

QUALITY OF ORGANIC FOOD AND ITS IMPACT ON HUMAN

HEALTH



Euroopa Maaelu Arengu
Põllumajandusfond:
Euroopa investeeringud
maapiirkondadesse



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Comparison of Organic vs. Conventional Foods: meta-analysis – 343 selected papers



Barański, M., Średnicka-Tober, D., Volakakis, N., Seal, Ch., Sanderson, R., Stewart, G.B., Benbrook, Ch., Biavati, B., Markellou, E., Giotis, Ch., Gromadzka-Ostrowska, J., Rembiałkowska, E., Skwarło-Sońta, K., Tahvonon, R., Janovska, D., Niggli, U., Nicot, Ph., Leifert, C. 2014. Higher antioxidant and lower cadmium concentrations and lower incidence of pesticide residues in organically grown crops: a systematic literature review and meta-analyses, *British Journal of Nutrition*, 112, 794–811

Is it worth buying organic?

- Do these foods differ from conventional foods in their chemical composition?
- Are they less contaminated?
- Are they more nutritious?



Meta-analysis results

Higher concentrations of polyphenols in organic plant foods



Many of these compounds have previously been linked to a reduced risk of chronic diseases, including cardiovascular disease, neurodegenerative diseases and certain cancers

**Protecting
cardiovascular
system**

**Anti-
inflammatory**

**Protecting
nervous
system**

Anti-aging

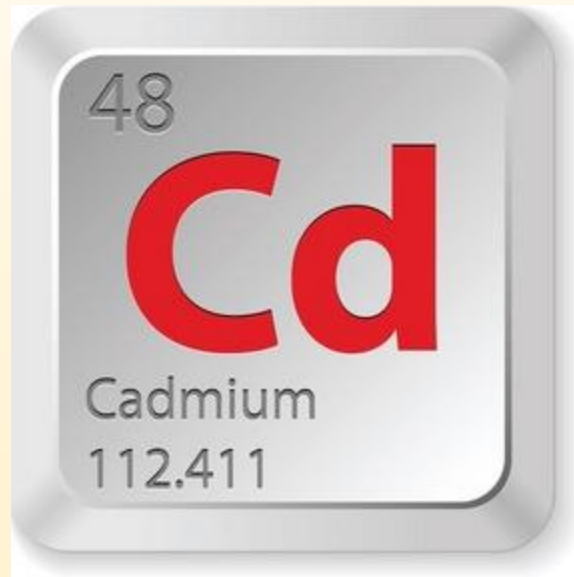
**Antio-
oxidative**

**Anti-
bacterial**

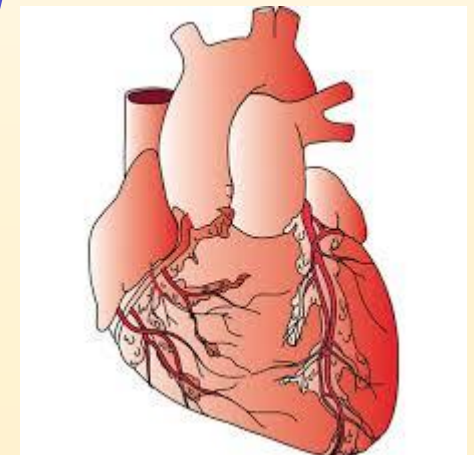
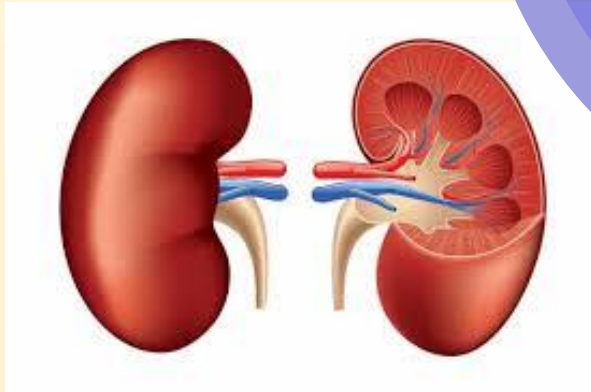
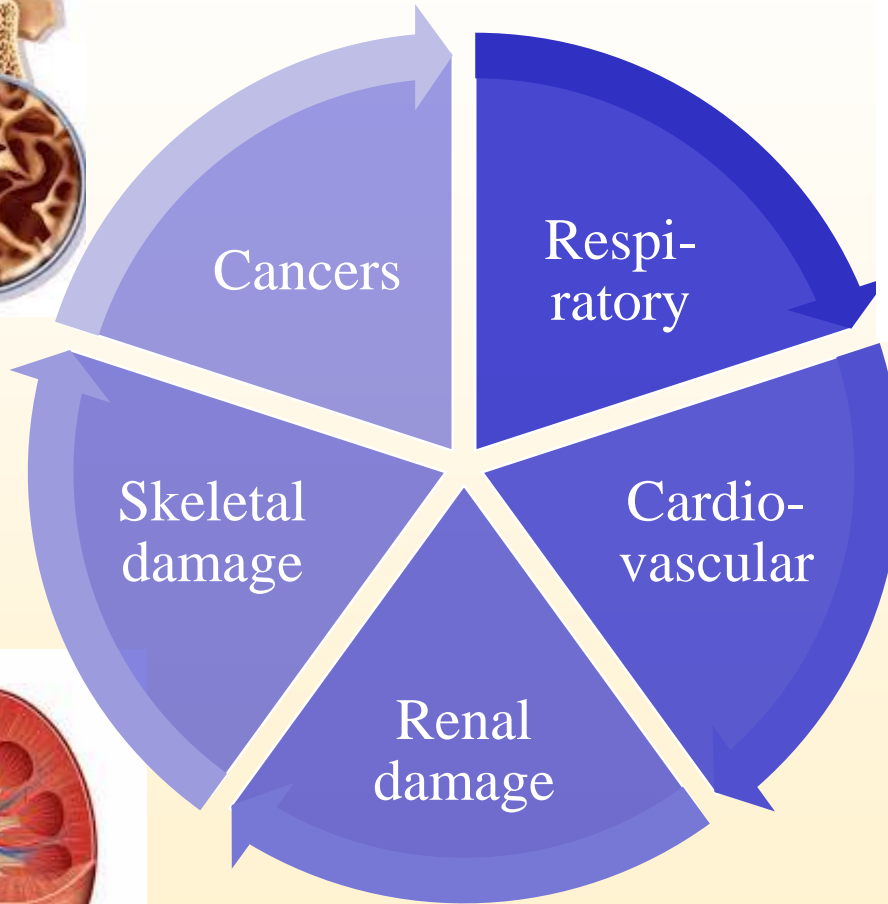
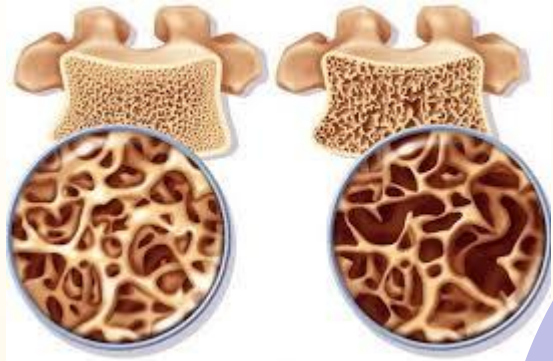
Anti-cancer



