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Food safety risk assessment

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Food security vs food safety

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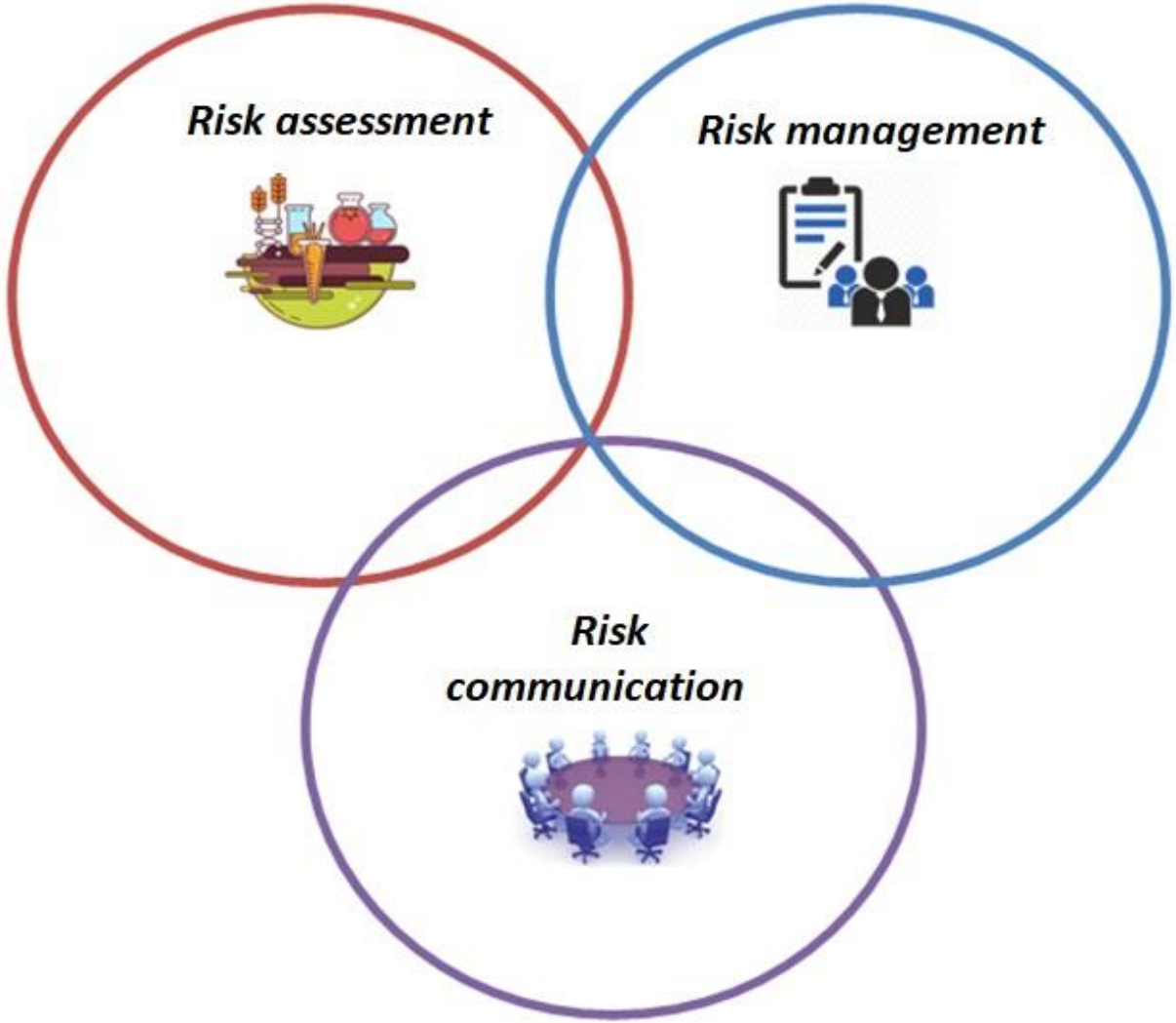
RISK ANALYSIS

- Modern strategy for ensuring food safety



Characterization of food safety systems

Traditional Food Safety System

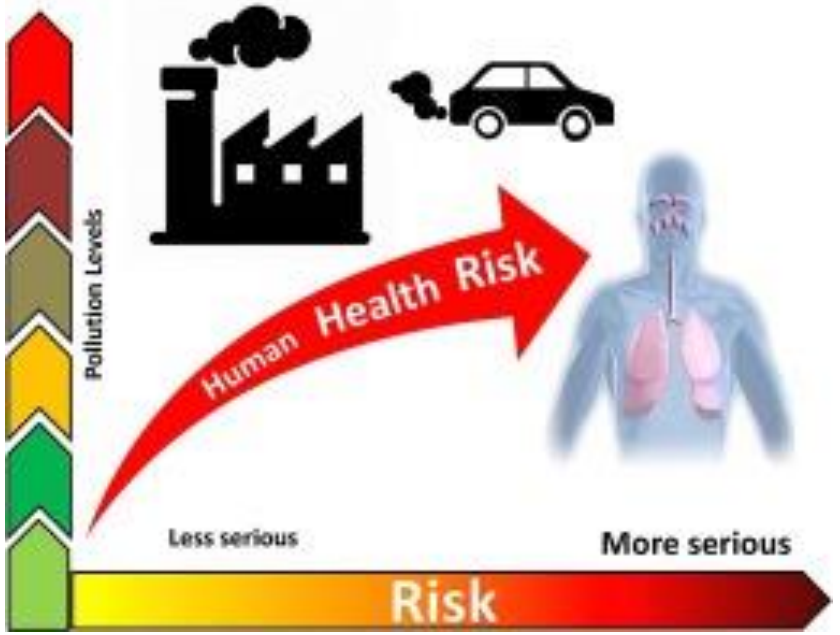
- Reactive approach
- Main responsibility of government
- No structured risk analysis
- Relies in end product inspection and testing

Modern food safety system

- Preventive approach
- Shared responsibility
- Science based
- Use of structured risk analysis
- Integrated food control
- Relies on process control

