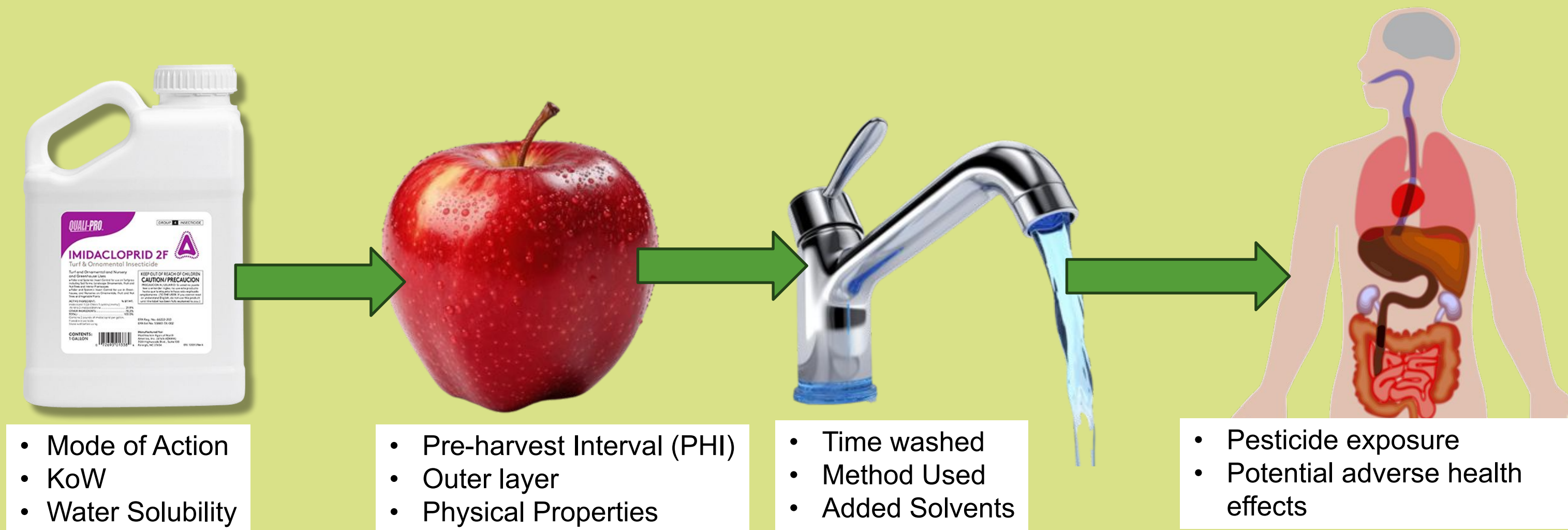


The Effect of Typical Consumer Washing on Pesticide Residue Levels in “Ready-to-Eat” Produce

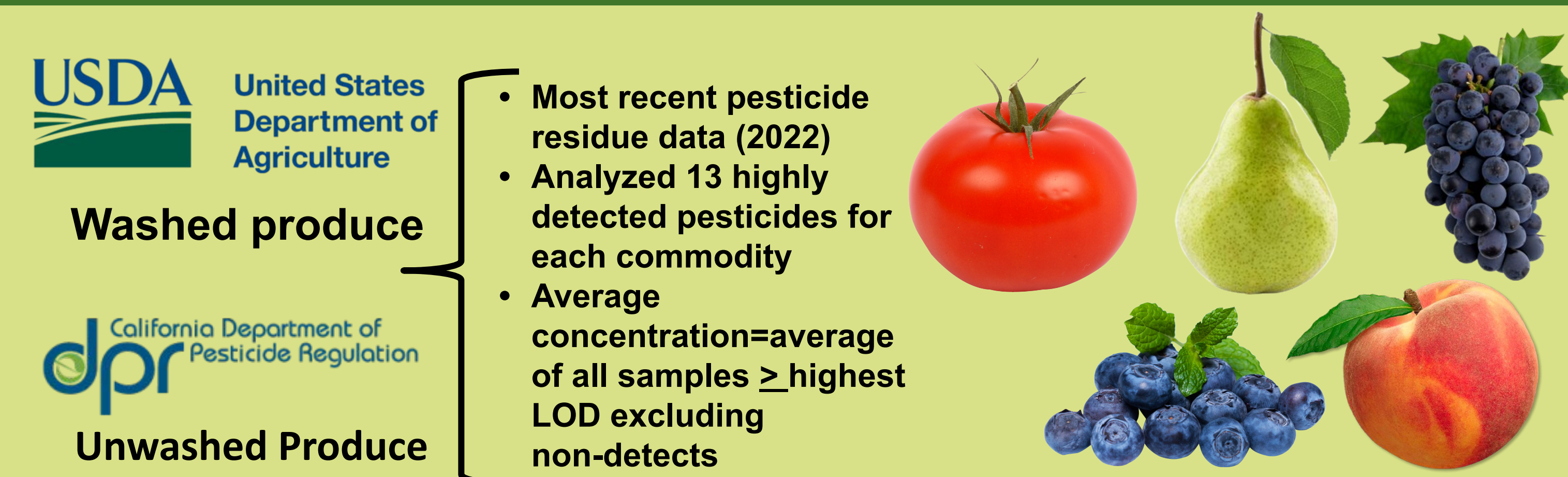
D. de Montagnac, A. Temkin, A. Friedman, and O. V. Naidenko.
Environmental Working Group, Washington, DC