**Lower cadmium concentrations
in organically grown crops (48 %
less)**



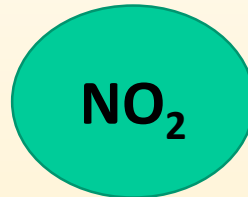
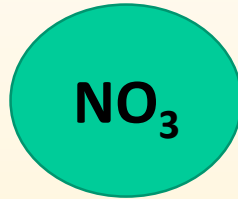
Cadmium - health concerns



Nitrogen compounds

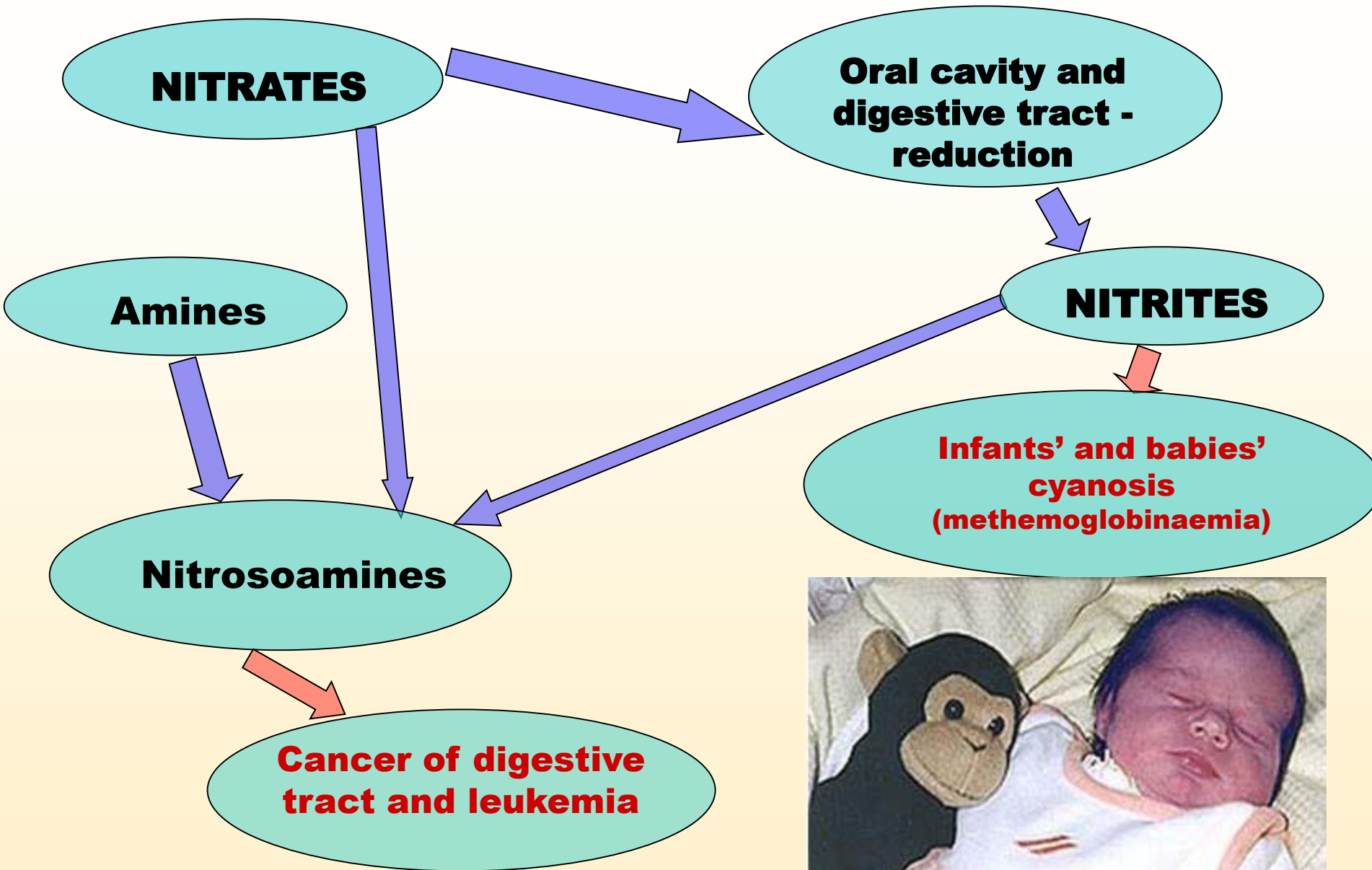
Nitrogen concentrations were found to be significantly lower in organic crops.