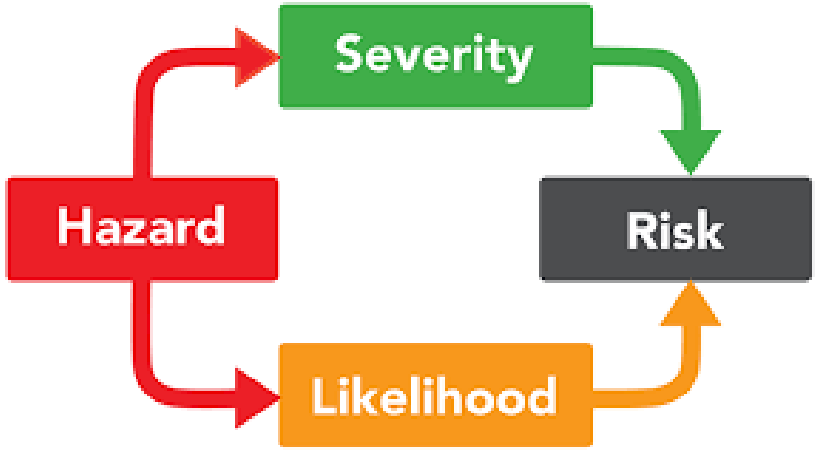
Principle of Risk Analysis

Overall **objective** for food safety: to ensure **human health** protection



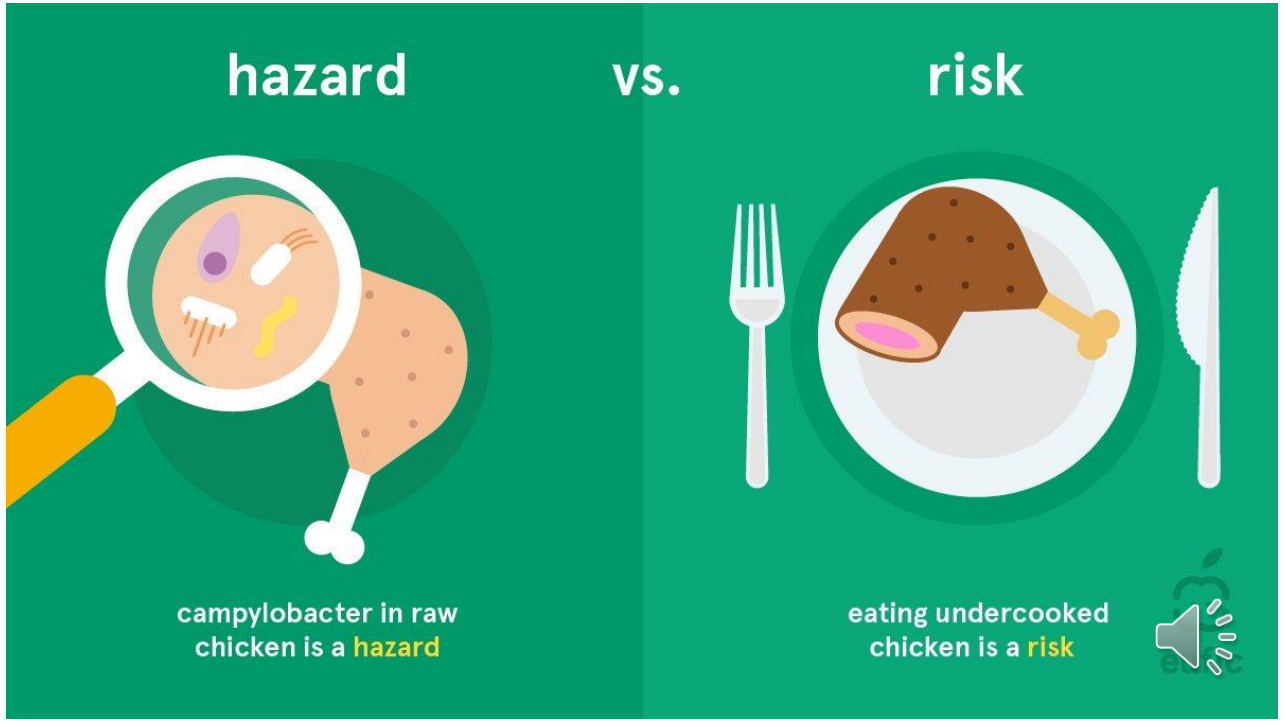
- principles apply equally to issues of **national food control** and **food trade** situations
- should be applied **consistently** and in a **non-discriminatory** manner
- **precaution** is an inherent element

Principles of Risk Analysis – Definitions



Risk

HAZARD



Principles of Risk Analysis - Transparency

- Food safety and protection of consumer interests are an increasing concern for:

✓ Governments
✓ Trade organisations
✓ Non-governmental organisations
✓ General public

- **Consumer confidence** is a key indicator of a successful food policy and is therefore a primary goal

RISK ASSESSMENT

Hazard identification	• Identification of known or potential health effects associated with a particular agent (i.e. types of injury and conditions of exposure.
Hazard characterization	• The qualitative and/or quantitative evaluation of the nature of adverse effects associated with biological, chemical and physical agents which may be present in food.
Exposure assessment	• The qualitative and/or quantitative evaluation of the degree of intake likely to occur.
Risk characterization	• the previous steps into an estimation of the adverse effects likely to occur in given population, including attendant uncertainties.

