



10th International Scientific and Professional
Conference

WITH FOOD TO HEALTH

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Osijek, Croatia

Nitrates and nitrites, metabolism & toxicity

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PTF

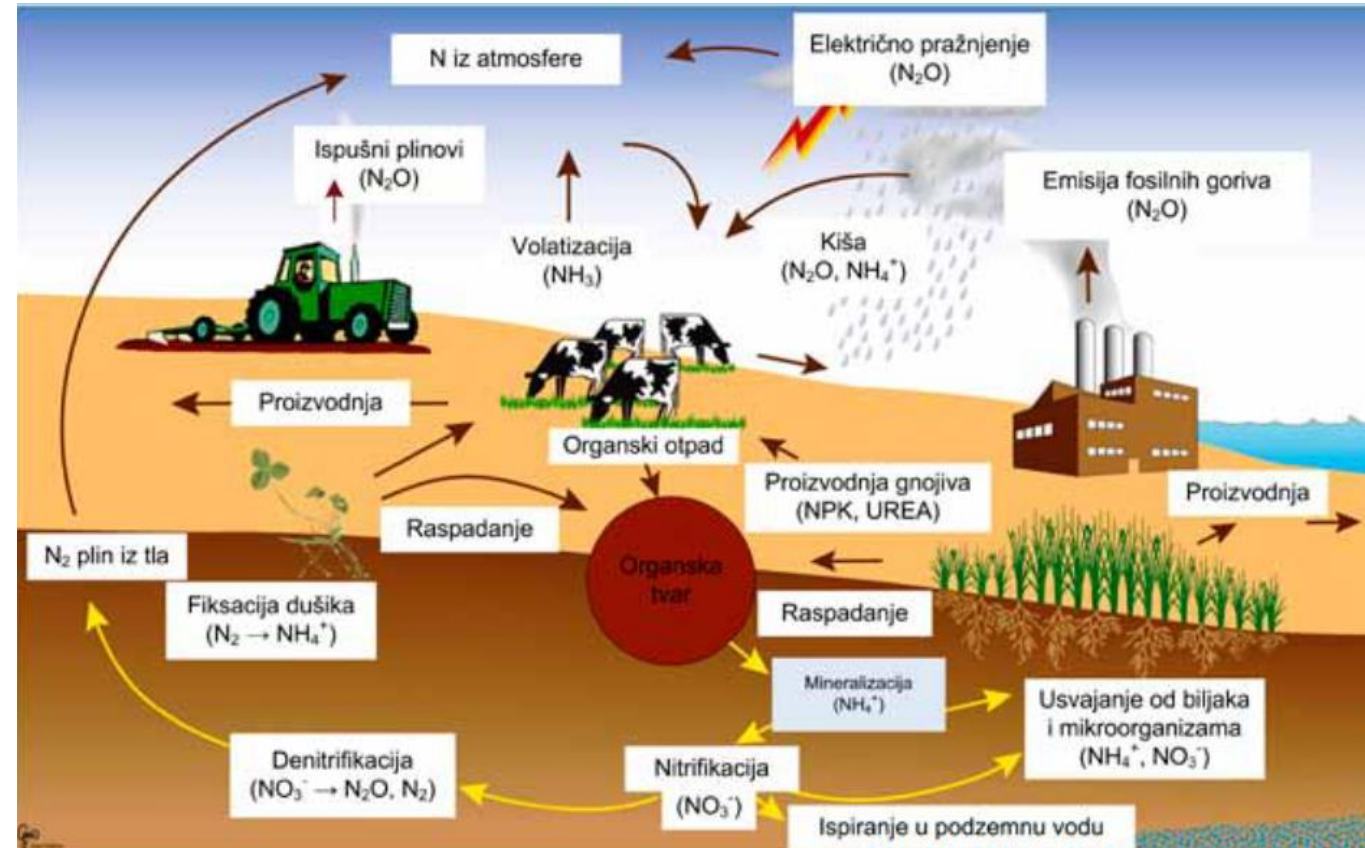
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INTRODUCTION



