

## New trends in estimating food quality

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**SUMMARY.** An overview is given what food quality means today. It is helpful to define sub-qualities and to rank them according to individual wishes and attitudes. Depending on social and economic status, food qualities are ranked.

Health aspects in connection with food are today more and more of public interest. This can be seen from so called „nutraceuticals“, having benefit to health. Amongst them all types of antioxidants are becoming of public as well as of scientific interest. This shows that also scientific progress fosters changes in food quality evaluation. Some examples for antioxidants in food and their influence at least on quality is given. In any instance, food quality is a dynamic concept, subjected to sociological changes and perception of new scientific knowledge, which is defined according to a personal ranking order of values.

Quality has many faces. Food quality depends on preference of a consumer and his attitude. As times change, the attitude of consumers change and also quality changes its meaning. One definition of quality may be: fulfillment of the need.

The European Union states:

*„Quality is the totality of features and characteristics of a product that bear on its ability to satisfy a given need“.*

It is obvious that a personal perception is included. And it is also obvious that all of us do have different preferences making our food choice.

Let me give some examples what food quality divided in subqualities [1] can be:

- quality prescribed by law and directives („Legal Quality“) - hygiene, labeling, composition,
- optical and sensorial quality - olfaction, gustation, consistency, colour, shape,
- physiological („inner“) quality - nutritive value, contaminants, additives, essential constituents, dietary fiber,

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- technological quality („convenience“),
- social-ecological quality - breeding, husbandery of animals, farming methods, sustainable methods, waste management, „social beneficial“.

This is not an exhaustive list.

*Legal quality* comprises the food law, its regulations and the food codex. HACCP concept and hygiene directive are nowadays under discussion and are introduced into food production, stimulated by EU regulations. It is a prescribed quality which is controlled by governments.

*Optical and sensorial quality* determine mostly (but not exclusively) the relish of eating. Odour, taste, consistency, colour, form and serving determine this subquality.

*Physiological quality* comprises energy content, nutritional value, value of components e.g. proteins, contaminants, additives, essential compounds (trace elements, minerals, vitamins, essential aminoacids and fatty acids), antioxidants, potential natural toxicants (e.g. glycoalkaloid in nightshades like potatoes and tomatoes), dietary fiber and other protective substances in food. This subquality deals a lot with human health and is discussed very intensively in the public.

*Convenience* is today a very important subquality. The share of ready-to-eat food is increasing and high quality is demanded. Preparation should be as easy as possible, microwave heating is preferred and the quality should be the same as in restaurants.

*Ecological quality* is rooted in sustainable agriculture, minimal processing and closed production circuits. Garbage is reduced to a minimum. Instead of chemical fertilizers, manure is used only and the soil and its microbial life is carefully observed and improved. Ecological farming uses autochthone plants, develops natural breeding and husbandery of animals and produces with these integrated methods food in a so called „social beneficial“ way.

If you personally now make a ranking order of these subqualities, I guess we all will end up with more or less different lists.

Depending on preferences, an upper-class high income single might give high priority to convenience and appearance of food. He is willing to pay a high price for a high quality in flavour and convenience. Therefore he buys

deep frozen or ready-to-eat dishes, only to be heated for minutes in a microwave oven. Possibly he prefers ethnic food to impress also his visitors.

A „green“ person, preferring sustainable economy and favouring grain and vegetable dishes ranks indeed ecological quality high. Consequently, he is looking for products from ecological farming, minimally processed, virtually free from contaminants and additives. He will enter a small shop, talk to the owner about the origin and the farm from where the products come and leave the shop with good feeling that something has been done for a better future.

Let us look for a moment back to the past. For hundreds of years, it was the only aim of mankind not to starve. The necessary quantity, irrespective of the quality, was the focal point. This has changed within the last decades. Things changed from a starving society to an affluent one within some 60 years e.g. in Europe.

In the same way the needs of food and consequently the attitude of what consumers understand by the term food quality has changed considerably.

Today health and wellbeing on the one hand and pleasure and variability of food on the other hand are measures to judge food quality.

This shows that food quality is subjected to permanent change.

### **Food and health**

Health, as defined by WHO, means not only absence of physical illness. WHO definition:

#### ***Health is wellbeing in physical, mental and social respect***

It is obvious now that wellbeing has its equally important social and mental aspects. If one thinks that all the minute residues of pesticides and „chemicals“ in food hurt his health, he feels and indeed is unhealthy.

Psychological feeling influences health.

Those who a priori, i.e. before the experience believe to get „poisoned“ develop fears. Such persons indeed are in an unhealthy status, too.

If a person does not accept personally the way in our society animal production is carried out, he will feel to be in a barbaric society und does not feel well. But the public opinion, which is mirrored in the personal ranking order of subqualities, has roots also in the development of scientific knowledge.