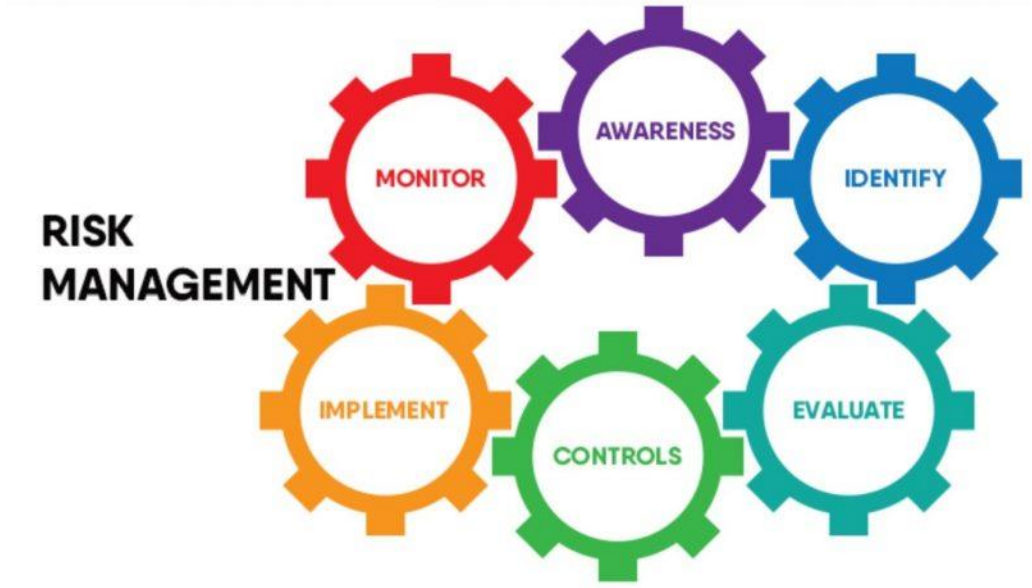
I. Risk assessment

Definition of risk assessment includes:

- **Quantitative** risk assessment
- **Qualitative** risk assessment
- Indication of the **attendant uncertainties**

II. Risk management

- The process of weighing policy alternatives in the light of the results of risk assessment and, if required, selecting and implementing appropriate control options, including regulatory measures.



III. Risk communication

- **Risk communication** is the exchange of information and opinions concerning **risk** and **risk-related factors** among risk assessors, risk managers, consumers and other interested parties.

- ideally **all stakeholder groups** (industry and consumers) should be involved from the start (WHO 2009)

Video learning from GreenFacts.org

- https://www.youtube.com/watch?v=PZmNZi8bon8

Case study

Risk assessment of **Cu** and **Mo** exposure through consumption of vegetables grown under the impact of Kajaran's mining complex

Mining industry is one of priority sectors of Armenia’s economy.

Impact of mining industry on agriculture

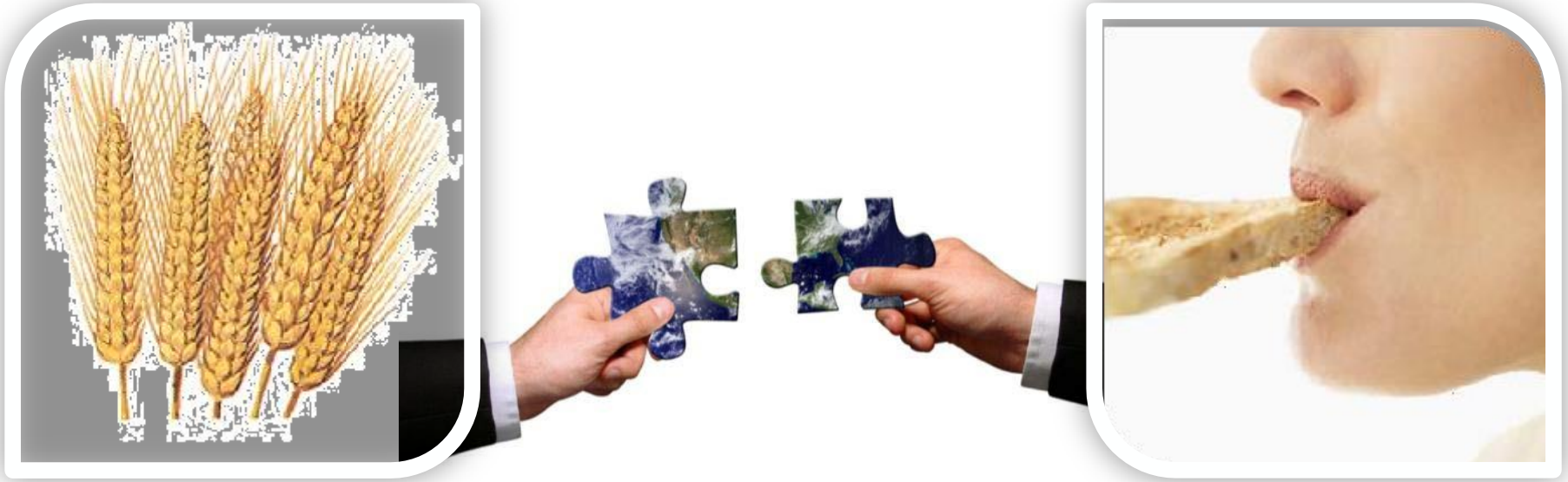
Fruits and vegetables in diet

Fruits and vegetables grown under the impact of mining industry are also sold in the markets of adjacent urban areas.

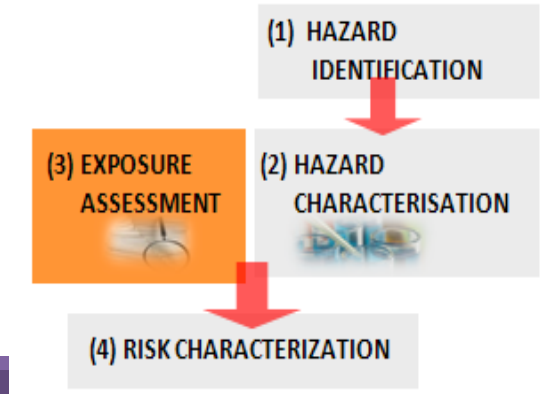
Study covered the markets of KAJARAN TOWN

N 39°09'17,72"C, E 46°07‘46.00

HUMAN EXPOSURE ASSESSMENT



Chemical Occurrence → **Exposure Assessment** ← **Food consumption**



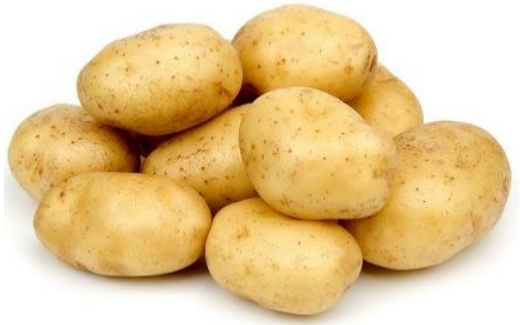
Material and method

- **SOPs** was elaborated in compliance with requirements of WHO/FAO.
- **Food frequency questionnaire** was elaborated to assess a **diet** of local population.
- Concentrations of trace elements in **soil samples** were estimated using a **XRF analyzer (Innov X-5000).**
- **A Perkin Elmer AAnalyst 800 AAS** was used to quantify the concentrations of trace elements in the filtrate of digested **plant samples**.
- **Statistical analyses** were carried out by Microsoft Excel и SPSS (SPSS Ins., Version 11).