- Nitrates and nitrites are inorganic chemicals highly soluble in water
- They occur naturally in water and soil by degradation of organic materials
- Ammonia – nitrites – nitrates



The use of nitrates and nitrites

- Artificial fertilizers (sodium, potassium and ammonium nitrate)
- Preservative (in meat and meat products as sodium nitrate and/or sodium nitrite)
- Medications (nitroglycerine, amyl nitrite, nitroprusside...)
- Color enhancement of processed meats (in reduced amounts)
- Dynamites (ammonium nitrate)
- Industry (glass making)



NITRATES & NITRITES IN FOOD



~ 250 mg/day
nitrate intake for
people whose diets
consist mainly of
food from
vegetables

Meat:

2.7 – 945 mg NO_3^- /kg and 0.2 – 6.4 mg NO_2^- /kg



Dairy products:

3 – 27 mg NO_3^- /kg and 0.2 – 1.7 mg NO_2^- /kg

NITRATES & NITRITES IN FOOD



	Nitrates	Nitrites
	(mg/100 g)	
Fruits		
Apple puree	0,3	0,008
Banana	4,5	0,009
Fruit mix	0,9	0,08
Orange	0,8	0,02
Vegetables		
Broccoli	39,5	0,07
Carrots	0,1	0,006
Cabbage	55,9	0,07
French fries	2,0	0,17
Ketchup	0,1	0,13
Mustard	116,0	0,003
Mixed salad	82,1	0,13
Spinach	741	0,02

	Nitrates	Nitrites
	(mg/100 g)	
Meat/processed meat		
Bacon	5,5	0,38
Bacon, without nitrites	3,0	0,68
Ham	0,9	0,89
Hot dog	9,0	0,05
Pork filet	3,3	0

International assessment of nitrate intake from food:

- 31-185 mg/day (Europe)
- 40-100 mg/day (USA)