Background

Reducing pesticide exposure may be beneficial to human health. Understanding the effectiveness of produce washing on removing pesticides from produce is crucial for consumer safety and public health.



Methods and Materials



Commodity	Sample Preparation - The wash and drain steps refer to a wash under cold running water for approximately 15-20 seconds to assure that all surfaces are rinsed, then a drain for at least 2 minutes. For all commodities, the sample is chopped, mixed, or blended until a visually homogeneous mixture is attained.
Blueberries	Wash blueberries by the handful or by using a colander and drain.
Grapes	Wash and drain. Remove all stems and extraneous matter
Peaches	Wash and drain. Do not peel. Remove stem and leaves if present. Using a clean, dry knife, cut the peach around the pit (i.e., without cutting through the pit). Remove the pit, being careful to remove as little of the meat as possible.
Pears	Wash and drain. Do not peel. Remove stem, if present. Using a clean, dry knife, cut each pear in half or quarters and remove the core portion.
Tomatoes	Wash and drain. Do not peel. Using a clean, dry knife, cut the tomato around the stem area. Remove any stem, being careful to remove as little of the meat as possible. The tomatoes may be quartered prior to homogenization.

Table 1. USDA sample preparation for each of the 5 analyzed commodities

Commodity	USDA	DPR
Blueberries	482	99
Grapes	706	108
Peaches	419	52
Pears	708	74
Tomatoes	709	119

Table 2. Sample sizes of each commodity and their 13 pesticides

Literature Review

- Inclusion Criteria: uses typical consumer washing, washable ready-to-eat produce (apples, cucumbers, pears and NOT grains or legumes or potatoes), wash time less than 5 minutes unless soaking used
- Data Extraction: lowest washing times, shortest pre-harvest interval, commodity and pesticide with highest removal rate



Figure 1. Breakdown of fruit and vegetables analyzed across 36 studies



Figure 2. Literature Review Process

Results

The differences in pesticide residue levels between USDA (washed) and DPR (unwashed) samples varied but were not meaningfully different.