- concentrations of total nitrogen were 10%
- nitrate 30%
- and nitrite 87%



lower in organic compared to conventional crops.

NITRATES' EXCESS IS HARMFUL TO HUMAN HEALTH



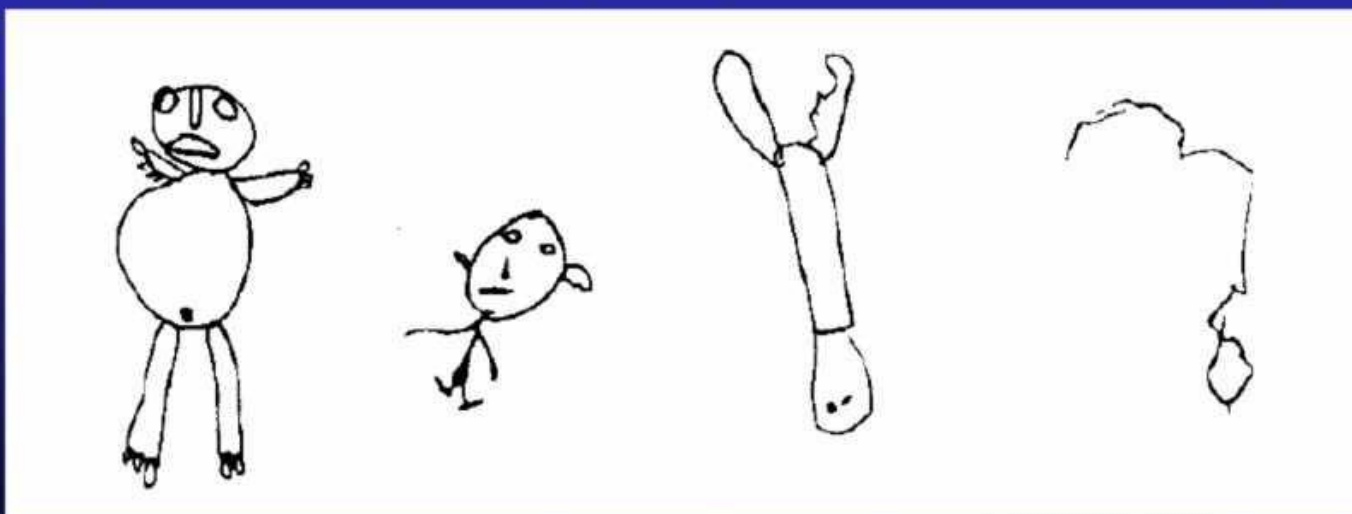
Four times higher frequency of occurrence of pesticide residues in **conventional** crops



Representative drawings of a person by 5-year-old Yaqui children from the valley and foothills of Sonora, Mexico

Foothills

Valley



60-month-old female

71-month-old male

61-month-old female

71-month-old male



**Grandjean
2015**

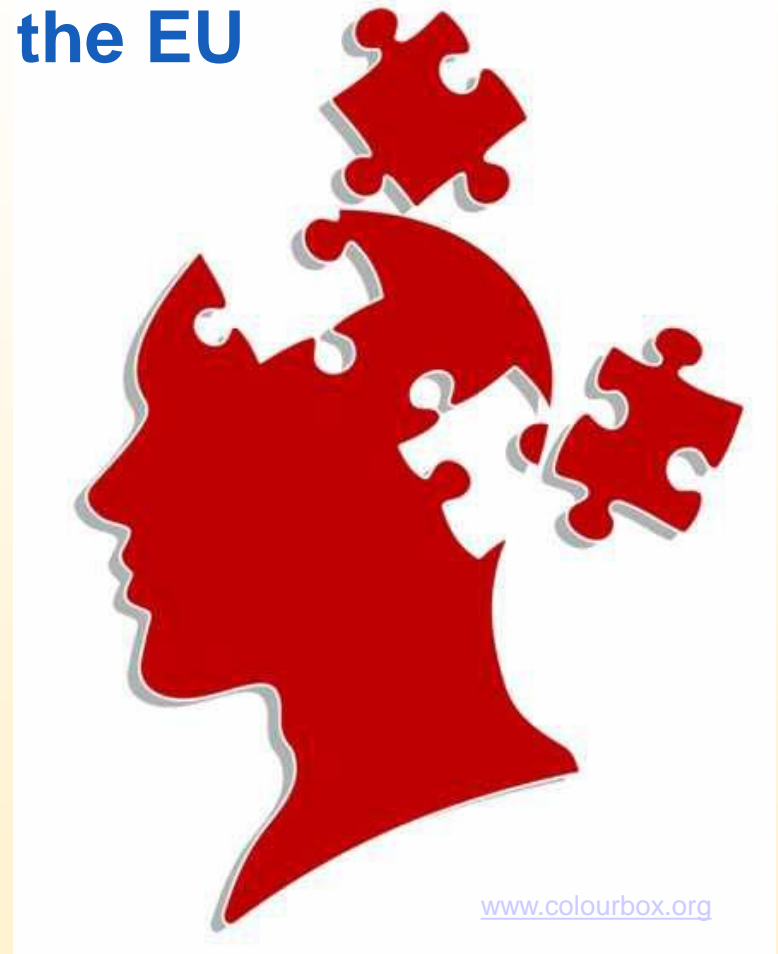
Children with prenatal pesticide exposure
have difficulty with coordination of motor
function (finger opposition test)

