PYRETHROID RESIDUES IN BEEF FROM TASHKENT REGION: A LITERATURE REVIEW AND FOOD-SAFETY PERSPECTIVE

Rasulov Utkir Ilashovich — Doctor of Veterinary Sciences (DSc)

Turdaliyev Azamatjon Abdullajon o‘g‘li — Veterinarian

Field: Veterinary sanitation and food safety

Abstract

This review examines the properties of pyrethroids used in veterinary practice, the possibility of residues occurring in beef, analytical approaches for their determination, and criteria for food-safety assessment. Uzbek literature was included, notably a study investigating residues of the “Alpha-Shakti” preparation in cow’s milk, alongside Uzbekistan’s sanitary standards on pesticide residues. Since no beef samples from Tashkent Region were analysed for this review, no quantitative conclusions are made about local prevalence or contamination levels.

Keywords: pyrethroids, beef, cypermethrin, deltamethrin, residue levels, veterinary-sanitary examination, food safety, GC-MS/MS, LC-MS/MS.

Introduction

Pyrethroids are synthetic insecticides used in agriculture and veterinary practice against certain ectoparasites. Cypermethrin, deltamethrin, permethrin and flumethrin are important members of this group. Their biological activity is associated with effects on voltage-gated sodium channels in the nervous systems of arthropods.

Chemical control of ectoparasites can support cattle health. However, incorrect use of a product or failure to observe the specified withdrawal period may create a risk of residues in food derived from treated animals. The determination of pyrethroid residues in beef is therefore relevant to veterinary-sanitary monitoring and food safety.

Aim and materials and methods

The aim was to synthesise the literature on the possible occurrence of pyrethroid residues in beef, laboratory methods for their determination, and food-safety assessment criteria, and to identify a relevant research direction for Tashkent Region.

The review considered international scientific papers, veterinary studies by Uzbek authors, and Uzbekistan's Sanitary Rules No. 0094-25. Attention was given to residue analysis, sample preparation, instrumental methods, method validation and maximum residue limits. This is a literature review: no beef samples from Tashkent Region were collected or analysed.

Results and discussion

Tuck et al. (2018) reviewed analytical methods for pyrethrin and pyrethroid residues in food of animal origin, including sample preparation and method validation. Instrumental approaches such as GC-MS/MS and LC-MS/MS may be used for relevant compounds; method selection depends on the analyte, food matrix and laboratory capability.

In a 2024 study, Uzbek researchers Kamalova, Mavlanov, Pulotov and Ismoilov investigated residues in the milk of dairy cows after application of the "Alpha-Shakti" 10% EC preparation against cattle ectoparasites in Karakalpakstan. The authors reported no signs of toxicity in indicator insects fed the milk samples and reported no detectable residue using the biological method described. These findings apply only to the study conditions and method used; they do not establish the absence of residues in meat or describe the situation in Tashkent Region.

Uzbekistan's Sanitary Rules No. 0094-25 set sanitary and hygienic requirements concerning pesticide residues in food products and feed. Analytical findings should be compared with the current national limit applicable to the specific pesticide and food commodity. The Codex Alimentarius database can provide an international point of

comparison, but international limits should not automatically be treated as substitutes for national requirements.

Some pyrethroids are lipophilic, so residue distribution may differ between muscle and fat. A future study should document sample type, treatment history, active ingredient, time between treatment and slaughter, and sample storage conditions. GC-MS/MS or LC-MS/MS should be used with a validated method, calibration, recovery assessment, limits of detection and quantification, and quality-control procedures.

A relevant research direction for Tashkent Region is planned sampling of beef by geographic area and supply source, laboratory determination of selected pyrethroid residues, and comparison of results with applicable standards. Sample size and the sampling design should be specified in advance in the study protocol.

Conclusion

The literature indicates that assessment of pyrethroid residues in beef requires validated instrumental analysis, appropriate sampling and application of the relevant regulatory requirements. The Uzbek study of “Alpha-Shakti” residues in cow’s milk is a locally relevant source, but it is not direct evidence concerning meat. Field sampling and laboratory testing are needed to establish the actual situation in Tashkent Region.

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