XRF analyzer

AAS

VEGETABLES



POTATO

CARROT

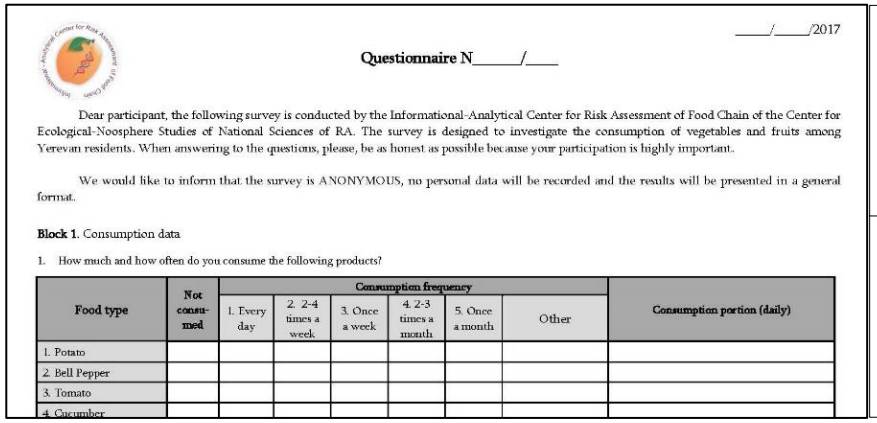
PUMPKIN

BEAN

FENNEL

DIET STUDY (FFQ)

- Individual-based approach
- 4 food item food frequency questionnaire **(FFQ)**



_____/_____/2017

Questionnaire N_____/____

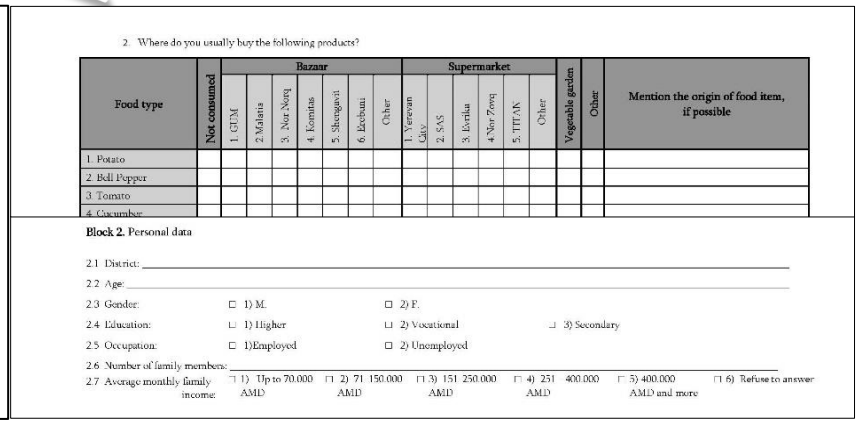
Dear participant, the following survey is conducted by the Informational-Analytical Center for Risk Assessment of Food Chain of the Center for Ecological-Noosphere Studies of National Sciences of RA. The survey is designed to investigate the consumption of vegetables and fruits among Yerevan residents. When answering to the questions, please, be as honest as possible because your participation is highly important.

We would like to inform that the survey is ANONYMOUS, no personal data will be recorded and the results will be presented in a general format.

Block 1. Consumption data

1. How much and how often do you consume the following products?

Food type	Not consumed	Consumption frequency						Consumption portion (daily)
		1. Every day	2. 2-4 times a week	3. Once a week	4. 2-3 times a month	5. Once a month	Other	
1. Potato								
2. Bell Pepper								
3. Tomato								
4. Cucumber								



2. Where do you usually buy the following products?

Food type	Not consumed	Bazaar						Supermarket						Vegetable garden	Other	Mention the origin of food item, if possible
		1. GUM	2. Malatia	3. Nor Nork	4. Komitas	5. Shengavit	6. Ajapnyak	Other	1. Yerevan City	2. SAS	3. Ayrikh	4. Nor Zovq	5. TTTAK	Other			
1. Potato																	
2. Bell Pepper																	
3. Tomato																	
4. Cucumber																	

Block 2. Personal data

2.1 District: _____

2.2 Age: _____

2.3 Gender: ☐ 1) M. ☐ 2) F.

2.4 Education: ☐ 1) Higher ☐ 2) Vocational ☐ 3) Secondary

2.5 Occupation: ☐ 1)Employed ☐ 2) Unemployed

2.6 Number of family members: _____

2.7 Average monthly family income: ☐ 1) Up to 70.000 AMD ☐ 2) 71 150.000 AMD ☐ 3) 151 250.000 AMD ☐ 4) 251 400.000 AMD ☐ 5) 400.000 AMD and more ☐ 6) Refuse to answer

EDI (mg/kg/bw/day)

$$EDI = (C \times IR \times EF \times ED) / (Bw \times AT)$$

C – concentration of trace element (mg/kg)

IR – ingestion rate (kg/day)

EF – exposure frequency (183 day/year, for potato 365 day/year)

ED – exposure duration (for female 69.7, for male 63.6)

Bw – body weight (for female 60 kg, for male 70 kg)