Chemical brain drain as public health concern for pesticide exposures in the EU

Vulnerability
is the price we pay
for our complex brain

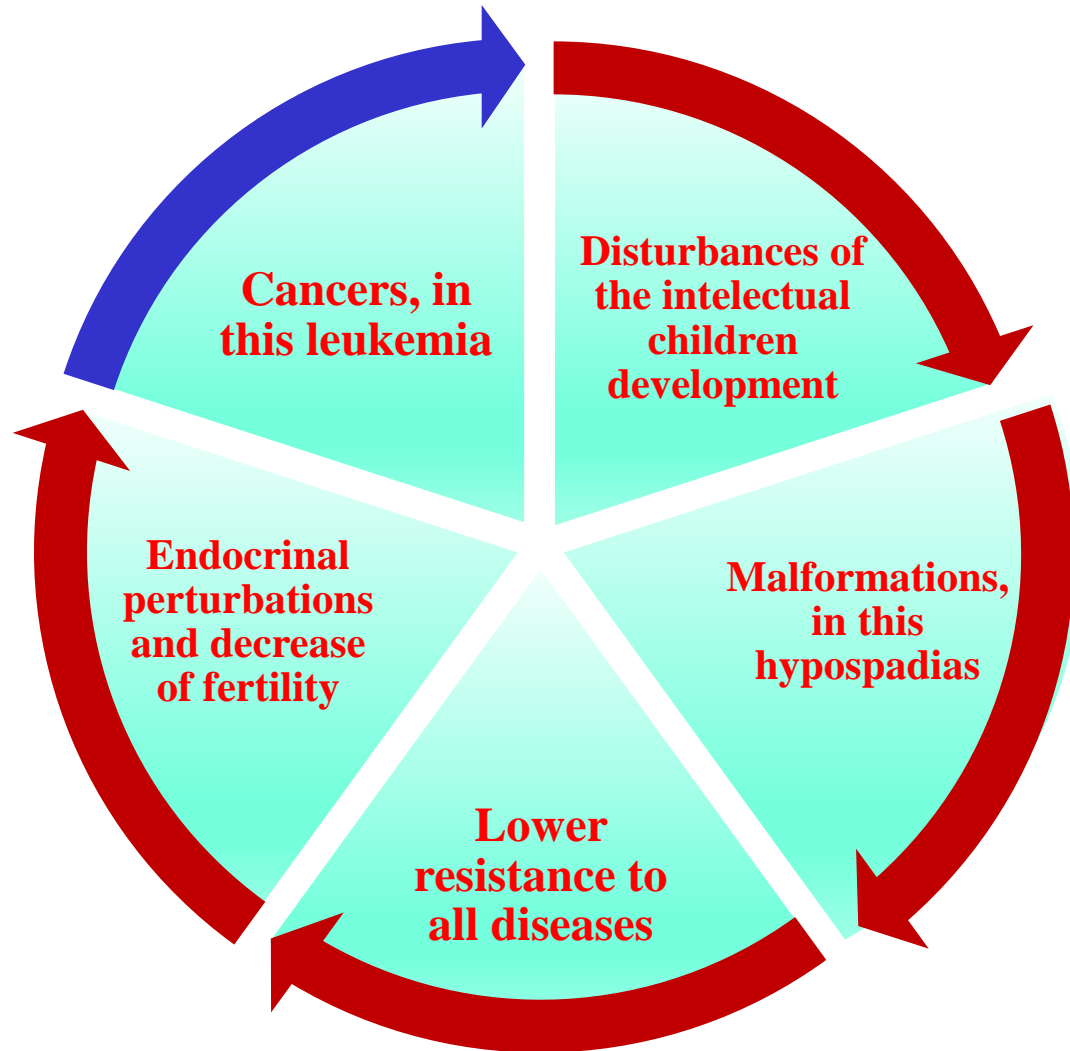
Early development
is particularly
vulnerable

