of public health is still desirable. The major concern of antibiotic residues is strongly motivated by economics in so far as it affects starter cultures for fermented products resulting in downgrading or rejection of whole batches. The Delvotest proved to be a rapid, convenient, and very reliable for screening raw milk for the presence of antibiotic residues. The test is sensitive not only to penicillin but also other antibiotics.

ACKNOWLEDGMENTS

Dr. C. van der Vlies, Gist-Brocades, for donating the Delvotest-kit together with the product brochure, the Dairy Services at Harare, Gweru and Bulawayo for enabling us to collect samples, and the farmers who participated in this exercise. Dr. G. Odiawo for useful discussions, Mr. J. Matukutire and Mr. L. Mareyanadzo, student research assistants, and the University of Zimbabwe Research Board for funding the project.

REFERENCES


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