# UNIVERSITI MALAYSIA SABAH

## PRELIMINARY STUDIES ON HEAVY METAL PROPERTIES IN RAW HONEY OF STINGLESS BEES (*Heterotrigona itama*) IN THE WEST COAST OF SABAH

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# INTRODUCTION

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- Stingless bees (*Heterotrigona itama*) = most reared species of bee in the commercial industry (Kelly et al., 2006)

- Honey = **sweet substance** (nectar and pollen of plants).

- It was recorded to give **positive** and **negative impact** on human depend on its surrounding environment and food sources.

- Some beekeepers were located near the **heavy traffic area** and **power plant industry**.

- Heavy traffic and power plant industry = sources of **heavy metal contaminations** (air, soil and water on its surrounding area).

- Heavy metal contamination on honey product were detected at located near the **traffics roads, vehicles and industrial area.**

- Plants and flower near contaminated area, were affected the nectar and pollen, bee's diet.

- Thus, raw and unprocessed honey that has been exposed to **pollutants,** has never been studied in Sabah

# PROBLEM STATEMENTS

- The **demand for stingless bee honey has increased** over the years compared to any other types of honey.
- **Meliponiculture** industry are located **closed to industrial area** that are easily to be exposed with **heavy metals contamination**.
- Environmental contamination with heavy metals may **reduce the quality of the stingless bee honey** that eventually can **affect human health**.
- **Lack of data** on heavy metal contamination in *H.itama* bee.

# SIGNIFICANCE OF STUDY

- Meliponiculture industry in the State of Sabah has **great economic potential**.
- Heavy metals in stingless bee honey will be **obtained**.
- The data will **provide useful information** for the beekeepers on how to properly manage the commercial stingless bee for sustainable honey production in an industrial area.
- These finding can lead to **considering the origins of honey contaminants** regarding the food safety in health policy, and providing best quality of food will protect public health and preserve consumer confidence.

# OBJECTIVES

- To measure the quantity of **heavy metals elements** (Arsenic (**As**),Cadmium (**Cd**), Chromium (**Cr**), Lead (**Pb**) and Zinc (**Zn**)) in *Heterotrigona itama* honey collected from three (3) study sites (Sipitang, Kimanis and Papar).

- To examine the **effect of heavy metals**, from polluted area to human health referring **Codex Alimentarius Standard**, Food and Agriculture Organization/World Health Organization (**FAO/WHO**) and also **Malaysian Food Act 1985**.

# MATERIALS AND METHOD

# MATERIALS

A. Sample Collection

- Raw and unprocessed honey of stingless bee (*H. itama)* were collected from the beekeepers located in **Sipitang, Kimanis and Papar, Sabah.**

- Collection of honey samples were performed far away from metallic wire crossing in order to avoid any kind of metal contaminantions.

# METHODS

Heavy metals analysis by Inductively Coupled Plasma – optical emission spectrometry (ICP – OES)

- Quantitative determination of **As, Cd, Cr, Pb and Zn** were performed by ICP – OES method.
- 5.0 g of *H.itama* honey were placed in the porcelain crucibles.
- The sample then heated for 24 hours in oven at 70 $^{0}$C before burned to ashes in furnace at 450 $^{0}$C.
- The ashes then dissolved in 5% nitric acid until 50 mL. The samples were filtrates and analysed by using ICP-OES.