Nitrate intake from water and processed meat ~35-44 mg/person 60 kg/day

NITRATES & NITRITES IN DRINKING WATER

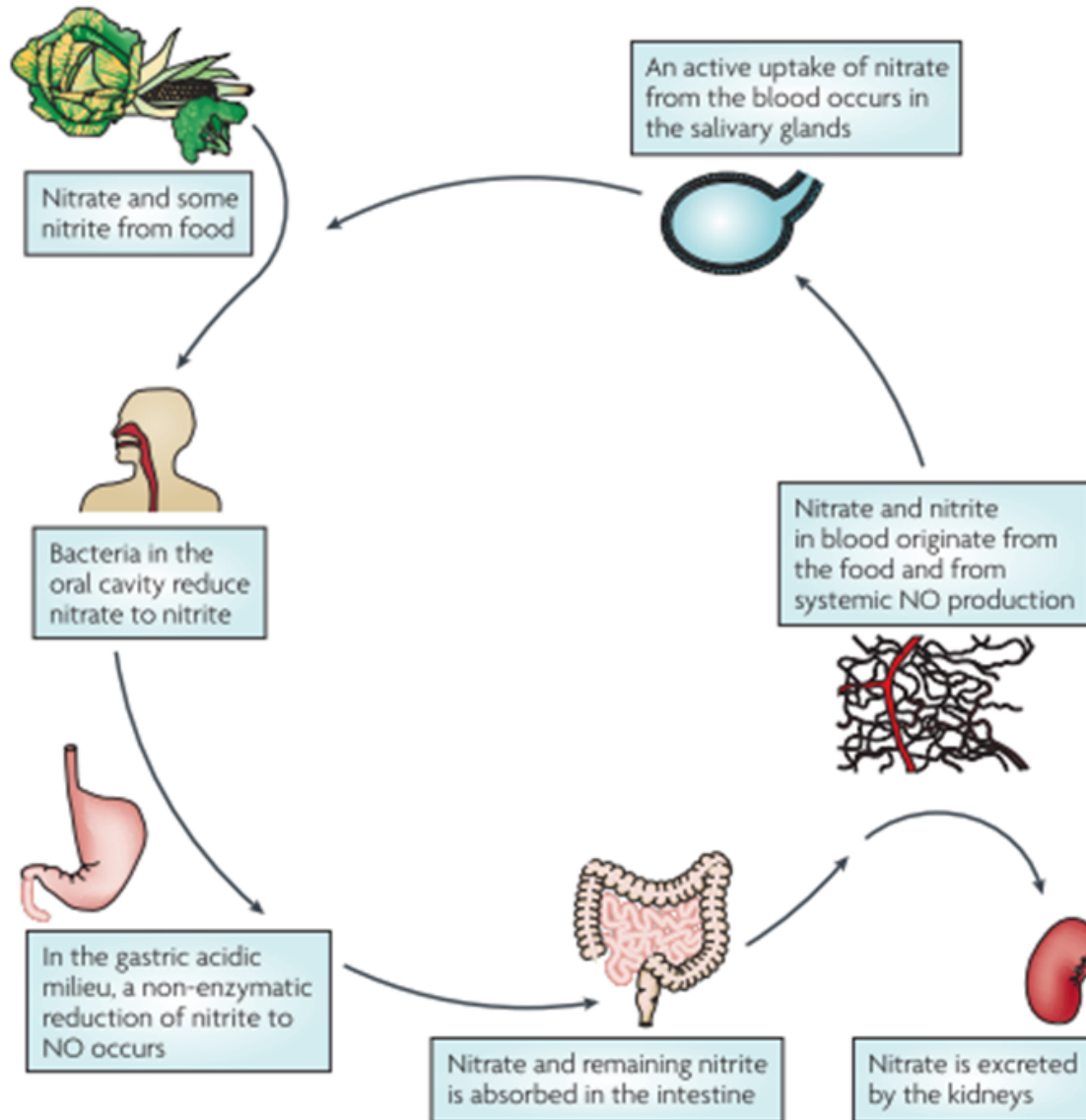


- Agricultural activities
- Inorganic nitrogenous fertilizers and manures
- Erosion of natural deposits
- Leaking from sewer tanks/sewage

Nitrites can be formed chemically in distribution pipes by *Nitrosomonas* bacteria during stagnation of (nitrate containing and oxygen poor) drinking water in galvanized steel pipes.