AT – time over which the dose is averaged

THQ & HI

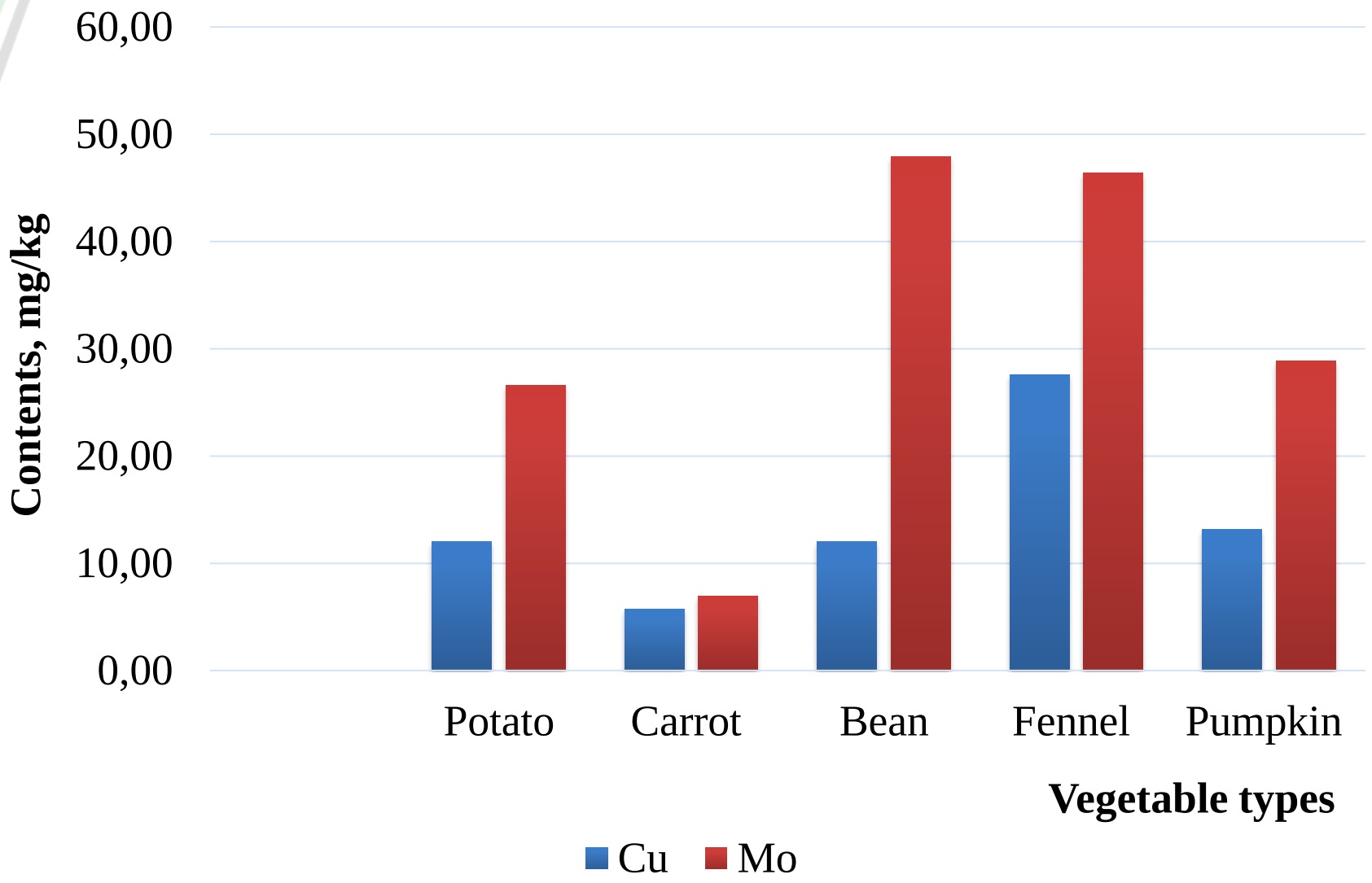
$$THQ = EDI / RfD$$

$$HI = \Sigma THQ$$

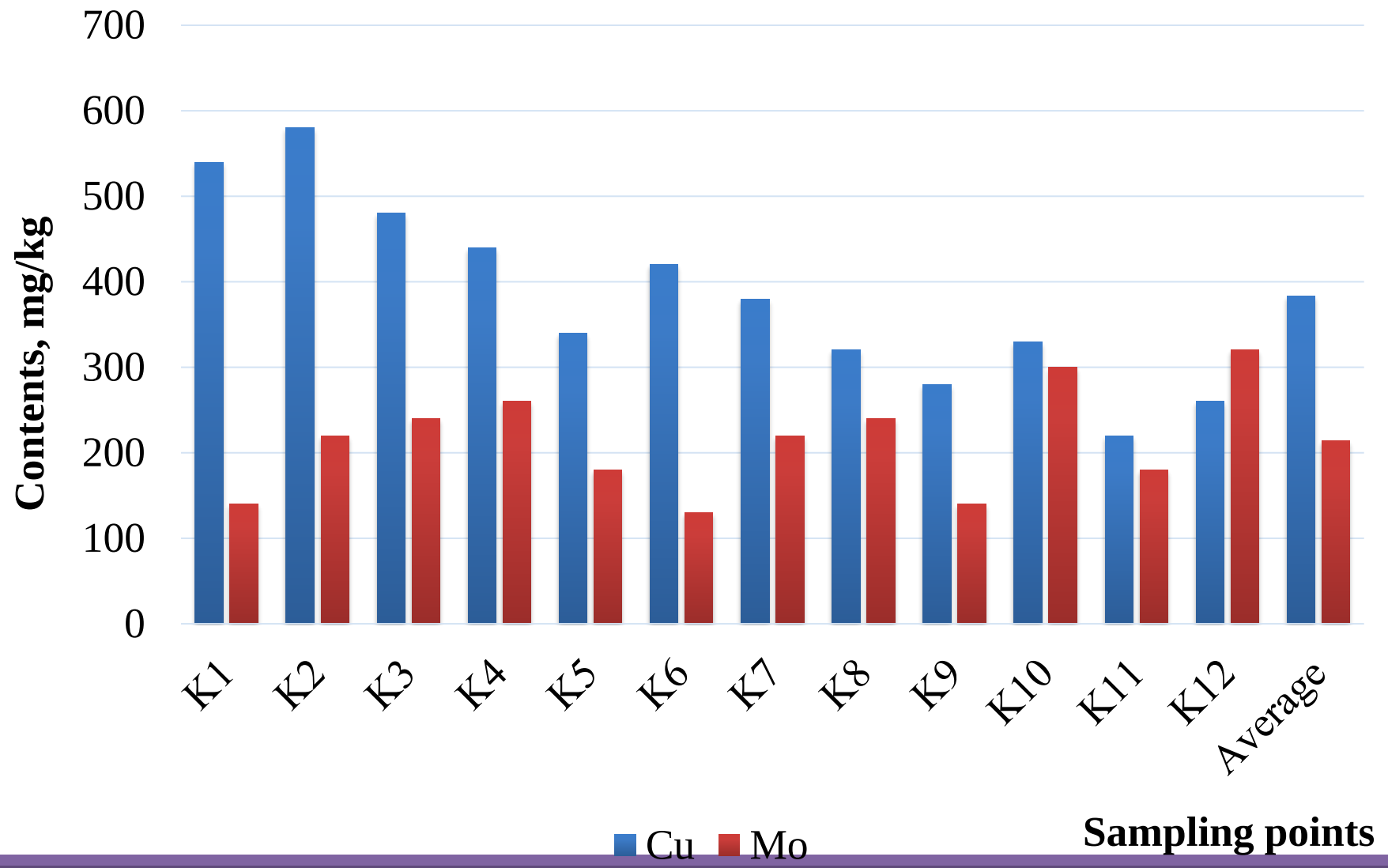
Trace element	Oral reference dose (mg/kg/day)
Cu	0.01
Mo	0.005