(

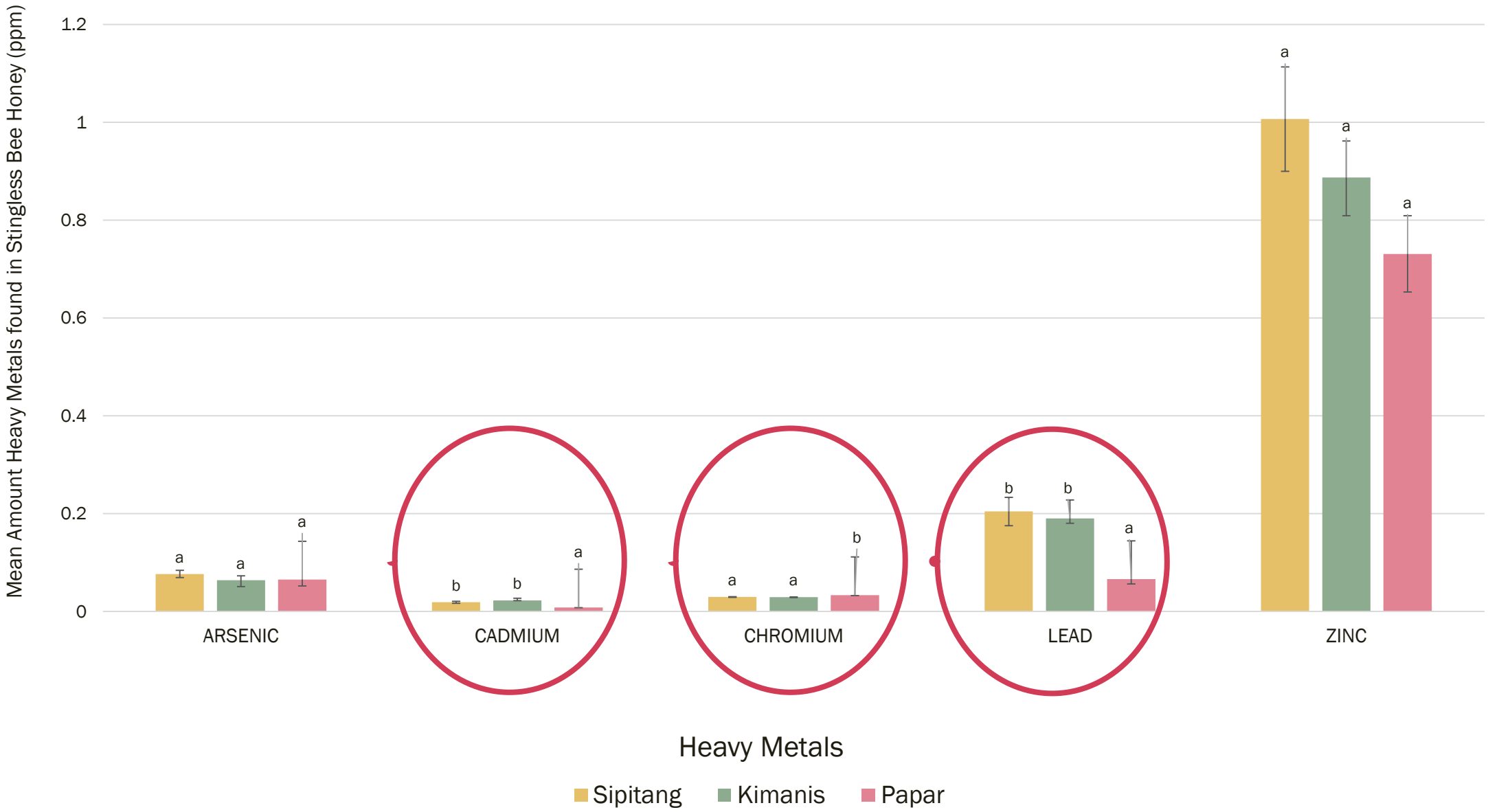
ICP-OES machine

# RESULTS AND DISCUSSIONS

# Objective 1

- To measure the quantity of **heavy metals elements** (Arsenic (**As**),Cadmium (**Cd**), Chromium (**Cr**), Lead (**Pb**) and Zinc (**Zn**)) in *Heterotrigona itama* honey collected from three (3) study sites (Sipitang, Kimanis and Papar).

