Organic diet enhanced the health of rats

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Many consumers expect organic food to be healthier than food produced under conventional conditions. But scientifically there is a lack of investigations that could support this view. One reason is that it is difficult to test the influence of foods on health, because a range of other parameters also influences health.We have now examined the importance of food type on the health of rats under standardised experimental conditions and found that for some aspects the rats benefited from eating organically grown food.

Diets from three cultivation strategies

The experiment was done with 36 rats that were fed on three diets consisting of potatoes, carrots, peas, green kale, apples, and rapeseed oil (Table 1). The difference between the three diets was that the ingredients were grown according to three different cultivation strategies:

- Organically: low input of fertiliser and without pesticides
- Minimally fertilised: low input of fertiliser and with pesticides
- Conventionally: high input of fertiliser and with pesticides

It should be noted that only one replication per cultivation strategy was included in the study reported here.

Table 1. Ingredients composition of the experimental diets

	Organic	Minimally fertilized	Conventional
Potatoes	300,0	300,0	300,0
Carrots	50,0	50,0	50,0
Peas	472,4	472,4	472,4
Green kale	10,0	10,0	10,0
Apples	10,0	10,0	10,0
Rapeseed oil	130,0	130,0	130,0
DL-methionine	6,4	6,4	6,4
CaCO3	12,5	12,5	12,5
Salt	0,7	0,7	0,7
Vitamin/mineral mixture	8,0	8,0	8,0

The diets had similar energy and protein contents (Table 2), and had a relatively high content of fat as compared to the recommended level for rats. The diets were analysed for pesticide residues, but these were below detection limits in all three diets.

Vitamins, minerals and amino acids were added to all three diets to fulfil the requirement of the rats. The rats received the same diets throughout their life and the measurements of heath started after weaning of their first litter (age, 19 weeks; weight, 212 g).

Table 2. Analysed chemical composition of selected nutrients in the experimental diets

	Organic	Minimally fertilized	Conventional
Dry matter (DM), g/kg	966	972	962
Energy, MJ/kg DM	21,0	21,2	21,3
Protein, g/kg DM	160,5	160,6	160,9
HCl-fat, g/kg DM	156,8	154,7	157,9
Vitamin E, mg/kg DM	32,1	19,2	31,7
Saturated fatty acids, %	8	7	8
Monounsaturated fatty acids, %	62	72	63
Polyunsaturated fatty acids, %	30	21	29

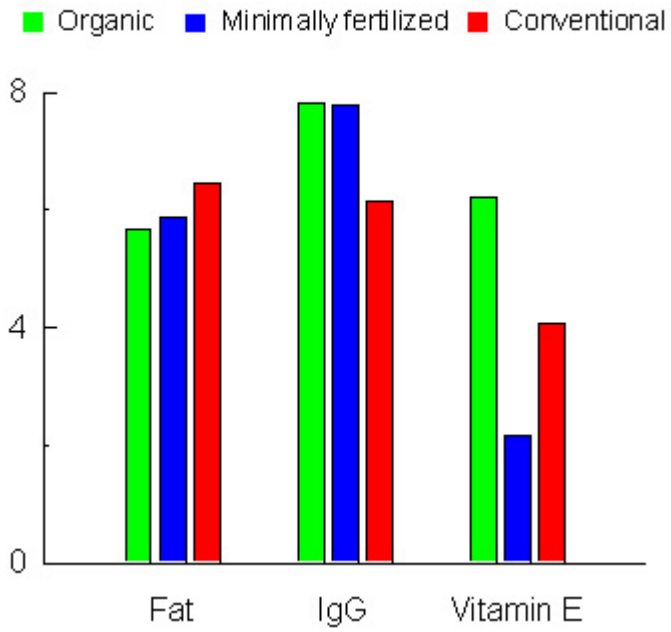
Measurement of health

The health of the rats was examined through physiological response measurements that comprised nutrient utilisation, function of organs and physical activity. Post mortem (44 weeks of age) blood and tissue samples were collected for analysis of biomarkers of health such as immune function, antioxidant status and nutritional status

In addition to the presently reported results, the main project comprised a range of other issues related to reproduction of the rats, bioavailability of the nutrients in the ingredients of diets, and annual variation in the content of nutrients and secondary metabolites in the ingredients.

Improved immune status

Immune status of the rats was measured as the total content of immunoglobulins in the blood serum. The results showed that rats fed on organic and minimally fertilised diets had a higher content of immunoglobulin G (IgG) than rats fed on the conventionally grown diet (Figure 1). There were no differences in the serum contents of immunoglobulins A and M.



