Pesticide residues (PRs) and toxic metals (TM)s pose substantial food safety concerns globally. This study examines the effects of cooking on TM.s and PRs in farmed shrimp (P. vannamei) and the potential health hazards. PRs in shrimp ranged from 0.005 (Hg) to 0.396 (As) mg/kg for raw, not detected (Hg) to 0.136 mg/kg for boiled, ND (Hg) to 0.231 (Pb) mg/kg for fried, ND (Hg) to 0.212 (Pb) mg/kg for grilled and ND (Hg) to 0.102 mg/kg for microwave (MWC) shrimp. All the processing methods significantly affect As (75 and 95%), whereas grilling and microwave cooking showed a noticeable impact on Hg (53 and 58%). Boiling (49%) and grilling (50%) showed a significant effect on Pb, while frying (7%) and MWC (3%) had a negligible effect. TM.s were below the MRL of 0.5 mg/kg set by the European Union. PRs in shrimp ranged from 0.007 to 0.703 μg/kg for raw, not detected (ND) to 0.917 μg/kg for boiled, ND to 0.506 μg/kg for fried, ND to 0.573 μg/kg for grilled, and ND to 0.514 μg/kg for microwave cooked shrimps. PRs in raw and cooked shrimps were below MRL set by CAC and the EC. The processing factor (PF<0.7), paired t-test (p<0.05), Tukey test (p<0.05), Bray-Curtis similarity index, and matrix plot exhibited that all the four thermal processing methods have a considerable impact on pesticides in the processed shrimps. However, frying (59.4%) and microwave cooking (60.3%) significantly reduced PRs than the boiling (48.8%) and grilling (51.3%). THQ and TTHQ for TM.s and HG and HR for PRs were <1, indicating no health risks for shrimp consumers in India and USA. Culinary processes such as boiling and grilling are recommended to reduce TM.s while frying and microwave processing are better methods for minimizing PRs in seafood.

Food safety is crucial in today’s competitive trading market, as it directly affects human health and seafood export (Mefatul et al., 2020). Farmed shrimp is a delicacy fetching high demand globally. Indian shrimp exports stand at 6,522,532 tons worth 450 million USD. Shrimps are mainly exported to the USA (43.3%), China (24.5%), European Union (11.3%), Japan (6.1%), Vietnam (4.9%), and UAE (3.8%) from India (MPEIDA, 2020)

Studies are very limited in assessing health risks caused by TM.s and PRs in shrimp subjected to different cooking methods.

Analysis of TM.s and PRs in cooked shrimps/food makes a sensible risk assessment in comparison with the guideline values set by various national and international agencies.

To study the influence of different heat treatments on PRs and TM.s in farmed pacific shrimp (P. vannamei).

To assess human health risks through consumption of raw and cooked shrimps.

EFFECT OF COOKING ON PESTICIDE RESIDUES

EFFECT OF COOKING ON TOXIC METALS

REDUCTION OF HAZARD QUOTIENT

Reduction of ∑PRs found in the following order: boiling (48.8%)-grilling (51.3%)-frying (59.4%)-MWC (60.3%).

Processing factor (PF<0.7), paired t-test (p<0.05), Tukey post hoc (p<0.05) test, Bray-Curtis Similarity Index and matrix plot confirmed that all the four thermal processing methods have a considerable impact on PRs in the processed shrimps.

PRs in raw and cooked shrimps were below MRLs set by the CAC (2021) and the EC (86/363/1996 and 57/2007).

Hazard quotient (HQ) & hazard ratio (HR) were <1, indicating no non-carcinogenic and carcinogenic health effects through shrimp intake.

Estimated maximum allowable shrimp consumption rate (CRmax) suggests an adult can eat >100 shrimp meals/month

Food matrix-based bioavailability and bioaccessibility of individual pesticides are not studied well

Studies report that PRs & TM.s degrade during processing due to hydrolysis, oxidation, solubilization, volatilization, thermal breakdown, and metabolites formation but the actual cause for reduction not studied well.

Fate of TM.s & PRs and their metabolite’s interaction with micro and macromolecules during food processing is unknown.

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LIMITATIONS AND FUTURE SCOPE

CONCLUSIONS

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