BARRIES – HEALTH EFFECTS AS AN ISSUE FOR PROMOTION OF RASPBERRIES IN THE WORLD

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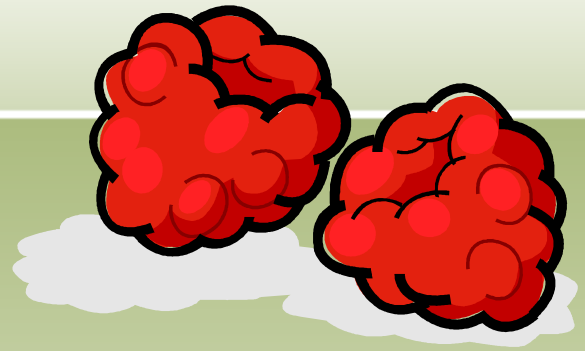
Wszelkie prawa zastrzeżone. Kopiowanie, publikowanie w części lub całości oraz wykorzystanie do innych celów niż samokształcenie jest zabronione.

Quality and Safety Factors of Food



MAIN FACTORS

- Appearance (visual);
- Texture (feel);
- Flavor (taste and smell);
- Nutritional/Health value;
- Safety.

Sensory attributes

Internal attributes

COMPONENTS e.g.:

Safety (partial list)	Microbial contamination (considered as the most serious problem by health authorities).
	Chemical residues (considered as important problem by consumers).

Ref.: A. Kader, 2003

Quality and Safety Factors of Food cont

MAIN FACTORS	COMPONENTS
Appearance	Size, shape, color, gloss, freedom from decay and defects (defects may also concern other factors)
Texture	Firmness, crispness, juiciness, mealiness and toughness
Flavor	Sweetness, sourness, astringency, bitterness, aroma, and off-flavors
Nutritional/ Health value	Carbohydrates (including dietary fiber), proteins, lipids, vitamins, minerals, reduction of disease risk (cancer, cardiovascular diseases), functional effects
Safety	Contaminants (pesticide residues, heavy metals), myco- & bacterial toxins, microbial contamination.

Ref.: A. Kader 1999 (major part)

Quality - Summary

In the components of food quality two groups may be distinguished:

1. Attributes which affect sensory characteristics of food;
2. „Internal" or „hidden" attributes which affect nutritional and/or health value of food.

These groups concern nature of the product.

The presence of antioxidant compounds can be considered as an internal quality parameter for edible fruit.

Nutritional Value of Raspberries

Fruit species	Water	Energy value	Protein	Fat total	Total sugars	Total fibre	Ash
Apples	85,6	52	0,26	0,17	10,39	2,4	0,19
Cherries	86,1	50	1,00	0,30	8,49	1,6	0,40
Raspberries	**85,8**	**52**	**1,20**	**0,65**	**4,42**	**6,5**	**0,46**
Black currant	82,0	63	1,40	0,41	–	–	0,86
Strawberries	90,9	32	0,67	0,30	4,66	2,0	0,40
Oranges	86,8	47	0,94	0,12	9,35	2,4	0,44

Ref. USDA Database

Nutritional Value of Raspberries contin.

Fruit species	Vitamin C	Tiamin (Vit B_1)	Ryboflavin (B_2)	Niacin	Vitamin B6	Folic acid *	β-Carotene
	(mg/100g)					(µg/100 g)	
Apples	4,6	0,017	0,026	0,091	0,041	3	27
Cherries	10,0	0,030	0,040	0,400	0,044	8	770
Raspberries	26,2	0,032	0,038	0,598	0,055	21	12
Black currant	181,0	0,050	0,050	0,300	0,066	–	–
Strawberries	58,8	0,024	0,022	0,386	0,047	24	7
Oranges	53,2	0,087	0,040	0,282	0,060	30	71

*All forms

Ref. USDA Database

Nutritional Value of Raspberries contin.

