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Examining the Impact of Soil Contamination on the Safety and Efficacy of Medicinal Plants and Dietary Supplements



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Title: Partnership for innovation on the exchange of best practices and the design of joint collaborative initiatives at European level related to the awareness of the effects of contamination on human health

Acronym: INNO-SAFE-LIFE



Introduction



Global rise in use of medicinal plants and dietary supplements



Soil quality plays a critical role in plant safety and therapeutic potency



Contaminants like heavy metals and pesticides can be absorbed by plants



Risk of toxicity and reduced medicinal value



Objective: Investigate how soil contamination affects the safety and efficacy of herbal products

Literature Review

Medicinal plants: cornerstone of traditional and alternative medicine
Common soil contaminants:

- Heavy metals (Pb, Cd, Hg, As)
- Pesticides and industrial waste
- Pathogenic microbes

Mechanisms of uptake and phytochemical alteration

Existing regulatory gaps and safety standards (WHO, FDA)



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Research Objectives



Assess contaminant levels in medicinal plant cultivation sites



Analyze contaminant absorption in plant tissues



Evaluate changes in phytochemical profiles



Conduct human health risk assessments



Recommend best practices for safer cultivation and production

Materials and Methods (1)

Site & Sample Collection

- Selection of polluted and non-polluted cultivation sites
- Soil and plant sampling (roots, leaves, stems)

Target Plants:

- *Curcuma longa* (Turmeric)
- *Ocimum sanctum* (Holy Basil)
- *Withania somnifera* (Ashwagandha)
- *Aloe vera*

Materials and Methods (2)

Laboratory Analysis:

- Soil: Heavy metals (AAS/ICP-MS), pesticides (GC-MS), microbes (PCR)
- Plants:
 - Contaminant bioaccumulation
 - Phytochemical profiling (HPLC, LC-MS/MS)
 - In vitro toxicity testing

Risk Assessment:

- Estimated Daily Intake (EDI)
- Hazard Quotient (HQ)
- Comparison with WHO/FDA thresholds

Results



Elevated contaminant levels found in polluted soils



High accumulation of heavy metals in roots and leaves



Significant reduction in active compounds in contaminated plants



Some samples exceeded safe consumption limits



Correlation between contamination and reduced medicinal quality



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Discussion



Soil pollution directly affects plant safety and therapeutic value



Toxic elements alter plant metabolism and phytochemical synthesis



Long-term health risks for consumers



Lack of strict environmental controls for medicinal plant farming



Urgent need for safe sourcing and transparent labelling



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Recommendations



Regular soil testing before cultivation



Use of clean water and organic farming methods



Implementation of Good Agricultural and Collection Practices (GACP)



Development of contamination-resistant plant strains



Stronger regulation of herbal product supply chains



Conclusion

Soil contamination poses a hidden threat to herbal medicine safety

Contaminated plants = reduced efficacy + increased health risks

Quality control must start from the ground (literally)

Ensuring clean cultivation is essential for public health and product trust