

## SHORT COMMUNICATION

# MICROBIOLOGICAL QUALITY OF LOCAL MILK SUBMITTED TO REGIONAL VETERINARY LABORATORIES IN 2017

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**ABSTRACT.** Raw milk from local dairy farmers sent to Pusat Pengumpulan Industri Tenuku (PPITs) or the Milk Industries Collection Centre are subject to platform tests based on a milk acceptance criteria, and are also submitted to the Regional Veterinary Laboratories for the total plate count (TPC) test. The TPC test result is also used for milk grading which determines the payment to the farmer. This study evaluated the percentage of raw milk samples (analysed by regional veterinary laboratories) with TPC results exceeding the limits to estimate the quality of local milk. From January to August 2017, a total of 3,417 raw milk samples from 16 PPITs were analysed by Kuantan Regional Veterinary Laboratory (MVKK), Johor Bahru Regional Veterinary Laboratory (MVKJB), Bukit Tengah Regional Veterinary Laboratory (MVKBT) and Kota Bharu Regional Veterinary Laboratory (MVKKB). The acceptable TPC in raw milk was  $1 \times 10^6$  cfu/ml or lower. Overall, 1,632 (48%) of the 3,417 samples were detected to have TPC results above the acceptable limit. The percentage of samples above the acceptable limit in decreasing order were from MVKJB

(64%), MVK BT (25%), MVKKB (4%) and MVKK (1%). These results could be used by policy makers to improve the hygiene and safety of production from farm to table to ensure that good quality milk is available for the country.

## INTRODUCTION

The safety of dairy products with respect to food-borne diseases is of great concern around the world, including the importance of its quality. Microbial load of milk is a major factor in determining its quality, reflecting the manner of handling from milking till consumption. Contamination can arise from the animal, environment and humans. Milk from a healthy udder contains few bacteria but it picks up more bacteria from the time its expressed from the teat of the cow until it undergoes further processing. Milk produced under hygienic conditions from healthy animals should not contain more than  $5 \times 10^5$  cfu/ml (O'Connor, 1994). Others may set different limits, for example at  $1 \times 10^5$  cfu/ml (raw cow's milk) whilst the limit for milk from sheep, goats or buffalo is  $1.5 \times 10^6$  cfu/ml if the milk is going to be heat treated

(Small, 2006). The Malaysian Food Act has established the limit for TPC in pasteurised milk at  $1 \times 10^5$  cfu/ml, but none for raw milk.

PPITs act as a bridge between local farmers and the milk processing industry. A small-scale dairy farmer would send milk to a PPIT for platform tests prior to acceptance. The PPIT then sends the raw milk to a regional veterinary laboratory for the TPC test. The TPC result is used to grade the milk which determines the payment to the farmer. The basic standard for raw milk of high quality was TPC  $10^6$  cfu/ml or less according to the Price Incentive Programme at PPITs (Chye *et al.*, 2004). This study evaluates results of TPC tests for the percentage of raw milk samples that fail to meet quality levels from milk samples submitted to four regional veterinary laboratories in 2017.

## MATERIALS AND METHOD

### Samples

A total of 3,417 raw milk samples were analysed from January to August 2017 by four regional laboratories, MVKK, MVKJB, MVKBT and MVKKB. Raw milk samples were sent by farmers to PPIT on a daily basis and put through platform tests prior to be accepted and pooled into a bulk tank. Not all milk received at PPIT are sent to the laboratories, but normally only once a week. About 200 ml of milk from individual farmers are sent to the laboratories on the same day or a day after being received at PPIT, maintained in a chilled condition ( $\leq 4$  °C).

### Microbiological Analysis

In all laboratories, samples are enumerated using TPC with varying methods such as conventional pour plate or rapid methods (SimPlate® and Petrifilm™), according to the Department of Veterinary Services (2016) and Feldsine *et al.* (2003). Samples were analysed at the laboratories on the same day of receipt or kept at a chilled temperature ( $\leq 4$  °C) for no more than 24 hours.

## RESULTS AND DISCUSSION

Table 1 summarises the results of TPC and other tests on raw milk samples. Overall, 1,632 (48%) of 3,417 samples were detected to have TPC results above the acceptable limit of  $1 \times 10^6$  cfu/ml. Among laboratories, the highest percentage of samples exceeding the limit was at MVKJB (64%), followed by MVKBT (25%), MVKKB (4%) and the least was from MVKK (1%). MVKKB also detected coliforms above the limit of 1000 titer in 33% of samples.