Fruit species	Ca Calcium	Fe Iron	Mg Magnesium	P Phosphor	K Potassium
Apples	6	0,12	5	11	107
Cherries	16	0,32	9	15	173
Raspberries	**25**	**0,69**	**22**	**29**	**151**
Black currant	55	1,54	24	59	322
Strawberries	16	0,42	13	24	153
Oranges	40	0,10	10	14	181

Ref. USDA Database

Factors Affecting Pre-harvest Fruit Composition

- **Genetics**
  - Cultivar
- **Environmental**
  - Temperature
  - Soil type
  - Rainfall
  - Light
- **Agronomic**
  - Fertilisation
  - Mulching
  - Plant protection
  - Crop load
  - Planting density
  - Maturity
  - Irrigation
  - Harvest time

+ Interaction of the above factors

Variability of Composition in Red Raspberry Juice

Constituent		Ranges
Titratable acidity at pH 8.1	meq	190 – 310
Citric acid (over 85% of titratable acidity)	g/L	9 – 22
D-isocitric acid	mg/L	60 – 250
L-malic acid	g/L	0.2 – 1.2
Glucose	g/L	15 – 38
Fructose	g/L	18 – 45
Sucrose	g/L max.	10
Sugar free-extract	g/L	23 - 70
Ash	g/L	3 – 6
Sodium (Na)	mg/L max.	40
Potassium (K)	mg/L	1300 – 2800
Calcium (Ca)	mg/L	110 – 230
Total phosphorus	mg/L	100 - 250
Nitrate (NO_3)	mg/L max.	10
Sulphate (SO_4)	mg/L max.	300