RESULTS

The contents of trace elements in vegetables from investigated areas



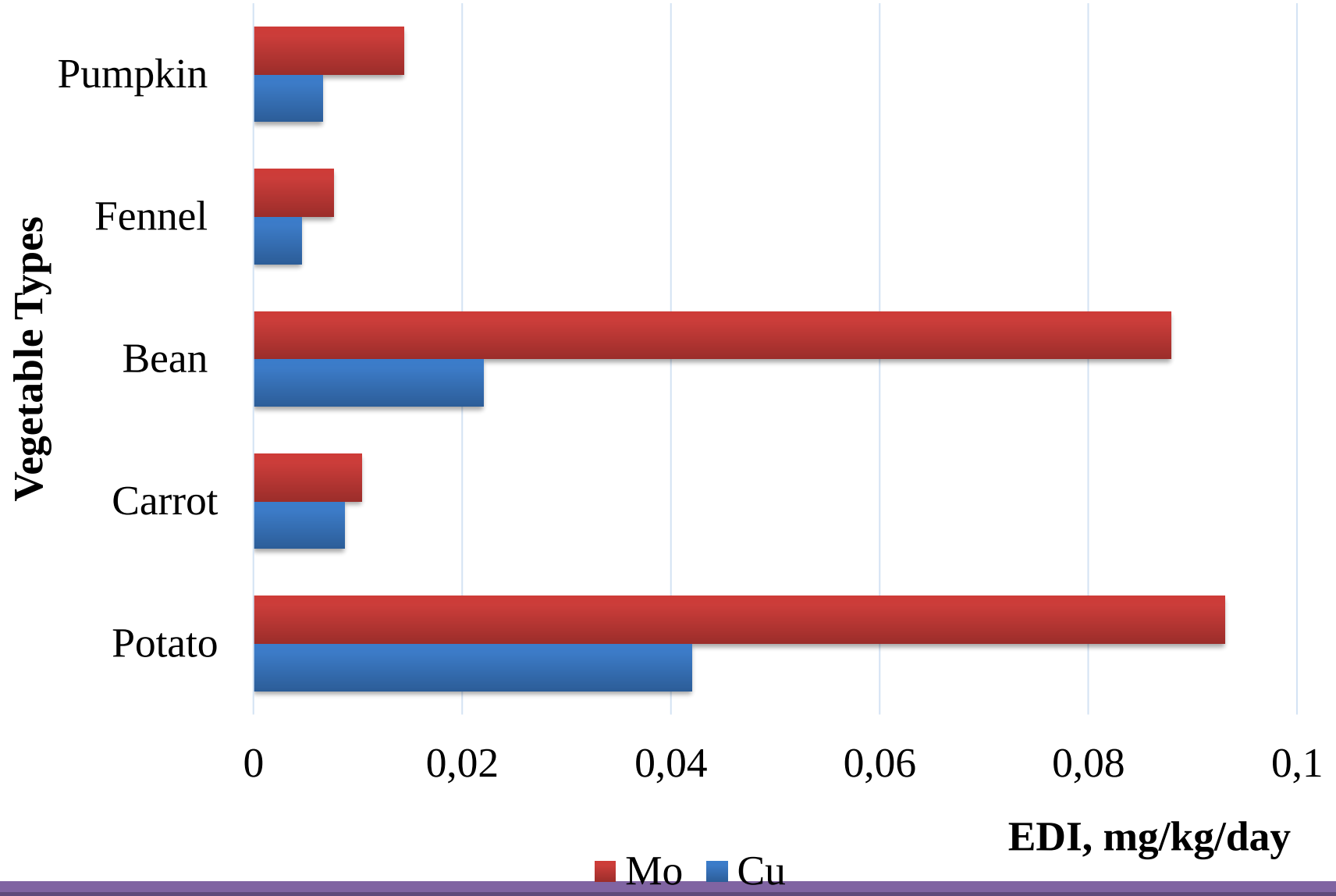
Contents (mg/kg fresh matter) in soil samples



