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BACKGROUND

•Agriculture is important in Suriname. The use of 8.8 kg of pesticides/ha cropland is among the highest in the region. Pesticide policies are lacking or minimally enforced and pesticide monitoring in crops is absent

•Screening from the Netherlands (2011-2013) on imported Surinamese produce showed that 21% of samples exceeded Maximum Residue Limits (MRLs) of the European Union (EU)

•Pesticide exposure has been associated with neurobehavioral disorders. Pregnant women and children may be vulnerable¹

•The Caribbean Consortium for Research in Environmental and Occupational Health (CCREOH) examines the impact of exposures to neurotoxicants on maternal and child health in 1000 mother/child dyads

•A subset of 696 pregnant women were examined for dietary exposure to pesticides

METHODS

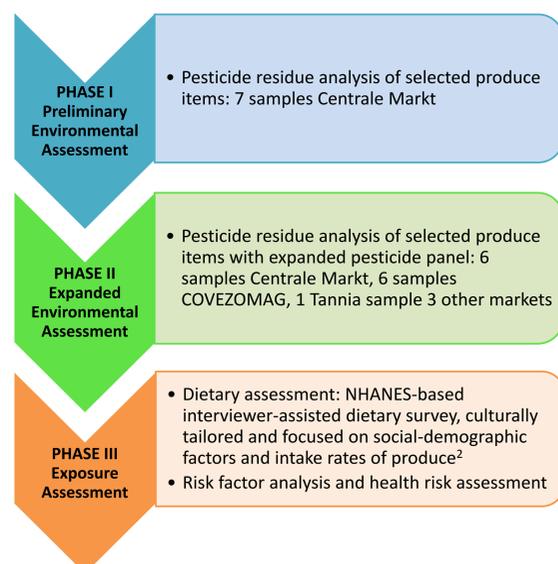


Figure 1. Study design

Phases I and II:

32 insecticides (organophosphates, organochlorines, carbamates, pyrethroids) and 12 fungicides were evaluated for their levels in selected produce.

Phase I selected produce: Tannia (*Xanthosoma brasiliense*), head cabbage (*Brassica oleracea var. capitata*), yard long beans (*Vigna unguiculata*), habanero pepper (*Capsicum chinense*), sweet potato (*Ipomoea batatas*), banana (*Musa species*). Chinese cabbage (*Brassica oleracea var. alboglabra*) and tomatoes were added in Phase II

Phase III:

•Pregnant women ≥ 16 years, singleton pregnancy and pregnancy duration < 27 weeks were recruited from all 4 hospitals in the capital Paramaribo

•Preliminary findings of the first 696 women were assessed to ascertain the influence of socio-demographic factors on consumption of Tannia; main outcome variable: high Tannia intake, defined as an intake rate $\geq 75^{\text{th}}$ percentile

•A preliminary deterministic non-cancer health risk assessment was conducted for dietary exposure to endosulfan and lindane in tannia (*Xanthosoma brasiliense*). HQs, critical intake rates and LOCs were determined under best, average and worst case scenarios

RESULTS

Phases I and II

•Phase I: the sample of Tannia contained 0.07 $\mu\text{g/g}$ endosulfan (higher than the EU MRL of 0.05 $\mu\text{g/g}$)

Phase II: four samples had detectable levels of pesticides: organochlorines (endosulfan and lindane) or pyrethroids (cypermethrin and lambda cyhalothrin) in tannia, tomato and Chinese cabbage (Table 1)³.