Ref.: AIJN Code of Practice

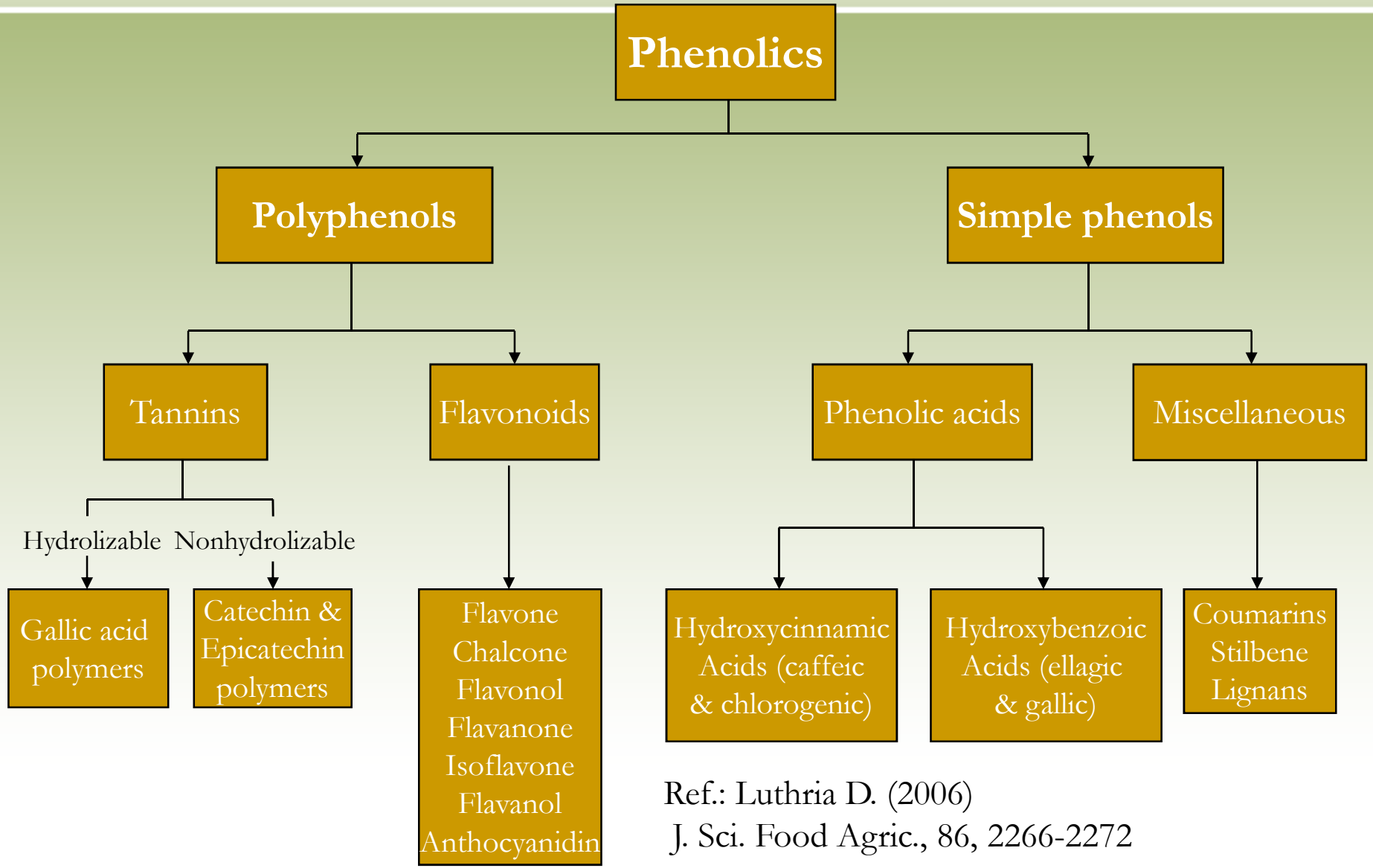
Phytocomponents

- **Vitamin C**
- **Folic acid**
- Selenium
- Glutathione
- Resveratrol
- **Polyphenols**
- ***N-3's***
- Selenium
- Zeaxantin
- Lycopene
- Beta Carotene
- Alfa Carotene
- Beta Cryptozanthin
- **Fiber**

Polyphenols (phenolics)

- Phenolic compounds are secondary plant metabolites
- They are nonnutrients but some of them have powerful bioactivity and can be considered as a quality parameter for edible fruit
- There are over 8000 phenolic compounds, and over 4000 are classified in a group called „flavonoids”
- Many phenolics are powerful antioxidants, and generally there is a strict correlation between antioxidative properties of food and phenolics content
- In recent years there is an explosion of research papers published on phenolics and their role in prevention of chronic diseases.

Classification of Phenolic Compounds



Ref.: Luthria D. (2006)
J. Sci. Food Agric., 86, 2266-2272

Phenolic Compounds

- Polyphenolic compounds sometimes exist as free aglycons
- May be conjugated with sugars, acids or other organic compounds
- May be monomers or highly polymerized
- There distribution in plant tissue is uneven
- They are associated with other cellular components (cell walls, carbohydrates, proteins etc.)
- Some polyphenolic compounds are very unstable

Polyphenolic Compounds in Raspberries

- The content of health promoting compounds in raspberries varies due to developmental and genetic factors
- Major differences are in pelargonidin type anthocyanidins and some procyanidin type tannins (more than 20 fold differences)
- Content of ellagitannins varied approximately 2 - 3 times
- Raspberries on contrast to strawberry and blackberry have the highest radical oxygen absorption capacity (ORAC) at the ripe stage
- Raspberries are highly potent antioxidants being rich source of phenolics.

Polyphenolic Compounds in Raspberries cont.