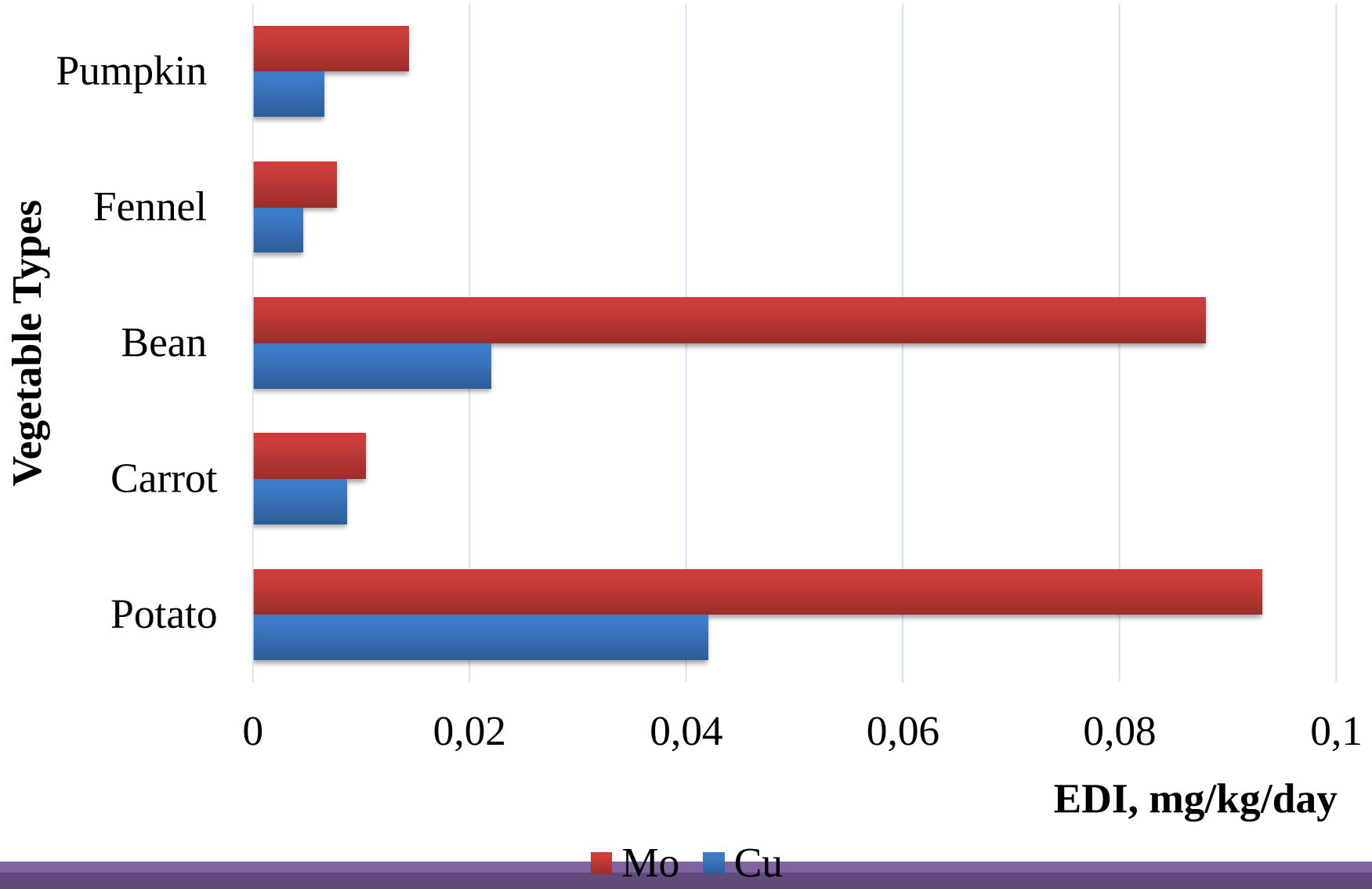
Soil-to-plant transfer factor of Cu and Mo

Plant species	Transfer factor of Cu	Transfer factor of Mo
	Range	Range
Potato	0.03	0.084-0.112
Carrot	0.014-0.018	0.026-0.047
Bean	0.027-0.034	0.16-0.2
Fennel	0.067-0.079	0.17-0.44
Pumpkin	0.034-0.040	0.083-0.134

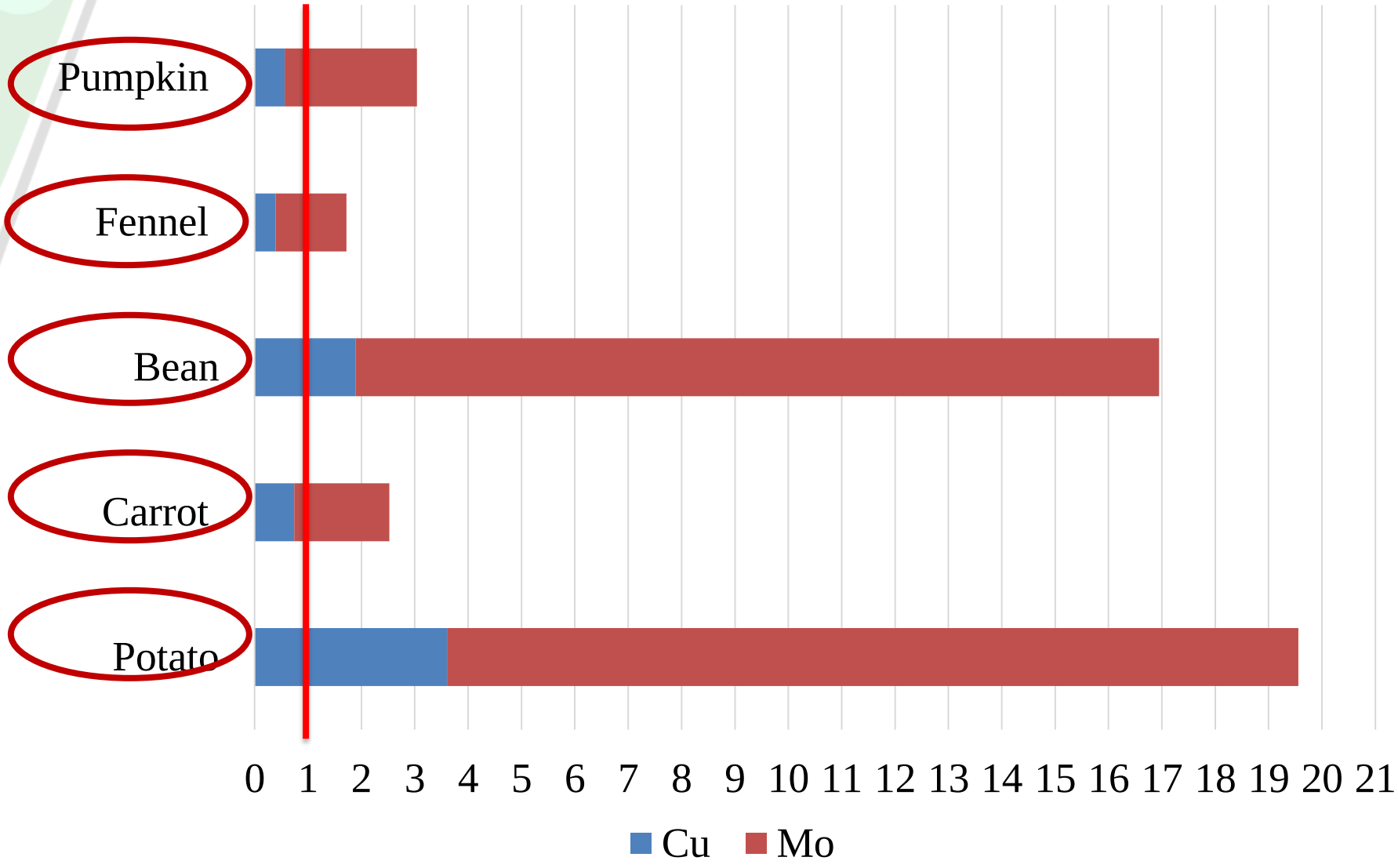
Estimated daily intake (EDI) of Cu and Mo for males