# Amount of Heavy Metals in Stingless Bee Honey Found at 3 Study Sites in Sabah



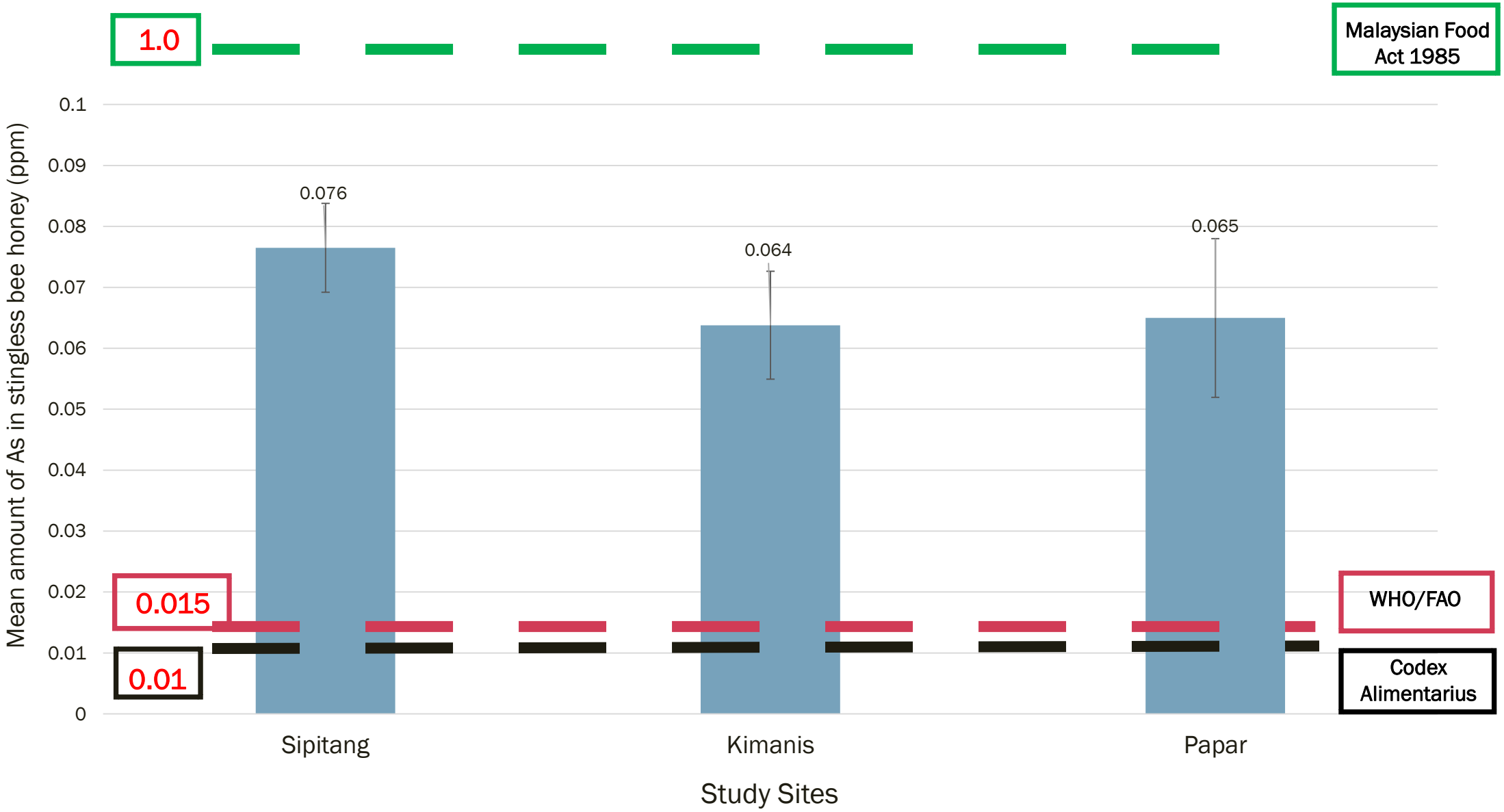
# Objective 2

- To examine the effect of heavy metals, from polluted area to human health referring Codex Alimentarius Standard, Food and Agriculture Organization/World Health Organization (FAO/WHO) and also Malaysian Food Act 1985