The dominant antioxidants in raspberries:

- Anthocyanins
- Ellagitannins,
- Proanthocyanidin-like tannins (decrease during ripening)

Other phenolic present:

- Quercetin
- Salicylic acid

The content of total phenolics varied from ca 200 mg/100g to almost 400 mg/100g

Content of Major Antioxidants in Raspberries and Blackbarries

Genotype	Antocyanins	Ascorbic acid	Ellagic acid *
	mg/100g	mg/100g	mg/g s.m.
Raspberries			
Beskid	38.9	11.3	2.9
Nawojka	43.4	12.0	3.3
Pokusa	75.7	18.9	3.4
Polana	50.0	19.7	4.2
Polka	49.4	23.4	4.2
Blackberries			
Gazda	81.8	1.6	4.3
Orkan	99.8	6.5	3.1

Cultivars bread in Poland by Dr J. Danek; * - contents of ellagic acid in edible part (without seeds)

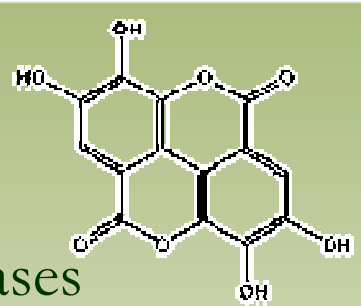
Raspberries – Possibly Functional Foods

Functional foods are defined as food or food component that provide health benefits beyond basic nutrition

Raspberries are among the richest fruit in fibre. Due to this fact and the presence of bioactive compounds raspberries may be classified as super food.

According to researchers from Plant Research International at Wageningen University antioxidative activity of raspberries turned out to be about 10 times higher than for instance tomatoes (Flora project, 6th Framework Program, Food-Ct-2005- 007130- Strep)

Health Effects of Phenolic Compounds:



- Antioxidants
  - Protect the body against harmful free radicals
  - Radicals may cause aging and many chronic diseases
- Other effects of phenolics
  - Antimicrobial
  - Anti-inflammatory
  - Antiallergic
  - Antitrombotic
  - Anticarcinogenic

In epidemiological studies conducted in Finland high intake of flavonoids had protective effect against:

- **Coronary heart disease**
- **Stroke**
- **Lung cancer**
- **Prostate cancer**
- **Asthma,**
- **Type 2 diabets**

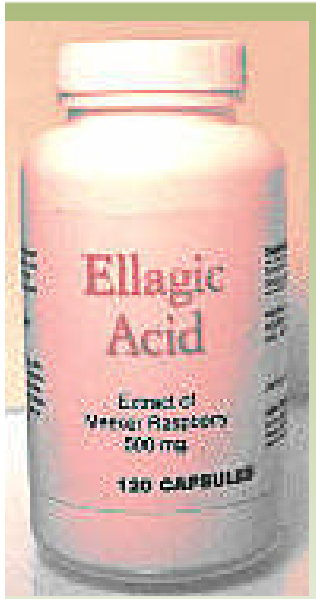
Secondary Plant Metabolites - Biologically Active Food Components (BAFC)

Impact on cancer prevention

- There is mounting evidence that exposure to BAFC is an important factor in modifying cancer risk
  - Developing produce with more concentrated levels of BAFC is acceptable approach
  - Efforts to more accurately assess exposure should continue
  - Efforts to target fruit & vegetable (FV) intake for specific cancers or selected subgroups (including genetic sub-groups) are warranted
  - There is support for similarities in FV recommendations for survivors and primary prevention

Ref.:C. Thompson, FAV Conference, Huston, 2007

Ellagic Acid in Pills



It is one of the most exciting, promising, nutraceutical compound to hit the cancer care field in years.
It is found throughout members of the berry family, but is found to be particularly concentrated in raspberries.

Plants produce ellagic acid and glucose that combine to form soluble in water ellagitannins, which are absorbed in digestive system.

Ref.: http://health.centreforce.com/health/ellagic.html

http://www.super-smart.eu/article.pl?id=0499&lang=en&fromid=GG132

Publications & Patents e.g.