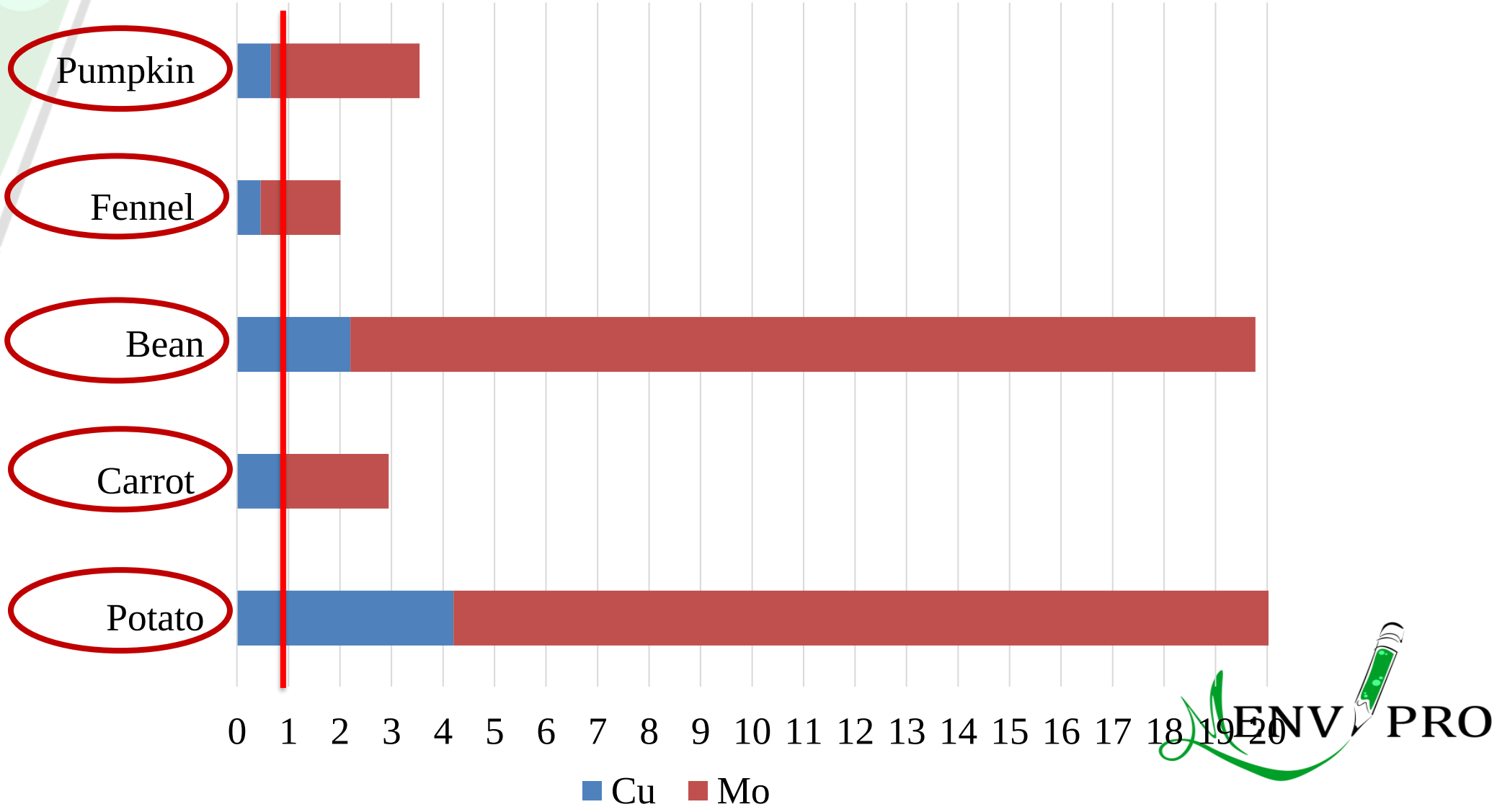
Estimated daily intake (EDI) of Cu and Mo for females



THQ FOR MALES



THQ FOR FEMALES



CONCLUSIONS

- The investigation of soil-to-plant transfer of **Cu** and **Mo** indicated poor response of studied vegetables towards these element uptakes
- The **EDI** of **Mo** for all investigated vegetables exceeded the reference value, meanwhile **EDI** values of **Cu** exceeded the reference value only for potato and bean.
- The **estimated cumulative daily intake** both for male and female **exceeded** the reference dose both for **Cu** and **Mo**.
- **HI > 1** values obtained indicated that **there is a risk posed to the health of local population by more than one trace element.**

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Thank you for your kind attention!

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