Developmental
damage is likely
permanent



**Grandjean
2015**

Pesticides – health problems



Meta-analysis results: meat & milk

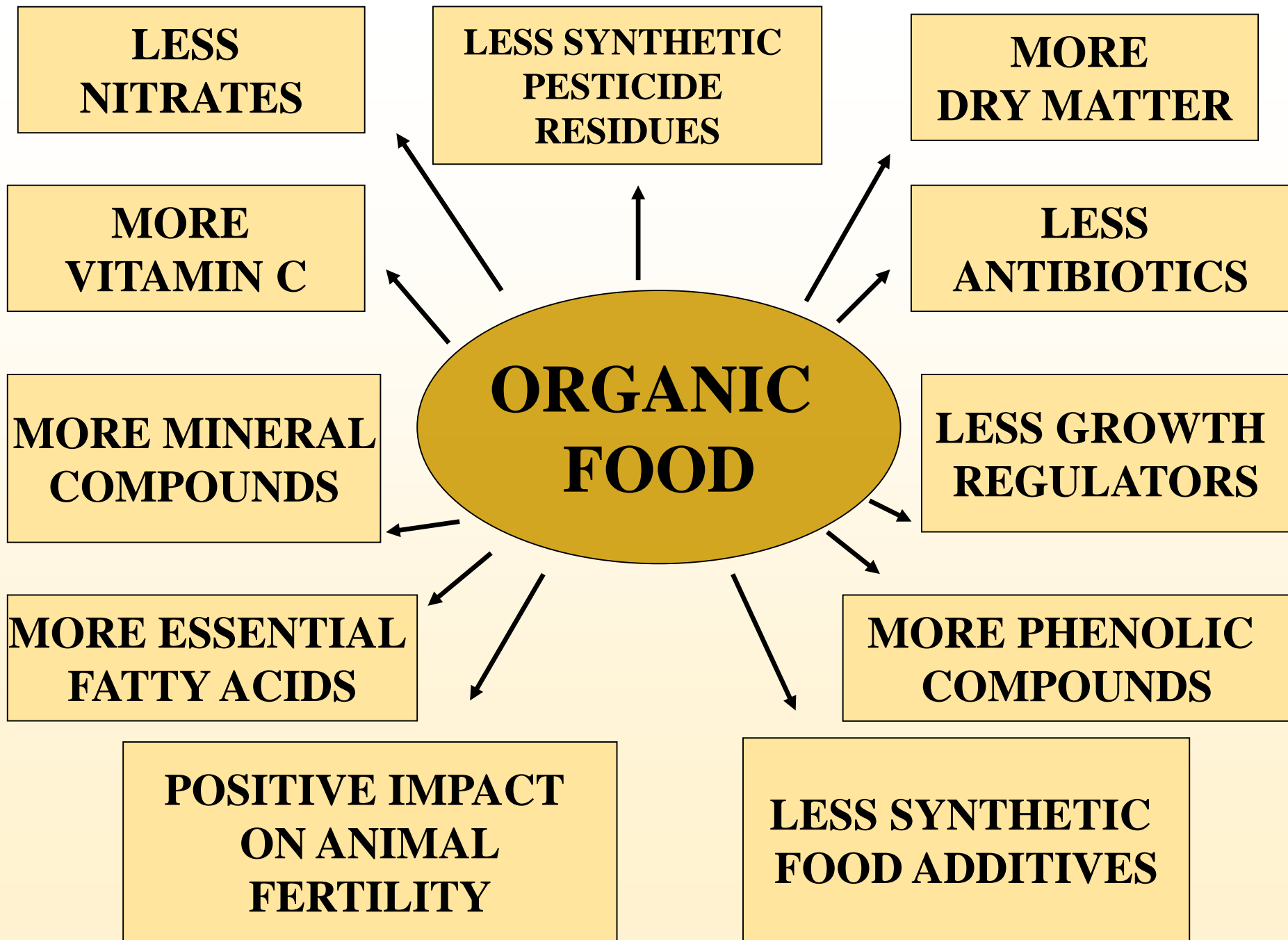


Średnicka-Tober D., Barański M., Seal C.J., Sanderson R., Benbrook C., Steinshamm H., Gromadzka-Ostrowska J., Rembiałkowska E., Skwarło-Sońta K., Eyre M., Cozzi G., Larsen N. K., Jordon T., Niggli U., Sakowski T., Calder P., C., Graham C. G. C., Sotiraki S., Stefanakis A., Stergiadis S., Yolcu H.,¹⁶ Chatzidimitriou E., Butler G., Stewart G., Leifert C. 2016: Higher PUFA and n-3 PUFA, conjugated linoleic acid, α -tocopherol and iron, but lower iodine and selenium concentrations in organic milk: a systematic literature review and meta- and redundancy analyses. *British Journal of Nutrition*, 115, 6, 1043-1060;

Średnicka-Tober D., Barański M., Seal C.J., Sanderson R., Benbrook C., Steinshamm H., Gromadzka-Ostrowska J., Rembiałkowska E., Skwarło-Sońta K., Eyre M., Cozzi G., Larsen N. K., Jordon T., Niggli U., Sakowski T., Calder P., C., Graham C. G. C., Sotiraki S., Stefanakis A., Yolcu H., Stergiadis S., Chatzidimitriou E., Butler G., Stewart G., Leifert C. 2016: Composition differences between organic and conventional meat: a systematic literature review and meta-analysis. *British Journal of Nutrition*, 115, 6, 994-1011.

50% more **n-3 fatty acids** in organic milk – is it meaningful for the consumer?

- half a litre of organic full fat milk (or equivalent fat intakes from other dairy products like butter and cheese) provides an estimated 16% (39 mg) of the recommended daily intake of very long-chain omega-3, while conventional milk provides 11% (25 mg)
- A switch from conventional to organic would raise omega-3 fat intake without increasing calories and undesirable saturated fat.



Conclusion from up-to now studies:

- ❖ composition of the organic food is more profitable for health than the conventional food.