At present, we have no explanation of the lower content of IgG in the rats that were offered the conventionally grown diet. Yet, it is noteworthy that the conventional diet had a higher content of

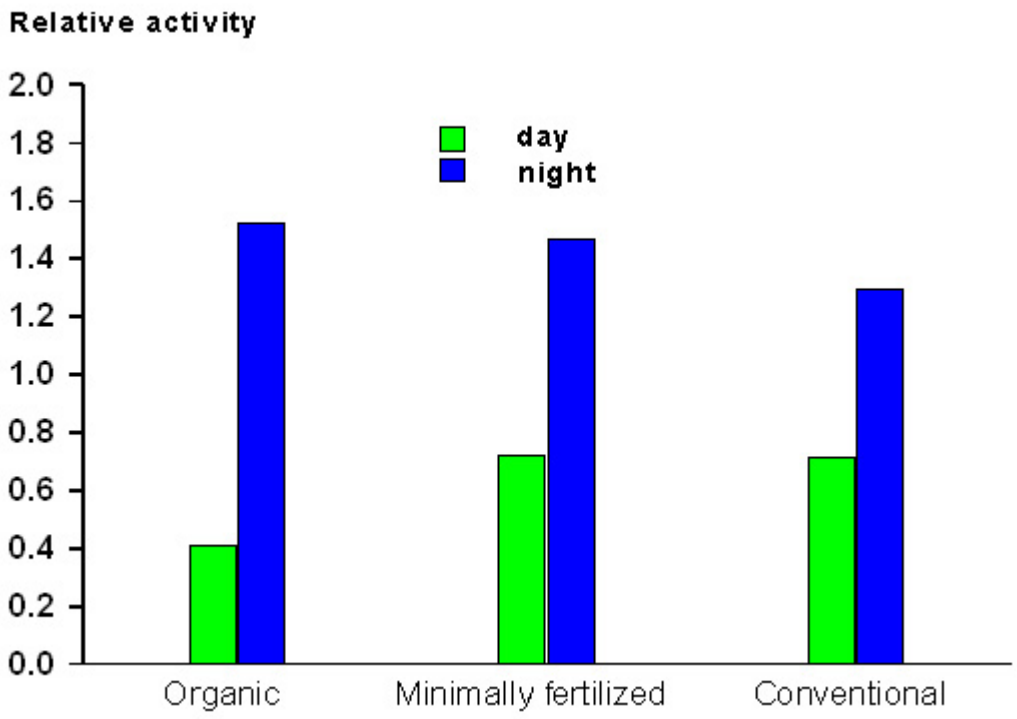
the sec-ondary metabolite falcarindiol than the other diets. It cannot be excluded that falcarindiol may have an inhibitory effect on initiation of the immune response.

Tendencies towards less adipose tissue and better rest

The rats thrived on all three diets and only showed minor differences with respect to utilisation of energy and nutrients. Even though the rats were genetically disposed for diabetes, there was no visual sign of this disease among the rats.

The rats had only a slight increase in weight after eating the diets for 25 weeks. However, the data showed a tendency towards a lower weight and a lower content of adipose tissue in the rats that were fed on the organic diet as compared to the other diets (Figure 1).

Concurrently with the measurements of energy utilisation, we measured the physical activity of the rats using infrared sensors. Rats are active at night, and there were no differences between the dietary groups with respect to activity at night. However, during daytime, when the rats are supposed to rest, our data indicated that rats fed on the organic diet was more relaxed than rats feed on the other diets (Figure 2).



Differences in vitamin E

Rapeseed oil comprised 25 pct. of the energy content of the diets. Due to experimental problems there was a different composition of fatty acids and a lower vitamin E content in the rapeseed oil from the minimally fertilised treatment (Table 2). This caused some differences in the fatty acid composition of the serum and the tissue of the three dietary groups of rats. Also, the vitamin E content was lower in blood plasma from rats that received the minimally fertilised diet.

The content of vitamin E in the organic and the conventional diet was similar (Table 2). Yet, there was a higher content of vitamin E in the blood of the rats that were fed the organically grown diet (Figure 1). This could be health beneficial as vitamin E is an antioxidant protecting the cells from

oxidative injury.

There were no differences in the vitamin E content of liver and adipose fat tissue between rats from the three dietary groups.

Need for further research

For most of the response measurements in the present study there was no differences between the three diets. But in all cases, where differences were observed, there was a beneficial effect of the organically grown diet regarding the health of the rats. This indicates a positive effect of organically grown foods as compared to conventionally grown food.

However, the results presently obtained cannot be extrapolated to all organic and conventional cropping systems as, for example, the crops were grown only in one replication and a very low level of fertiliser was used in the organic system. Likewise, the results can not directly be extrapolated from rats to humans. Nevertheless, the results show the need for further interdisciplinary research in the area of human health aspects in relation to organic foods.