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RISK ASSESSMENT OF MANUAL APPLICATION OF PESTICIDES: COMPARING EFFECTIVENESS OF PASSIVE DOSIMETRY METHODS

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ABSTRACT

This study compares two methods of passive dosimetry widely adopted for quantitative assessment of occupational exposure to pesticides. Experiments were conducted to simulate manual application of pesticides in three distinct target situations: soil, foliage and greenery upper front. There were significant differences between the results and the trend to overestimation of the sampling procedure on the census method. Special care is recommended for its adoption and restricted use to comparative assessments.

Keywords: pesticides, quantitative evaluation, passive dosimetry

INTRODUCTION

The risk of human poisoning by potential exposure to pesticides has been studied by the scientific community as a serious public health problem. It presents a direct impact to workers and consumers in particular, and to society in general through environmental contamination, especially in developing countries (Rebelo et al, 2011; Lu, 2009; Ntow et al, 2009; Kumar et al, 2009). The International Labour Organization and the World Health Organization (ILO/WHO, 2011) estimate that in developing countries annually, 7 million workers are poisoned by pesticides and, of these, 70 000 workers suffer fatal intoxication. Studies on this topic have adopted two approaches: (1) qualitative, focusing on public policies for prevention, exposure control and analysis of the exposed workers' subjectivity; and (2) quantitative, evaluating workers potential exposure to pesticides in different workplace scenarios, through passive dosimetry techniques.

Passive dosimetry application requires collecting samples of the substances that are absorbed by workers during a workday. Special absorbing clothing can be used, or special absorbent samplers, either in real work situations (with pesticides) or through simulation (with dyes or other markers). In the present study, the census and the sampling methods were compared, in simulated work situations with the use of dyes. It was only taken into consideration the activity of manual application of pesticides, using a portable (operator-carried) sprayer, by spraying in 3 different situations: down applications (towards the ground), forwards and upwards.

RESULTS AND CONCLUSIONS

The obtained results indicate major differences between the methods regarding potential dermal exposure (from 25% to 401%) and a clear tendency to overestimate the sampling

method (Table 1). Furthermore, relevant differences were registered when considering the different body regions of the affected workers (figure 1).

Table 1 - Potential exposure estimates: sampling and census methods (mg/day of syrup)

	Experiment 1 (low)			Experiment 2 (forefront)			Experiment 3 (top)		
	C[1]	A[2]	Δ[3]	C[1]	A[2]	Δ[3]	C[1]	A[2]	Δ[3]
Worker 1	243	470	**93**	169	480	**184**	574	1749	**205**
Worker 2	277	803	**190**	303	728	**140**	251	748	**198**
Worker 3	116	145	**25**				175	575	**229**
Worker 4	84	271	**223**				231	1158	**401**

[1]Census method, [2]Sampling method, [3]registered difference (%)

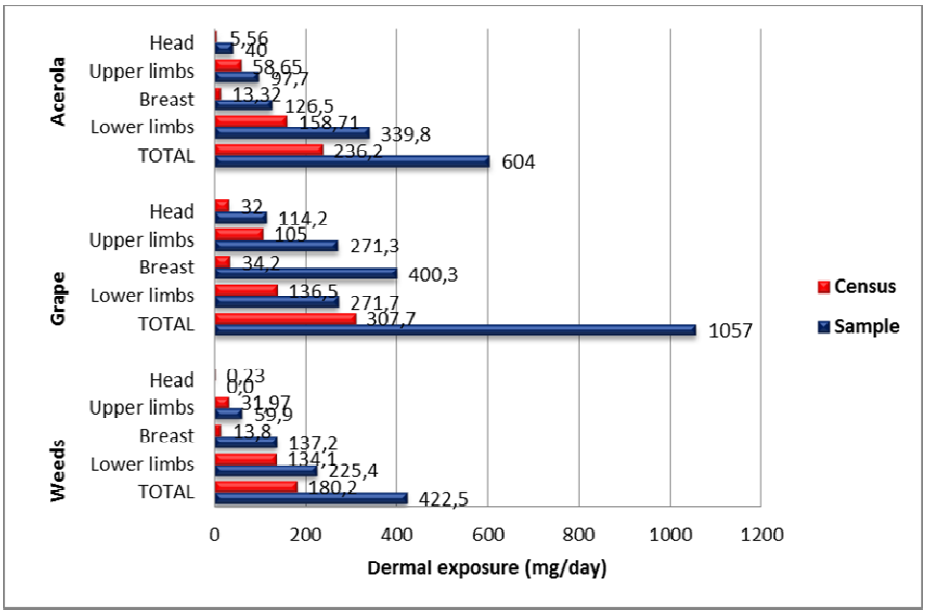

Fig. 1 - Comparison of average dermal exposure by body parts

Recommendations based on the final results: (1) a review of WHO standard anthropometric surfaces when calculating the samplers' expansion factors, (2) census evaluation method preferential utilization, (3) sampling method limited adoption to comparative studies.

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