Hypothesis:

- ❖ regular consumption of the organic food a should have a positive impact on animal and human health

Conclusions from the animal studies

- 1. Experimental animals (rats, mice, rabbits) consuming organic feed exhibit different physiological profile, better fertility parameters and greater resistance than their conventional counterparts**
- 2. Cows from organic system show stronger immune system and lower frequency of the metabolic disorders (mastitis, ketosis, milk fever, abscesses, arthritis, and liver diseases such as lipidosis) than cows from conventional farms; the management is very important (grazing at the open pastures)**
- 3. Further animal studies are necessary to understand better the functional relationships.**

Human studies can be different, in that:

- **Intervention-dietary studies on the small groups**
- **Cohort – epidemiological studies on the big groups.**

Selected intervention - dietary studies

Influence of biodynamic nutrition on immunological parameters and well-being of postmenopausal women („convent-study”)

(Fuchs et al., 2003)



- **PLACE OF THE STUDY:**
Monastery of Heiligenbronn
in the Black Forest, Germany



- **PARTICIPANTS:**
17 women (nuns) between 59
and 80 years old ($M = 69,4$)



Design of the study: 8 weeks

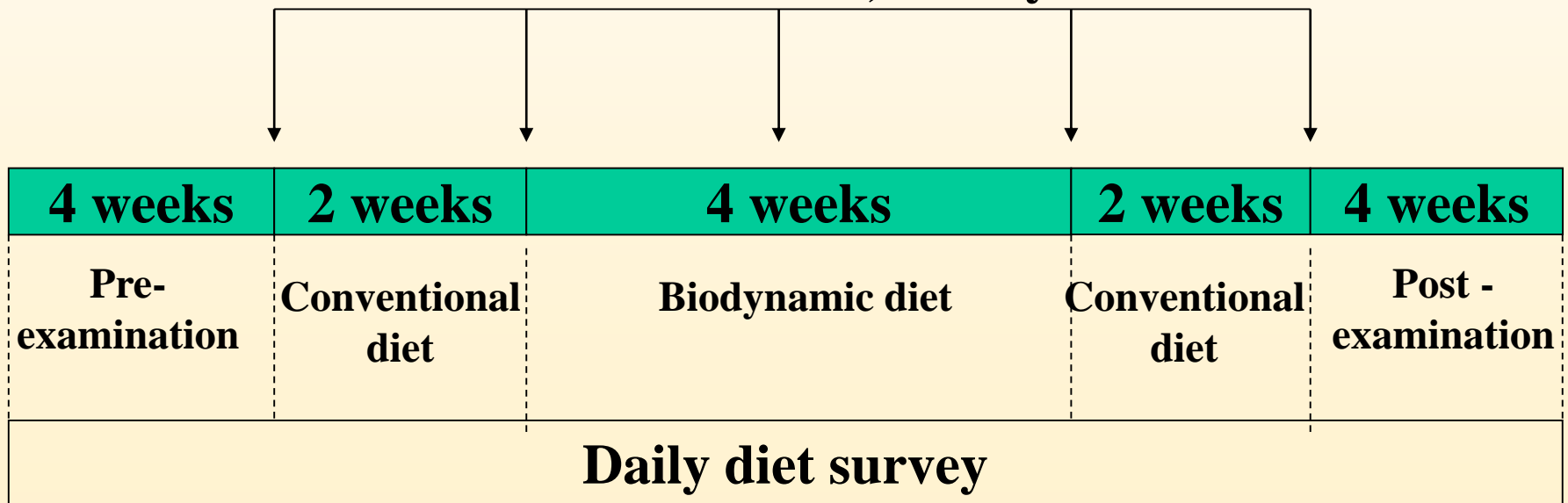
3 PHASES:

PHASE 1. 2 weeks; usually served frozen conventional meals were replaced with freshly cooked conventional meals

PHASE 2. „**BIODYNAMIC PHASE**”- 4 weeks; biodynamically produced food was served (85% of biodynamic food + 15% of organic food)

PHASE 3. 2 weeks; conventional fresh food was served again

Examinations, surveys



During the biodynamic phase respondents:

- Evaluated their physical fitness much better
- Evaluated their spiritual well-being higher
- Had better intellectual acuity
- Had better ability to handle stress
- Had less headaches



...They also liked the biodynamic food a lot better...

Physiological parameters

- Lower blood pressure
- Better immune status that seems to indicate less stress (less T helper cells, more natural killer cells in blood)

...during the biodynamic phase



Summary

- Nun study was criticized, because nuns knew that they were eating organic / biodynamic food, however...
- The results can indicate that feeling of safety improves the well-being and this aspects should be further investigated.

Is antioxidant plasma status in humans
a consequence of the antioxidant food
content influence?

Di Renzo et al., 2007



Aim of the study

The aim of the study was to compare the effects of consuming organic and conventional foods and their impact on human plasma antioxidant capacity measured by ORAC.

ORAC (oxygen radical absorption capacity) - ORAC indicator shows how powerful antioxidant is a substance; a unit for measuring the strength of an antioxidant.

Study design

Participants in the study: 10 white Italians

Age of participants: 30-65 years

Duration of test: 2x14 days - 28 days

Other criteria: not who have developed hypertension, cardiovascular disease, not abusing alcohol, no burning or patients taking any other medication.

Participants could not take any oral medication a month before the start of the study, as well as its duration.



