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## Introduction

Mineral and trace elements concentrations in fresh milk are not constant but mainly vary according to two kinds of factors; i) those related with secretion from the mammary gland, such as the lactation state, animal species and health status and ii) extrinsic factors, such as season, dairy cattle ration (nutritional status of cow) and environment (nature of soil and locality of the farm) (1). Mineral content may represent a valid parameter to evaluate both the nutritional status in milch animals and the nutritional value of their milk. On the other hand, the presence of trace elements and heavy metals may be indicator of pollution in the environment where food is produced (2). In this study, concentrations of minerals, trace elements and heavy metals in fresh milk from Melaka, Selangor and Negeri Sembilan were determined by inductively coupled plasma mass spectrometry (ICP-MS).

## Methodology

1ml of milk was acid digested in 8 ml of 65% nitric acid and 2 ml of 30% hydrogen peroxide in a microwave digestion system (Milestone). The temperature program used in the microwave oven lasted 20 min and consisted of two steps: i) from room temperature to 200°C, ramp time 10 min and (ii) 200°C for 10 min (3). After cooling down, the digested samples were transferred to polypropylene sample tubes and diluted to 50 ml with Milli-Q ultrapure water. Minerals and trace elements were determined by ICP-MS.

Table 1. ICP-MS operating conditions and measurement parameters

Spectrometer	Perkin Elmer SCIEX
Nebulizer	1.0-1.07
Auxiliary	1-1.3
RF power (kW)	1.35
Lens voltage (V)	6.25
Plasma	16

A total of 48 fresh milk samples from three states in the month of October 2013 were analysed.

Each sample was tested for:

- Minerals - Na, K, P, Ca and Mg
- Trace elements - Fe, Zn, Cu, Mn, Se, Al, Cr
- Heavy metals - Pb, Cd, As, Hg, Sn, Sb

The data were analysed using the Statistical Package for Social Science (SPSS) Version 16.0. The mean concentration of mineral, trace elements and heavy metals of the samples obtained from the three states were analysed statistically by one-way ANOVA. A P value of less than 0.05 ( $p < 0.05$ ) are considered statistically significant.

## Conclusion

- ✓ The results of the present study indicate that concentration of several trace elements and heavy metals in milk from Melaka are significantly higher compared to Selangor and Negeri Sembilan.
- ✓ However, these results should be considered preliminary because of the low number of milk analysed.
- ✓ More samples in a longer time frame are needed to make solid conclusions especially related to the higher variation observed in some elements.

## Results and Discussion

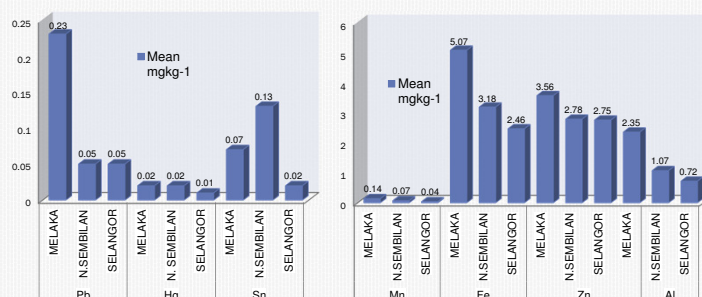
Table 2. Concentration of selected trace elements and heavy metals (mgkg<sup>-1</sup>) in fresh milk from three states.

Elements	States	N	Mean mgkg <sup>-1</sup>	Std. Deviation	Range
Pb	MELAKA	23	0.23 <sup>a</sup>	0.10	0.05-0.40
	N.SEMBILAN	11	0.05 <sup>b</sup>	0.03	0.02-0.13
	SELANGOR	14	0.05 <sup>b</sup>	0.02	0.02-0.07
Hg	MELAKA	13	0.02	0.01	0.01-0.05
	N. SEMBILAN	3	0.02	0.01	0.01-0.02
	SELANGOR	1	0.01	.	
Sn	MELAKA	23	0.07	0.11	0.01-0.44
	N.SEMBILAN	5	0.13	0.13	0.03-0.31
	SELANGOR	8	0.02	0.01	0.01-0.04
Fe	MELAKA	23	5.07 <sup>a</sup>	2.40	2.58-11.42
	N.SEMBILAN	11	3.18 <sup>b</sup>	2.01	1.93-8.00
	SELANGOR	14	2.46 <sup>b</sup>	0.44	1.88-3.56
Zn	MELAKA	23	3.56 <sup>a</sup>	0.96	1.88-5.22
	N.SEMBILAN	11	2.78 <sup>b</sup>	0.64	2.06-4.11
	SELANGOR	14	2.75 <sup>b</sup>	0.77	1.87-4.94
Mn	MELAKA	23	0.14 <sup>a</sup>	0.08	0.07-0.41
	N.SEMBILAN	11	0.07 <sup>b</sup>	0.04	0.03-0.17
	SELANGOR	13	0.04 <sup>b</sup>	2	0.03-0.09
Al	MELAKA	23	2.35 <sup>a</sup>	1.51	0.79-6.90
	N.SEMBILAN	11	1.07 <sup>b</sup>	1.36	0.34-4.78
	SELANGOR	14	0.72 <sup>b</sup>	0.43	0.37-1.72

Results show that:

- ✓ all five mineral contents in the milk from the three states are not significantly different.
- ✓ From the seven trace elements tested, Cu and Cr did not show significant difference between the three states, while other elements show significant difference of milk produced from Melaka and Selangor.
- ✓ Hg and Sn were detected in milk from all three states at low level.
- ✓ Low level of Cd, As and Sb were detected in milk from Melaka but not from Selangor and Negeri Sembilan.
- ✓ Pb was detected in milk from all the three states but it was significantly higher in Melaka as compared to Selangor and Negeri Sembilan.

Table 3. Bar chart of selected trace elements (right) and heavy metals (left) in fresh milk from Melaka, N.Sembilan and Selangor.



## References

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