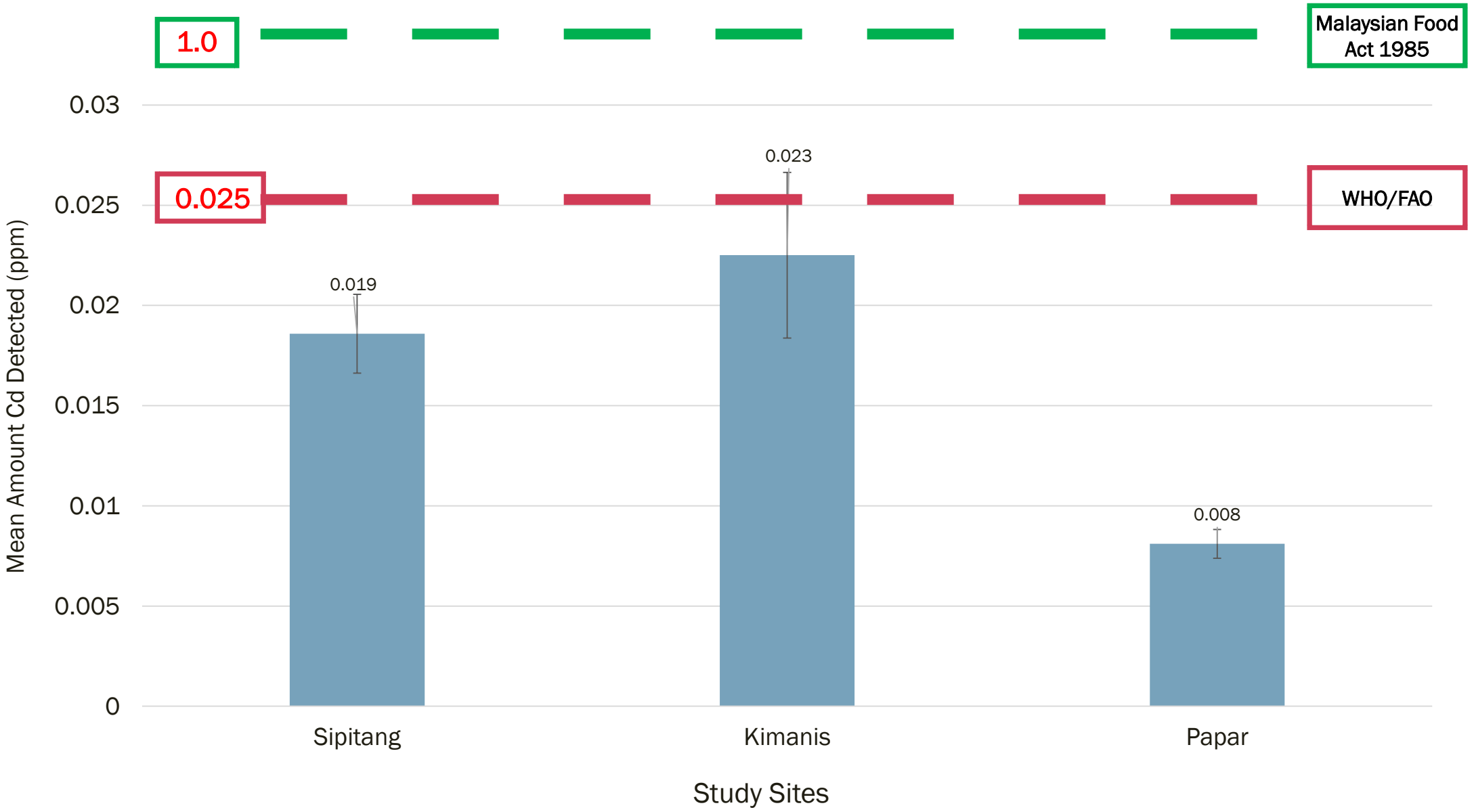
# Maximum Allowable Contaminants In Food(ppm)