Conclusions

After 14 days of the consumption of Mediterranean organic diet a significant ($p < 0.005$) increase (21%) of the human plasma total antioxidant capacity was observed.

The results clearly show that the organic food products have a higher total antioxidant activity and bioactivity than the conventional foods.

The results could be used in public health campaign to increase the consumption of products able to provide a significant health protection and prevention of chronic diseases.

Cohort - epidemiological studies

Atopy in children of families with an anthroposophic lifestyle *(Alm et al. 1999)*



Children from Steiner schools and reference schools - comparison of health parameters

(Alm et al. 1999)

	STEINER SCHOOLS		REFERENCE SCHOOLS	
Total number of children	295		380	
Clinical symptoms				
	Number of cases	% of children	Number of cases	% of children
Together	39	13%	96	25%
Bronchial asthma	17	5,8%	65	17%
Previous skin allergy	15	5,1%	31	8,2%
Present skin allergy	8	2,7%	34	8,9%
Catarrhal allergy	21	7,1%	55	14%
Food allergy	3	1,0%	4	1,1%
Nettle-rash	3	1,0%	3	0,8%
Skin tests				
Number of tests	292	99%	376	99%
Positive results in general	21	7,2%	50	13%
Animal allergies	18	6,2%	34	9,0%
Plant pollen	12	4,1%	38	10%
Food	2	0,7%	9	2,4%
D pteronyssinus and cladosporium	5	1,7%	3	0,8%
Blood analyses				
Number of tests	271	92%	334	88%
Positive results in general	65	24%	110	33%
Positive result in Phadiotop	57	21%	90	27%
Positive result in fx5	25	9,2%	52	16%
Positive result in ex 70	6	2,2%	7	2,1%

To summarize...



- Children with the organic / anthroposophic diet had less allergies, but...
- Anthroposophic diet based on biodynamic food products is a kind of lactoovovegetarian diet and has probably many positive health effects, decreasing the risk of circulatory system diseases, cancers, allergies and osteoporosis
- Lifestyle related to anthroposophy can decrease the risk of atopy in childhood: avoidance of antibiotics and antipyretics, very few vaccinations, organic/biodynamic diet, lots of naturally fermented vegetables in diet effecting in strong development of *Lactobacillus plantarum* in intestinal microflora.

**Consumption of organic foods
and risk of atopic disease
during the first 2 years of life in
the Netherlands**

(Kummeling et al. 2007)



Study characteristic



- **Participants:** 2764 children in the first 2 years of life
- **Repeated questionnaires** (parents were sent detailed questionnaires when the infants were 3, 7, 12 and 24 months of age)
- **Blood analysis for total and specific IgE** – venous blood samples were taken from 815 infants at two years of age

Types of diets



Diet	% of organic products
Conventional	< 50%
Moderately organic	50 - 90%
Strictly organic	> 90%

% of infants with atopic diseases in analyzed groups

Conventional group (n=2306) [%]	Moderately organic group (n=283) [%]	Strictly organic group (n=175) [%]
Eczema in first 2 years		
32	33	29
Recurrent wheeze in first 2 years		
12	7	8
Prolonged wheeze in first 2 years		
5	6	5
Atopic sensitization at Age 2++		
28	23	29



SUMMARY OF THE RESULTS

- Consumption of **organic dairy products** was significantly associated with **lower eczema risk**
- There was **no association** of **organic meat, fruit, vegetables or eggs, or the proportion of organic products within the total diet** with the development of **eczema, wheeze or atopic sensitization.**
- There was a **tendency** towards **lower eczema risk** in group of **children eating organic** (no significant differences)
- Total serum **IgE level** was **not associated** with **organic food** consumption

Organic food consumption and the incidence of cancer in a large prospective study of women in the United Kingdom

Bradbury et al., 2014



Design of study

Test site: All England and Scotland

Duration of study: 1996-2001

Participants in the study: 1.3 million middle-aged women who have been invited to participate in screening studies of prophylactic prevention of the occurrence of breast cancer research centers, among which 623 080 people were selected

Test method: a questionnaire survey on the frequency of consumption of organic food



Conclusions

In this large prospective study there was little or no decrease in the incidence of cancer associated with consumption of organic food, except for non-Hodgkin lymphoma.

About **21% reduced risk of non-Hodgkin's lymphoma** for women who reported that they often or always ate organic food compared with those who had never consumed.

**Non-Hodgkin Lymphoma
and Occupational Exposure
to Agricultural Pesticide
Chemical Groups and Active
Ingredients:
A Systematic Review and Meta-
Analysis**

Schinasi and Leon, 2014

Conclusion

Random effects meta-analysis showed that the phenoxy herbicides, insecticides, carbamate insecticides, lindane, active ingredients and organophosphorus insecticides organochlorine were very well connected by non-Hodgkin lymphoma (NHL)



Profiles of Organic Food Consumers in a Large Sample of French Adults: Results from the Nutrient-Sante´ Cohort Study

Kesse-Guyot et al., 2013



Aim of the study

The aim of the study was to show the possibility of a link between nutrition and health, as well as the determinants of dietary behaviors and nutritional status.

53 311
respondents in
France



Results



In conclusion, the present survey of this very large cohort indicated that consumers of organic foods have:

- **a higher level of education,**
- **a dietary pattern better fitting food-based recommendations and micronutrient/fiber recommended intakes,**
- **a sustainable diet concept.**

Organic consumers are:

- **less overweight and less obese compared to conventional consumers.**

Health effects of an organic diet – consumer experiences in the Netherlands

van de Vijver & van Vliet, 2012



Aim of the study

The aim of the study was to assess the perceived health effects of organic foods by consumers using the free online questionnaire - **566** respondents.