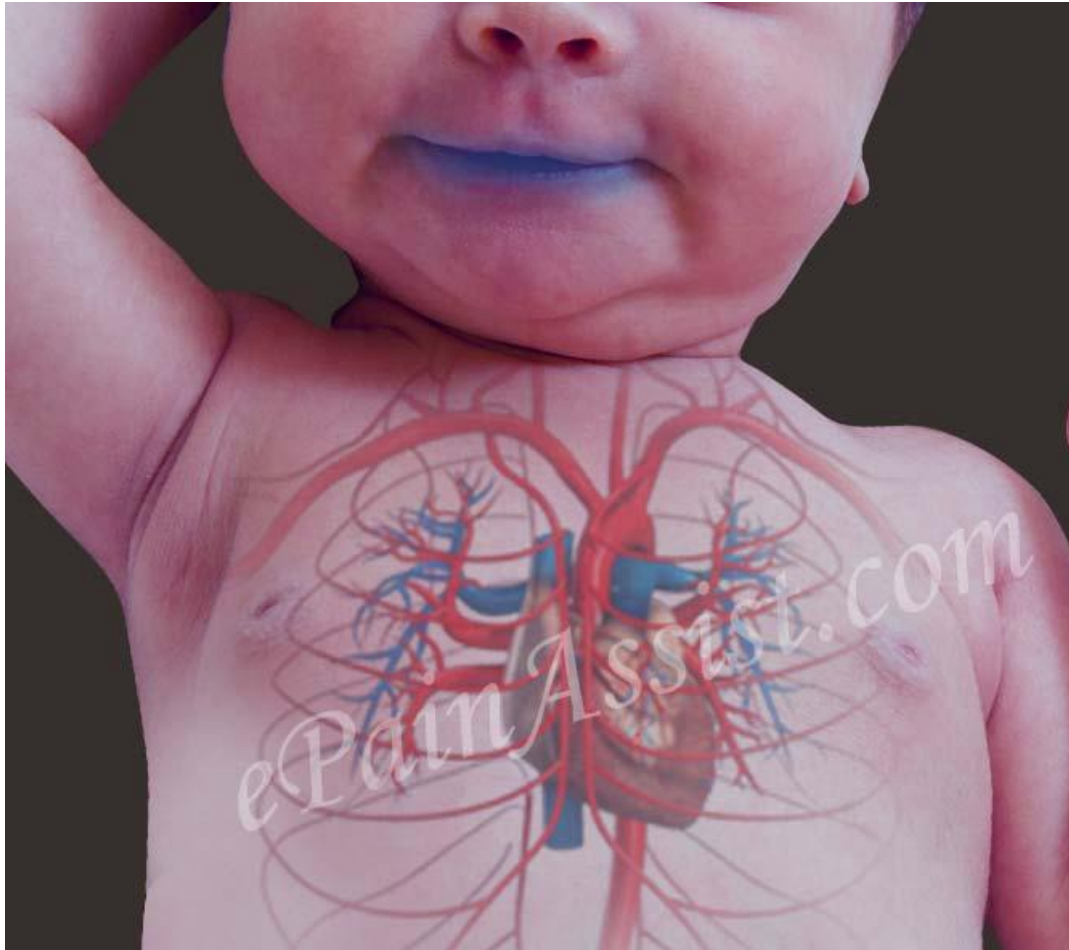


KINETICS & METABOLISM



- Ingested inorganic nitrate from dietary sources is rapidly absorbed in the small intestine. Although much of the circulating nitrate is eventually excreted in the urine, up to 25% is extracted by the salivary glands and concentrated in saliva.
- Reduction of nitrates to nitrites by nitrate reductase
- In the acidic stomach, nitrite is spontaneously decomposed to form nitric oxide (NO)

TOXICITY OF NITRATES & NITRITES



Nitrates in the bloodstream is involved in the oxidation of haemoglobin (Hb) to methaemoglobin (metHb), the Fe^{2+} present in the haem group is oxidized to its Fe^{3+} form, and the remaining nitrite binds firmly to this oxidized haem. The Fe^{3+} form does not allow the oxygen transport, owing to the strong binding of oxygen.

ACUTE

Methaemoglobinemia – high conc. can result in temporary blood disorder in infants –blue baby syndrome – brain damage and eventually death

Predisposing factors:

- Age (infants 6 months most sensitive population)
- Pregnant women (due to a natural increase in MetHb during the later stage of pregnancy ~ 30th week)
- Individuals with digestive difficulties (reduced stomach acidity)

CHRONIC

After nitrate is converted to nitrite in the body, it can react with amine containing substances found in food to form Nitrosamines, which are potentially carcinogens. Nitrosamine formation is inhibited by antioxidants that may be present in food such as Vitamin C and E.

- Irritability, lack of energy, headache, dizziness, vomiting, diarrhea
- Labored breathing
- Blue-gray or pale purple coloration to areas around the eyes, mouth, lips, hands and feet
- Cyanosis (blue skin) of limbs/trunk, weakness, and rapid heart rate, due to methaemoglobinemia

Methaemoglobinemia:

- CNS depression
- Brief loss of consciousness, shock, convulsions, coma
- Irregular heart beats
- Death occurs when MetHb level exceeds 50%

PREVENTION



- Avoid exposure to water, soil or food contaminated with high levels of nitrates and nitrites
- Well water from areas that contain large amounts of nitrogen containing fertilizers, water monitoring is recommended!
- Soil and groundwater protection!!!





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Thank you for your
Nitrates and nitrites,
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Hvala!

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