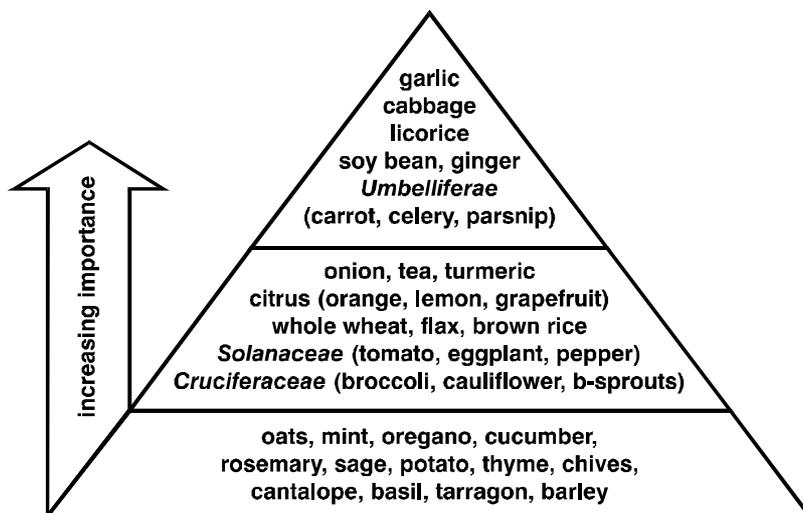


FIG. 1. Foods with an assumed protective action against cancer.

OBR. 1. Potraviny, o ktorých sa predpokladá, že majú ochranný účinok proti rakovine.

Fig. 1. shows approximately 40 foods with an assumed protective action against cancer.

On the top of the pyramide you can find those six foodstuffs now under experimental investigation at the US National Cancer Institute [2].

Looking closer to these foodstuffs, some secondary metabolites and ingredients have been identified, which are known or believed to possess cancer-preventive properties. They are believed to appear in greater abundance in the food and ingredients included in Fig. 2. Their name is phytochemicals.

For some years investigation is centered on these substances, their presence in food and their quantities.

In trade, health claims are appearing. In the USA e.g. health claims connecting calcium content with prevention of osteoporosis and linking consumption of cereal products, fruits and vegetables with coronary heart diseases are allowed.

It seems to be only a question of time that these health claims can be also found on European foodstuffs.

|                | Sulfides | Phytates | Flavonoids | Glucarates | Carotenoids | Coumarins | Mono-terpenes | Tri-terpenes | Lignans | Phenolic acids | Indoles | Isothiocyanates | Phthalides | Polyacetylenes |
|----------------|----------|----------|------------|------------|-------------|-----------|---------------|--------------|---------|----------------|---------|-----------------|------------|----------------|
| Garlic         | ✓        |          |            |            |             |           | ✓             | ✓            |         | ✓              |         |                 |            |                |
| Green tea      |          |          | ✓          | ✓          |             | ✓         |               |              |         | ✓              |         |                 |            |                |
| Soy bean       |          | ✓        | ✓          |            | ✓           | ✓         |               | ✓            | ✓       | ✓              |         |                 |            |                |
| Cereal grains  |          | ✓        | ✓          | ✓          | ✓           | ✓         |               | ✓            |         | ✓              |         |                 |            |                |
| Cruciferaeae   | ✓        |          | ✓          | ✓          | ✓           | ✓         | ✓             | ✓            |         | ✓              | ✓       | ✓               |            |                |
| Umbelliferaeae |          |          | ✓          |            | ✓           | ✓         | ✓             | ✓            |         | ✓              |         |                 | ✓          | ✓              |
| Citrus fruits  |          |          | ✓          | ✓          | ✓           | ✓         | ✓             | ✓            |         | ✓              |         |                 |            |                |
| Solanaceae     |          |          | ✓          | ✓          | ✓           | ✓         | ✓             | ✓            |         | ✓              |         |                 |            |                |
| Cucurbitaceae  |          |          | ✓          |            | ✓           | ✓         | ✓             | ✓            |         | ✓              |         |                 |            |                |
| Licorice root  |          |          | ✓          |            |             | ✓         |               | ✓            |         | ✓              |         |                 |            |                |
| Flax seed      |          |          | ✓          |            |             | ✓         |               |              | ✓       | ✓              |         |                 |            |                |

FIG. 2. Phytochemicals, which are known or believed to possess cancer-preventive properties.

OBR. 2. Fytochemikálie s dokázanými alebo predpokladanými ochrannými účinkami proti rakovine.

### Nutraceuticals - food and pharmaceutical all in one?

The new word for these foodstuffs assumed to be beneficial for human health is *nutraceuticals*. This artificial word means compounds acting similarly to pharmaceuticals but being naturally present in food.

Selected groups of nutraceuticals are:

- dietary fiber,
- polyunsaturated fatty acids (fish oils),
- aminoacids (Try, Arg, Gln, Val, Ser, Thr, Met...),
- ketoacids,
- minerals (Ca, Mg),
- trace elements ( Fe, Zn, Se, Cr ...),
- antioxidative vitamins (C,E,A),
- phytochemicals (e.g. flavone, polyphenoles...).

Let us review some examples:

### *Dietary fiber*

Dietary fiber content is reduced considerably by milling processes. In former times it was assumed to be useless for human consumption but applicable only for feeding purposes.