| Food Standard | Arsenic (ppm) | Cadmium (ppm) | Chromium (ppm) | Lead (ppm) | Zinc (ppm) |
|---|---|---|---|---|---|
| Malaysian Food Act 1985 | 1 | 1 | Did not set any limit for Cr | 2 | 100 |
| WHO/FAO | 0.015 | 0.025 | Did not set any limit for Cr | 0.025 | - |
| CODEX | 0.01-0.50 | - | - | 0.1 | 5.0 |
| (GB2762-2005) and (GB14963-2011) in China | 0.1 | 0.05 | - | 1.0 | 25.0 |

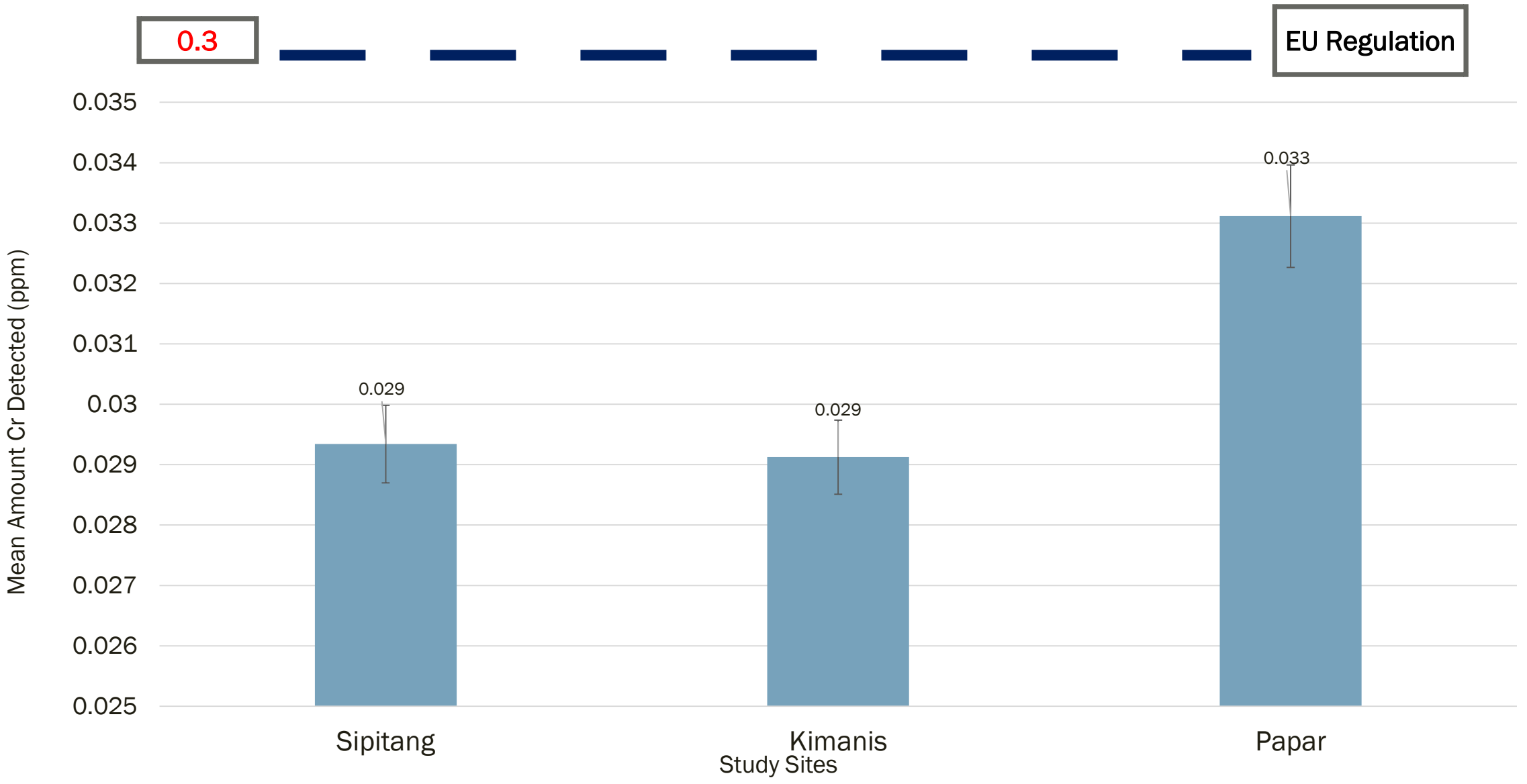
# ARSENIC


1.0
Malaysian Food Act 1985
0.1
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
Mean amount of As in stingless bee honey (ppm)
0.076
0.064
0.065
0.015
0.01
WHO/FAO
Codex Alimentarius
Sipitang
Kimanis
Papar
Study Sites