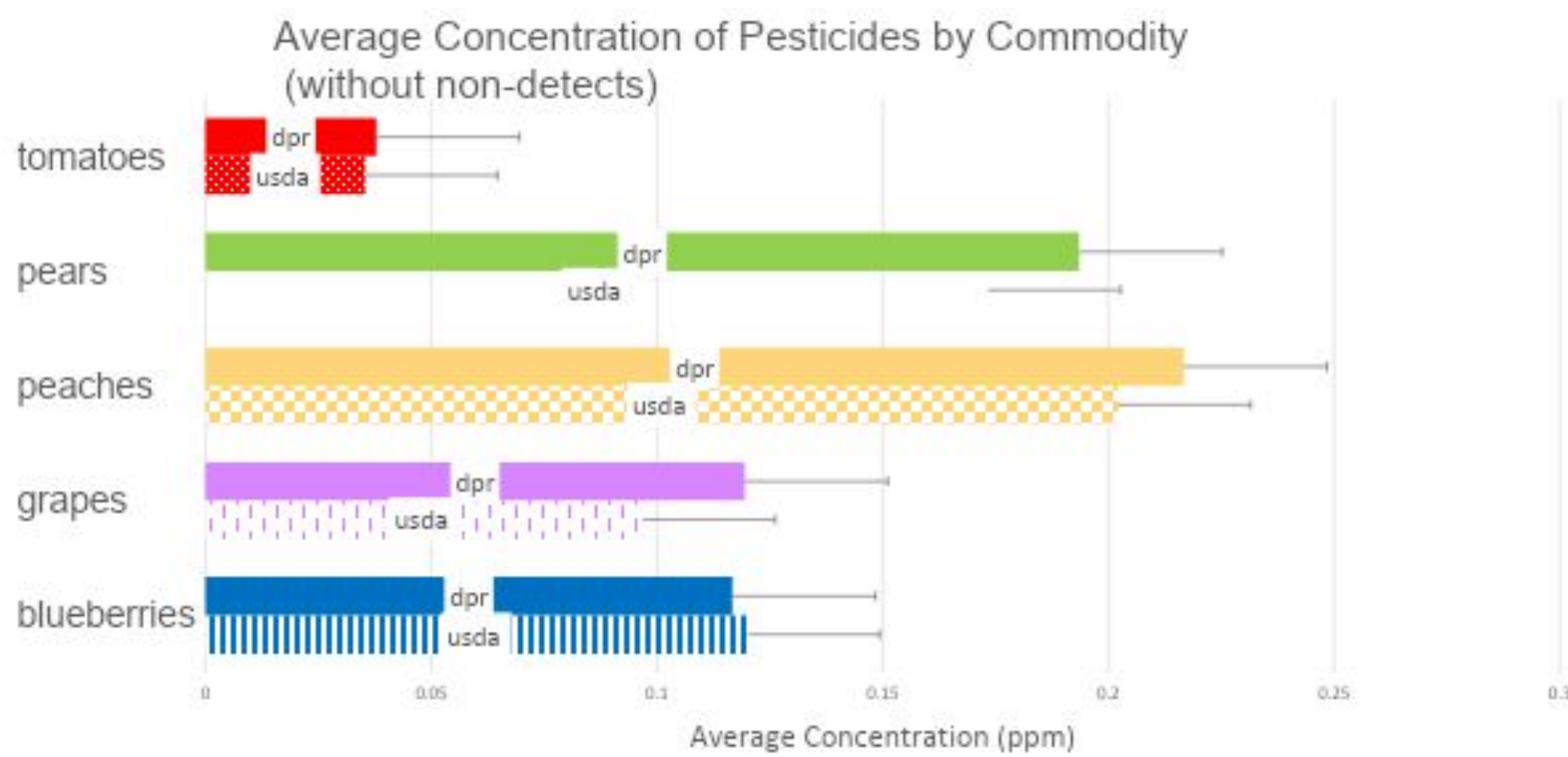


Figure 3. Compared average pesticide concentrations of each commodity between USDA and DPR, with standard error