Now it has turned out that fibers contain valuable amounts of trace elements and minerals as well as vitamins. But besides these well known facts, dietary fibers have additional health effects. An outline is given here:

#### Properties:

- absorbs water,
- swells and increases fecal bulk,
- is highly absorptive.

#### Effects:

- enhances passage time in the gut, prevents constipation,
- reduces intake of contaminants,
- prevents large intestine cancer,
- regulates blood sugar and insulin.

#### Sources:

- whole grain products,
- bran,
- fruits,
- vegetables.

#### Dietary uptake [3,4]:

- actual: 18.5 (11.6 - 25.4) g/person and day
- recommended : 30 g/person and day

### *Polyphenols*

Polyphenols, an extensive group of different compounds, are the top hits today.

#### **Flavonoids**

Amongst antioxidants, polyphenols and especially flavonoids play an important role. Based on the 2-phenyl-benzo- $\alpha$ -pyron ring, various groups of

substances are becoming more and more in the center of interest. Flavonols, flavons, catechins (flavon-3-ols), flavanons, anthocyanidins and isoflavonoids are some of them.

It is interesting to note, that besides a vast number of substances that have been identified as either aglyca or glycosides, a considerable lack of quantitative data exists.

Quantitative data on dietary uptake are restricted to groups of substances and within groups to the dominating compounds.

So flavonols and flavones uptake in the Netherlands was estimated to 23 mg.d<sup>-1</sup>, the contribution of quercetin was 16 mg.d<sup>-1</sup> [5].

Main sources identified were tea (48 %), onions (29 %) and apples (7 %). Data from other countries [6] show large variations. In Japan, the intake estimated to 70 mg of flavonols and flavones, whereas in Finland only 3 mg.d<sup>-1</sup> were consumed [5,6].

The food supplying polyphenols are different from country to country. Whereas tea in Japan and Holland was dominating, red wines contribute to Italian diet most and in USA, onions and apples were the favorite sources of flavonols and flavones.

Interesting enough: no correlation to cancer, but strong correlation with coronary heart diseases was observed.

### *Essential trace elements*

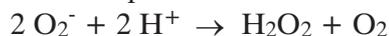
Essential trace elements are from the point of view of antioxidative properties also of increasing importance.

Since selenium has been identified as an important essential element in some bioorganic molecules, research has centered to the beneficial effect of this trace element in human nutrition [7-9]. But also some other trace elements seem to be of importance with respect to their antioxidative properties.

Oxidation in organisms is a natural and necessary process. But induction of an overwhelming oxidation may be the cause of cancer. Therefore a sufficient amount of antioxidants should be present or available in case of a higher oxidation rate induced by food or environmental impact (e.g. radiation). Here is an outline of antioxidative enzymes having minerals in their molecule [10,11]:

Minerals in antioxidant enzymes:

- Cu Zn-superoxide dismutase and Mn-superoxide dismutase



- Glutathioneperoxidase: Se  
 $2 \text{H}_2\text{O}_2 + 2 \text{GSH} \rightarrow \text{H}_2\text{O} + \text{GSSG}$
- Catalase: Fe  
 $\text{H}_2\text{O}_2 + 2 \text{GSH} \rightarrow \text{H}_2\text{O} + \text{O}_2$
- Ceruloplasmin: Cu  
Oxidizes iron without forming hydrogen peroxide or oxygen radicals  
 $\text{Fe}^{2+} \rightarrow \text{Fe}^{3+}$   
May scavenge hydrogen peroxide, superoxide and hydroxyl radicals.

These few examples show that the new trends in defining food quality are directed to health beneficial food or food components.

From the examples given, one can see that besides a high hygienic and nutritional quality, the main attention of consumers has shifted towards sensorial quality and „nutraceuticals“.

It can be seen that the former borderline between food and health, nutrition and medication is more and more vanishing.

In the near future, a lot of new products will appear on the market satisfying these new attitudes and needs.

In summary it can be stated: Food quality is a dynamic concept, subjected to sociological changes and perception of new scientific knowledge, which is defined according to a personal ranking order of values.

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### **Nové trendy hodnotenia kvality potravín**

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**SUMMARY.** Prehľadný článok uvádza súčasný význam termínu kvalita potravín. Za užitočné sa považuje definovať subkategórie kvality a zoradovať ich na základe prístupu jednotlivých konzumentov a na základe ich sociálneho a ekonomického postavenia. Do popredia všeobecného záujmu sa dnes vo vzťahu k potravinám čoraz viac dostávajú zdravotné hľadiská. Toto možno vidieť na tzv. nutraceutikách, látkach prospešných pre zdravie. Spomedzi nich sa stávajú predmetom všeobecného i vedeckého záujmu všetky druhy antioxidantov. Znamená to, že aj vedecký pokrok podporuje zmeny v hodnotení kvality potravín. Kvalita potravín je v každom prípade dynamická kategória podliehajúca sociologickým zmenám a prijímaniu nových vedeckých poznatkov, pričom ju určuje stupnica hodnôt konkrétneho jednotlivca.