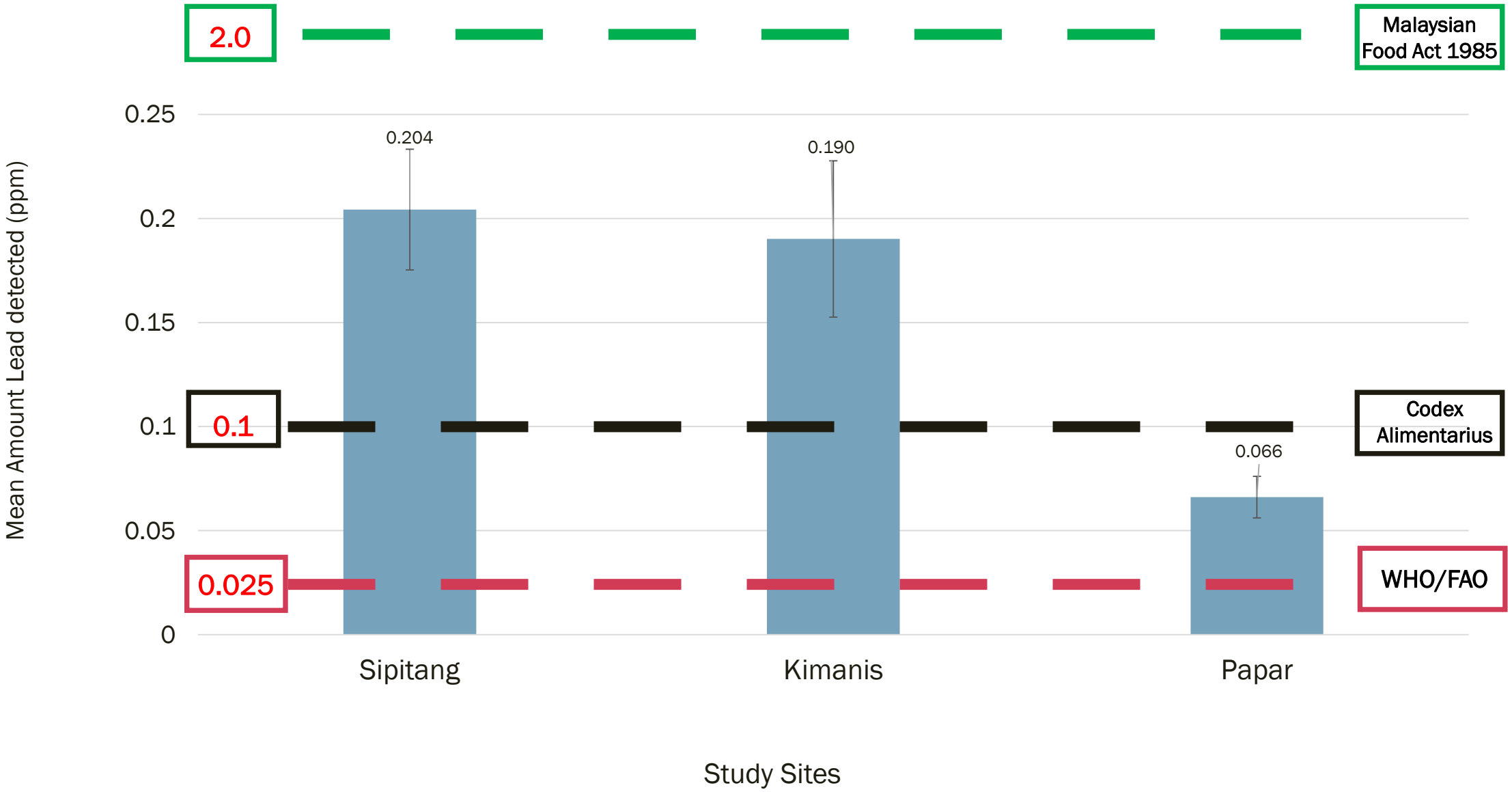
# CADMIUM


1.0
Malaysian Food Act 1985
0.03
0.025
0.025
WHO/FAO
0.02
0.015
0.01
0.005
0
Mean Amount Cd Detected (ppm)
0.019
0.023
0.008
Sipitang
Kimanis
Papar
Study Sites