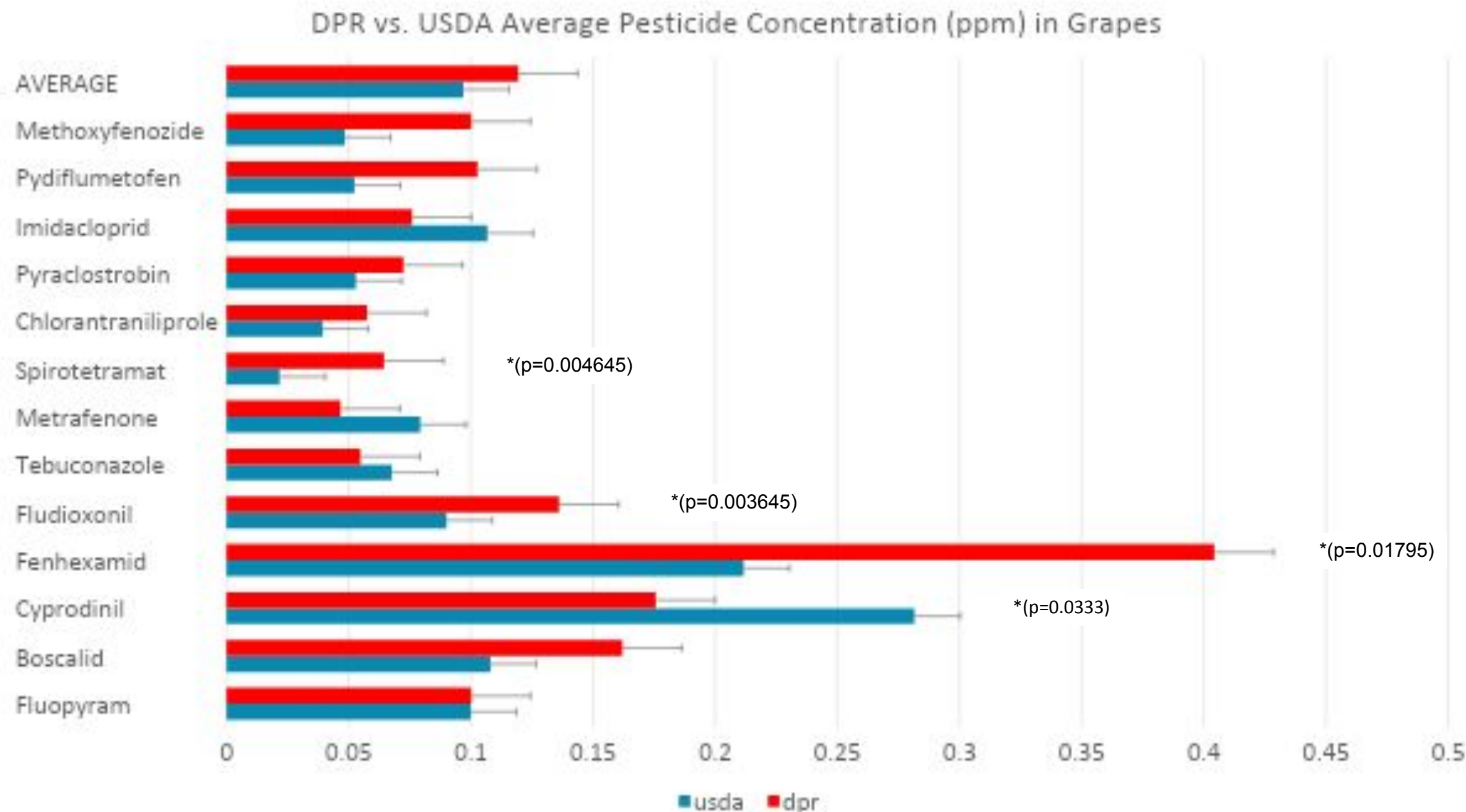


Figure 4. Average pesticide concentration of pesticides analyzed in grapes from USDA and DPR, with standard error

Literature Review Findings:

- Washing with tap water removed residues to levels below MRLs
- Alternative removal methods in tandem with washing with tap water were most effective
- Cooking is one of the most effective ways to remove all pesticide residues
- Longer pre-harvest interval is correlated with a decrease in pesticide residues

Discussion

- The literature review found a **50% decrease** on average when washing produce for ≤ 5 minutes and a **37% decrease** for ≤ 1 minute. The most significant differences between USDA and DPR were found for **Fludioxonil and Spirotetramat in grapes** where DPR had a higher concentration in the analysis.
- Limitations: lack of available data and confounders that affect pesticide levels in analysis
- Factors that influence pesticide residue removal efficiency highlighted in the reviewed literature:
 - Pre-harvest interval
 - Octanol-water coefficient and solubility of specific pesticides
 - Pesticide mode of action (systemic vs. contact pesticides)
 - Commodity physical properties
 - Disposition of pesticide into plant
 - Added or naturally occurring cuticular wax
 - Very weak correlation between octanol-water coefficient and removal efficiency.

Conclusions

- The differences in pesticide residue levels between USDA (washed) and DPR (unwashed) samples varied but were not meaningfully different, which may be due to insufficient data.
- Based on the results of the literature review, washing is an effective method for removing pesticide residues below MRL, but even more so when used in combination with other methods.
- A more robust dataset with a higher sample size and testing for paired washed and unwashed produce in a controlled setting is needed for a more accurate comparison.



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References



No conflicts of interests to disclose