RESULTS

- A total of 566 respondents participated, of whom 30% reported no health effects.
- The other respondents reported better general health, including feeling more energetic and having better resistance to illness (70%),
- A positive effect on mental well-being (30%), improved stomach and bowel function (24%), improved condition of skin, hair and/or nails (19%),
- Fewer allergic complaints (14%) and improved satiety (14%).
- Furthermore, it was found that the switch to organic food was often accompanied by the use of more freshly prepared foods and other lifestyle changes.

**Relation between the organic diet during pregnancy and
hypospadias in the infants:
study of the mothers of 306 boys operated because of
hypospadias**



Aim of a study

The aim of a study was to look for the relationship between the regular organic diet used by the pregnant women and hypospadias in their infants.

A study comprised:


- conducting the phone interviews among Danish mothers having sons operated because of hypospadias,
- obtaining the information about mothers diet,
- highlighting the relationship between a diet and hypospadias.



Conclusions

- Regular consumption of the organic products by pregnant women diminished the probability of delivering a son with hypospadias.
- Frequent consumption of the CONVENTIONAL milk products containing high fat content increased the frequency of hypospadias in the infants.





**Reduced risk of pre-eclampsia
with
organic vegetable consumption:
results
from the prospective Norwegian
Mother
and Child Cohort Study**

Torjusen i in., 2014.

Aim of the study



Aim of a study was to analyze the relationship between the consumption of the organic food by Norwegian women and risk of pre- eclampsia in pregnancy

A study comprised:

- **A survey among pregnant women**
- **Looking into the correlation between the organic diet and frequency of pre-eclampsia.**

Results

Women eating more organic vegetables were also eating more fruits of the sea, milk and products rich in calcium and iodine.

Conclusions



Women regularly consuming organic food during pregnancy were less endangered with the pre-eclampsia than women eating conventional food.

It is recommended for the pregnant women to eat more organic vegetables in order to diminish the risk of pre-eclampsia.

Health and dietary traits of organic food consumers: results from the NutriNet-Santé study

Baudry et al. 2015

*Baudry J., Méjean C., Péneau S., Galan P., Hercberg S., Lairon D. and Kesse-Guyot E. 2015. Health and dietary traits of organic food consumers: results from the NutriNet-Santé study. British Journal of Nutrition, page 1 of 10
doi:10.1017/S0007114515003761*

Aim of the study and characteristics of studies

The aim of the study was to depict, according to organic food consumption, using data from the NutriNet-Santé study:

(1) dietary traits,

(2) disease history,

(3) knowledge of the French nutritional guidelines and to test for a modulating effect of organic food consumption in the association between nutritional knowledge and dietary consumption.

Conclusions

Compared with non-organic food consumers, regular organic food consumers had a lower risk of type II diabetes, hypertension and CVD. However, this effect was only significant for men. In contrast, organic consumers were more likely to report food allergies,

Consuming organic food appeared to affect the relationship between nutritional knowledge and adequate intake of meat/poultry/seafood/ eggs and starchy food among both sexes,

Our study provides new insights into the diet- and health-related behaviours of organic food consumers in a large sample of participants residing in France. This should be taken into account in future studies investigating relationships between health and organic food consumption.

Interrelations between organic food consumption and metabolic syndrome– results of the NutriNet-Santé study

Baudry et al. 2017, Eur. Journal of Nutrition

Metabolic syndrome

Metabolic syndrome, sometimes known by other names, is a clustering of at least three of the five following medical conditions (giving a total of 16 possible combinations giving the syndrome):

- abdominal (central) obesity (cf. TOFI)
- high blood pressure
- high blood sugar
- high serum triglycerides
- low high-density lipoprotein (HDL) levels



Metabolic syndrome is associated with the risk of developing cardiovascular disease and type 2 diabetes.

Aim of study

- **Aim of study was to investigate the relations between organic food consumption and metabolic syndrome among French adult consumers.**
- **Method: 8174 persons taking part in the NutriNet-Santé study, who paid a clinical visit and filled in the questionnaire about the frequency of the organic food consumption, were included into this evaluation.**

Results

- Higher organic food consumption was negatively correlated with the occurrence of the metabolic syndrome, and it was highly statistically significant
- Higher consumption of the organic food of plant origin was also connected with the lower probability of the metabolic syndrome
- These correlations were confirmed for all studied groups except tobacco smokers.

The new French study on the large population (68 946 people)

The higher the frequency of consumption of organic foods is associated with a significantly reduced risk of cancer (all cancers combined, post menopausal breast cancer, non-Hodgkin lymphoma & all leukemia).

Although the test results need to be confirmed, the promotion of the consumption of organic food among consumers may be a promising strategy for preventing the development of cancer.

STOP!



General conclusions

- **Animal studies indicate different physiological reaction towards organic vs conventional feeding**
- **Human intervention - dietary studies are giving less evident results comparing to the cohort – epidemiological ones;**
- **Regular organic consumer exhibit better dietary patterns compared to the conventional consumers;**
- **Among the regular organic consumers some symptoms of better well-being and health can be observed compared to the conventional consumers;**
- **Future studies are necessary to confirm the first results and to understand the physiological impact of the organic diet on animal and human health.**

Thanks for your attention