Table 1. Phase II pesticide residues in crops with positive results ($\mu\text{g/g}$)

SOURCE & COMMODITY	PESTICIDE RESIDUE LEVELS (in $\mu\text{g/g}$)										
	ORGANOCHLORINES				PYRETHROIDS						
	Endosulfan sum		Lindane		Cypermethrin			Lambda cyhalothrin			
PRL ^a \pm SD ^b	MRL ^c EU	PRL \pm SD	MRL EU	PRL \pm SD	MRL EU	MRL USA	MRL WHO	PRL \pm SD	MRL EU	MRL USA	
Centrale Markt											
Tannia	0.04 \pm 0.03	0.05	0.02 \pm 0.01	0.01	ND	---	---	---	ND	---	---
Tomato	ND	---	ND	---	0.32 \pm 0.20	0.50	0.20	0.20	ND	---	---
Covezomag											
Tannia	ND	0.05	0.03 \pm 0.02	0.01	ND	---	---	---	ND	---	---
Chinese cabbage	ND	---	ND	---	ND	---	---	---	1.08 \pm 0.71	1.00	0.40

PRL: Pesticide Residue Level/ ND: Non Detect.

Phase III

•87.4% reported to obtain vegetables from a fresh market, 43.4% from the supermarket and 33.5% from their own garden

•39.2% ranked Tannia as the top 1 consumed leafy vegetable



Figure 2. Tannia (*Xanthosoma brasiliense*)

•Median frequency of consumption 0.14 times/day (IQR: 0.14-0.57);
•Median intake quantity per meal 62.50 gram (IQR: 62.50-112.50);
•Median intake rate 11.70 gram/day (IQR: 8.94-35.69)

•37.0% of women had high intake rates (≥ 35.69 gram /day)

•Multivariate analysis: The intake rate of Tannia was higher for women living in the city (OR 1.5; 95% CI 1.0 - 2.2; $p = 0.076$) and for higher educated women (OR 1.9; 95% CI 1.2 - 3.2; $p = 0.011$)

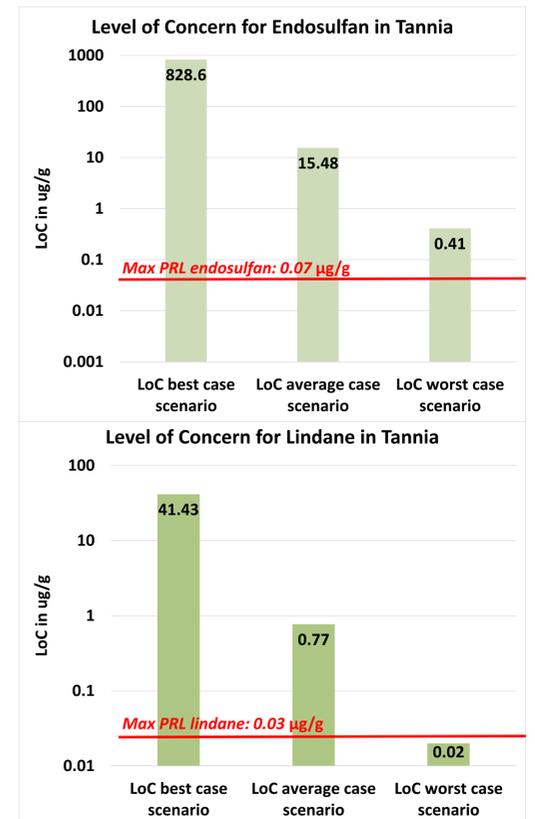


Figure 3. Levels of concern endosulfan and lindane in tannia compared to highest measured pesticide residue level

DISCUSSION

•Among the few pesticide residues detected in selected produce items were endosulfan and lindane, prohibited in Suriname and listed under the Stockholm Convention to eliminate and/or control their use

•Since the value of an MRL is based on Good Agricultural Practices, an investigation of agricultural practices is needed

•Most women (39.2%) reported Tannia as the top 1 consumed leafy vegetable, which confirmed selecting Tannia in Phases I & II

•Dietary exposure to endosulfan in tannia does not seem to pose a risk for adverse health effects. Since the current RfDs for endosulfan and lindane are based on non-neurotoxic endpoints, the risk assessment findings must be interpreted cautiously

CONCLUSIONS

The pilot environmental study showed the presence of widely banned POPs in Surinamese produce. The findings emphasize the need to address environmental policy gaps. However, a more comprehensive sampling and analysis of produce from Suriname as well as a cumulative health risk assessment is warranted

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