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Assessment of exposure to pesticide residues in Tunisian crop greenhouses

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❖Introduction

During cultivation, chili pepper and tomato require the use of a broad range of pesticides to prevent and control pests and diseases. Fruits and vegetables are sprayed several times and up to the final harvest. Harvested products are often put onto the markets without consideration of the pre-harvest interval (PHI). As a consequence, the pesticide residues left on fruits can generate a potential health hazard for consumers. Many pesticides applied on tomatoes and chili peppers are persistent, dislodgeable by contact with the hands, and fat-soluble. As they can easily be absorbed through skin contact, farm workers who harvest tomatoes and chili peppers daily and for several hours can potentially be exposed to residual deposits of pesticides and possibly endanger their health.

❖Objective

The aim of this study is to assess assess the potential exposure for some consumers groups and farm workers during the harvest tasks through models

❖Material & methods

Ten volunteers working in tomato and chili pepper greenhouses were chosen at random to evaluate their potential dermal exposure (**PDE**).

Two pairs of cotton gloves were distributed to **each worker** and worn during two consecutive half days during harvesting fruits in 20 tomato and chili pepper greenhouses (**from min 2 h to max 3 h/day**).

Sampling : tomatoes (**10 samples**) + chili peppers (**10 samples**)
Analyse: multi-residue+combination (**GC-MS/MS and LC-MS/MS**)

PDE (mg/kg bw per day) = (C_T (mg/kg) × GW (kg) × 4) / bw (kg)

C : concentration of the substance in the sub-sample (5 g)
GW : average weight of the cotton gloves samples (61 g)
T : task duration (2 h during the trial; 8 h per day),
bw : body weight (conventionally, 60 kg).

SE (mg/kg bw per day) = PDE × 0.75

Risk : SE > AOEL (Acceptable Operator Exposure Level)

Predicted Short Term Intake (PSTI) = (LP × OR × v) / bw

LP : the 97.5th percentile of the portion size in kg food per day,
OR: is the observed residue level the sample (in mg/kg),
bw : is the mean body weight (in kg)
v : variability factor

Risk : PSTI > ARfD (Acute Reference Dose)

❖Results & Discussion

❑ worker risk assessment


Pesticide residues detected	**57**	**63**
Average pesticide residues per sample	**18**	**18**
Average total concentration of residues (mg/kg)	**111**	**148**
Most severely contaminated sample (mg/kg)	**622**	**939**

➢AOEL EXCEEDANCE:

For tomato greenhouses	**15** pesticide residues
For chili pepper greenhouses	**9** pesticide residues

❑Consumer risk Assessment

➢LMR EXCEEDANCE:

➢ **Tomatoes :** chlorpyrifo ethyl **(2685% of LMR)**
➢ **Chili peppers :** acetamiprid (**156%** of LMR), propagite (**2000%** of LMR), proquinazid (**341%** ; **451 %** of LMR), thiophanate methyl (**298%; 324%** of LMR)

➢ARfD EXCEEDANCE PSTI of the insecticide chlorpyrifos-ethyl exceeds the **ARfD** with a factor of **3.1** times (**312%**).

❖Conclusion

According to potential dermal exposure values, workers who spend several hours on a daily basis in greenhouses are at risk during re-entry activities, with potential effects on their health. Observations completed by analytical results indicate multiple pesticide applications leading to MRL exceedances and probable acute risk for Tunisian consumers There is an urgent need for awareness raising amongst professionals' and training on good practices and hygiene rules to avoid their excessive exposure. This survey should be completed later by a bio-monitoring of the operators during spraying and workers during re-entry activities, with analysis of blood, urine and hair samples.

❖References

Toumi, K., Joly, L., Tarchoun N., Souabni, L., Bouaziz, M., Vleminckx, C., & Schiffers, B. (2018). Risk assessment of Tunisian consumers and farm workers exposed to residues after pesticide application in chili peppers and tomatoes. Tunisian Journal of Plant Protection. (in press).

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