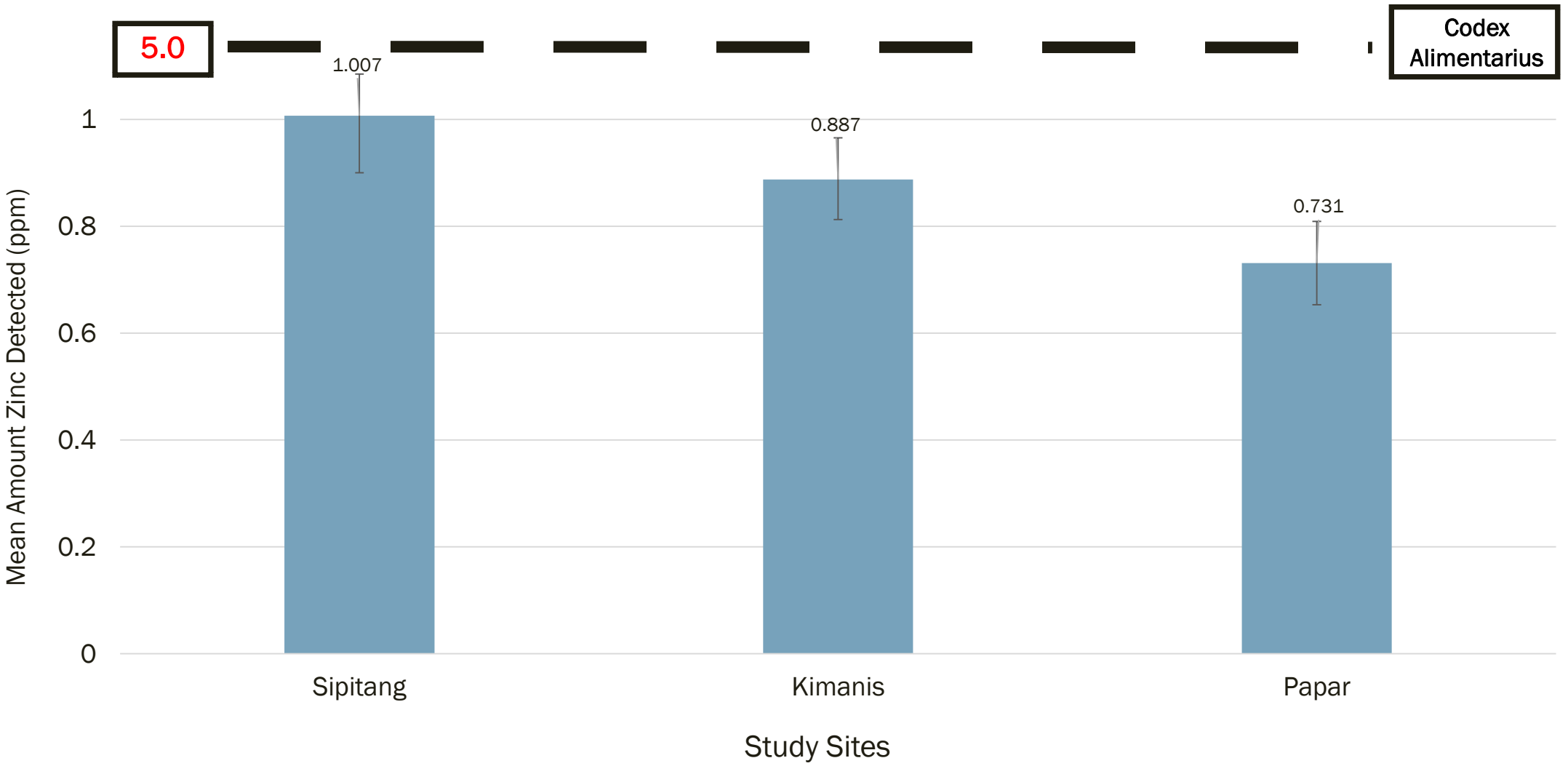
# CHROMIUM


0.3
EU Regulation
0.035
0.034
0.033
0.032
0.031
0.03
0.029
0.028
0.027
0.026
0.025
Mean Amount Cr Detected (ppm)
0.029
0.029
0.033
Sipitang
Kimanis
Papar
Study Sites

# LEAD


2.0
Malaysian Food Act 1985
0.25
0.2
0.15
0.1
0.05
0
0.1
0.025
0.204
0.190
0.066
Codex Alimentarius
WHO/FAO
Mean Amount Lead detected (ppm)
Sipitang
Kimanis
Papar
Study Sites

# ZINC


5.0
Codex Alimentarius
1.007
0.887
0.731
1
0.8
0.6
0.4
0.2
0
Mean Amount Zinc Detected (ppm)
Sipitang
Kimanis
Papar
Study Sites

- Air pollutants result from **burning oil and natural gas**.
- Continued oil and gas use will produce pollution such as **particulate matter and smog**.
- Particulate matter is released by **dust, exhaust, and other air emissions**. Smaller particles can get lodged in the lungs and lead to potential health problems. (**Source:** *U.S. Environmental Protection Agency*, "Air Quality Trends (1980-2013).
- A heavy metal is any metallic element that has a relatively high density and is toxic or **poisonous even at low concentrations** (Lenntech, 2014).
- Uptake of heavy metals along the food chain is a **potential threat to animal and human health**. (Sprynskyy et al., 2007).
- In accordance to Malaysian Standard (MS) 2679:2017 for Amalan Pertanian Baik (APB), clause 4.3.2 “Pemeliharaan lebah/kelulut hendaklah tidak dijalankan di lokasi yang mempunyai sebarang potensi pencemaran dan risiko keselamatan kepada lebah, kelulut, hasil tuaian,orang awam dan alam sekitar”.

# CONCLUSION

- In conclusion, heavy metals (As, Cd, Cr, Pb and Zn) has been detected in stinglesss bee honey *(H.itama)* in all three (3) study sites including Sipitang. Kimanis, and Papar Sabah.

- Heavy metals (As, Cd, Cr, Pb and Zn) that presents in stingless bee honey *(H.itama)* are safe to be consumed by human according to Malaysian Food Act 1985 but Arsenic(As) and Lead (Pb) element were exceed the Codex Alimentarius and FAO/WHO standard.

- Further experiments will be performed to confirm this finding.

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# THANK YOU