MVKJB received the highest number of samples (about 70%) as the state has the highest number of dairy farmers. MVKBT receives milk from PPITs in Kedah and Pulau Pinang. MVKKB receives milk from PPITs in Kelantan and Terengganu. Milk from farmers in the central region (states of Melaka, Negeri Sembilan and Selangor) are analysed by Makmal Susu Alor Gajah, Melaka.

Even though the laboratories were using different methods of TPC analyses, the methods were standard methods recognised by the Association of Official Analytical Chemists (AOAC) or Australian standards (AS): pour plate method (AOAC 966.23C, AS

**Table 1.** Total Plate Count (TPC) of Milk Samples Submitted to Regional Veterinary Laboratories in 2017 (Jan - Aug)

Laboratory	No. of PPIT (n)	No. of sample (n)	TPC test <sup>a</sup>		Method
			No. of sample above limit, n	(%)	
MVK Kuantan	2	211	2	(1%)	SimPlate <sup>®</sup>
MVK JB	5	2,370	1,516	(64%)	Pour plate
MVK BT	5*	371	94	(25%)	Petrifilm <sup>™</sup>
MVK KB	4**	465	20	(4 %)	Petrifilm <sup>™</sup>
Total	16	3,417	1,632	(48%)	

MVK: Makmal Veterinar Kawasan, PPIT: Pusat Pengumpulan Industri Tenuku, TDS: total dissolve solid

a Limit for TPC in raw milk is  $1 \times 10^6$  cfu/ml

\* 5 PPIT: 4 PPIT in Kedah, 1 PPIT in Pulau Pinang

\*\* 4 PPIT: 3 PPIT in Kelantan, 1 PPIT in Terengganu

\*\*\*Milk composition comprises of fat, solid non-fat, density, protein, lactose, added water, temperature, freezing point, salts, pH and conductivity

# Limit used is 1000 titer

1766.3.13), SimPlate<sup>®</sup> (AOAC 2002.07) and Petrifilm<sup>™</sup> (AOAC 990.12). These methods are similar or identical, have undergone collaborative trial process and have been validated as Official Methods<sup>™</sup> by the AOAC Research Institute (Tortorello, 2003). Hence, there is no issue on the reliability of results obtained by different laboratories.

A previous study in 2004 involving 930 raw milk samples from PPIT of four regions in Peninsular Malaysia (southern, central, eastern and northern) showed that the TPC results for each region were above the limits, with an average of  $12 \times 10^6$  cfu/ml (Chye *et al.*, 2004). This study also found a high percentage of samples with TPC results exceeding the limit. It is thought that it may be partially due to locations where the price for raw milk was a flat rate and not based on quality. Perhaps, this had contributed to the lack of awareness among farmer on the importance of producing good quality and hygienic milk.

MVKJB conducted total dissolve solid (TDS) test for milk using oven drying method as this laboratory did not have milk analyser machine. A TDS is defined as a measure of the combined content of all inorganic and organic substances contained in a liquid in molecular, ionised or micro-granular suspended form (Department of Veterinary Services, 2016). TDS values of 11% to 15% for raw cow's milk is acceptable. However, the presence of coliforms bacteria in milk was another important indicator of poor hygiene and sanitary practices during milking and further handling (Chye *et al.*, 2004).

Even though raw milk from PPITs are sent to dairy processing plants and pasteurised prior to be marketed for public consumption, raw milk with high bacterial load is still poor quality milk, having shorter shelf life and could cause economic losses to the industry, especially small dairy farmers. Some of the reasons for high counts could be due to health of the dairy herd, infected udders of the cows, unhygienic milking

process or equipment, poor quality of water used for cleaning utensils and animals, handlers, storage and transportation conditions (Chye *et al.*, 2004; Aumaitre, 1999).

In the production of safe and good quality milk, good husbandry practice should be applied, prescribed in the guidelines issued by the Department of Veterinary Services (Department of Veterinary Services, 2014). The results in this study help policy makers improve the hygiene and safety of production from farm to table, ensuring good quality milk is available for the country. The type of tests carried out for the raw milk could also be made uniform for all the laboratories.

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