United States Patent Application	***20050136141***
Kind Code	**A1**
Stoner, Gary D. ; et al.	**June 23, 2005**

Compositions of and derived from strawberry and raspberry and therapeutic uses thereof

Abstract

Isolated berry extracts and components thereof, in a form suitable for use as a foodstuff, dietary supplement, or pharmaceutical composition, are disclosed. The isolated berry extracts or compositions comprising one or a combination of components derived from the berry extracts, can be used as agents for inhibiting a variety of diseases or disorders, for example, cancer or cardiovascular disease. In addition, the invention features novel methods of preparing berry extracts in a form suitable for adding to foodstuffs, dietary supplements, or pharmaceutical.

Publications & Patents e.g.

Molecular mechanisms involved in the inhibition of MDA-MB-435 breast cancer cells by phenolic acids from red flesh peach BY00P6653

Giuliana Noratto[1], David Byrne[1], Weston Porter[2], Luis Cisneros-Zevallos[1]
Departments of Horticulture Science[1] and Vet. Integrated Biosciences[2], Texas A&M University, College Station, TX

National Cancer Institute

Bioactive Phytochemicals in Fruits and Vegetables for Cancer Prevention

Sharon Ross, PhD, MPH
rosssha@mail.nih.gov
Nutritional Science Research Group
Division of Cancer Prevention
National Cancer Institute, NIH

Chemoprotection against Cancer: Induction of Phase-II Drug Metabolizing Enzymes by Myristicin

Valdivia, V., Cadena, A., Martinez, E., Amro, M., Robles, B., Patel, R., Zapata, A., Mancha, A., Lai, W., and Ahmad, H

Department of Chemistry
University of Texas-Pan American
Edinburg, TX

UTPA
THE UNIVERSITY OF TEXAS-PAN AMERICAN

Bioactive Molecules from Fruits and Vegetables Significantly Potentiate Traditional Chemotherapy.

Richard Gunasekera, Ph.D., Desiree Arrambide, B.S., and Siva G. Somasundaram, Ph.D.
Presenter: Jeff Cokenour, B.S.

Joint Program in Bioactive Phytochemicals
Department of Biology,
University of Houston-*Victoria*, Victoria, TX 77901
http://www.uhv.edu/asa/faculty/faculty.asp?id=1

Important EU legislation

- Regulation (EC) No 1924/2006 of the European Parliament and of the Council of 20th December 2006 **on nutrition and health claims made on foods**

  http://eur-lex.europa.eu/LexUriServ/site/en/oj/2007/l_012/l_01220070118en00030018.pdf;

- COMMISSION DECISION of 23 May 2001, authorising the placing on the market of pasteurised fruit-based preparations produced using high-pressure pasteurisation under Regulation (EC) No 258/97 of the European Parliament and of the Council (2001/424/EC)

  http://eur-lex.europa.eu/LexUriServ/site/en/oj/2001/l_151/l_15120010607en00420043.pdf

- Council Directive 2001/112 on fruit juices and similar products

  http://eur-lex.europa.eu/LexUriServ/site/en/oj/2002/l_010/l_01020020112en00580066.pdf

Regulation (EC) No 1924/2006 nutrition and health claims

Article 13

Health claims other than those referring to the reduction of disease risk;

1. Health claims describing or referring to:

a) the role of nutrient or other substances in growth, development and the function in the body, or

b) psychological and behavioural functions, or

c) Without prejudice to Directive 96/8/EC, slimming or weight control or a reduction in the sense of hunger or an increase in the sense of satiety or the reduction of the available energy from the diet, which are included in the list provided for in paragraph 3 may be made without undergoing the authorisation procedure laid down in Article 15 to 18, if they are:

i. based on generally accepted scientific data; and

ii. well understood by the average consumer.

Regulation (EC) No 1924/2006 nutrition and health claims

1. Member States shall provide the Commission with lists of claims as referred to in paragraph 1 by 31 January 2008 at the latest accompanied by the conditions applying them and by references to the relevant scientific justification.

2. After consulting the Authority, the Commission shall adopt, in accordance with the procedure referred to in the Article 24(2), a Community list of permitted claims as referred to in paragraph 1, and all necessary conditions for the use of these claims by 31 January 2010 at the latest.

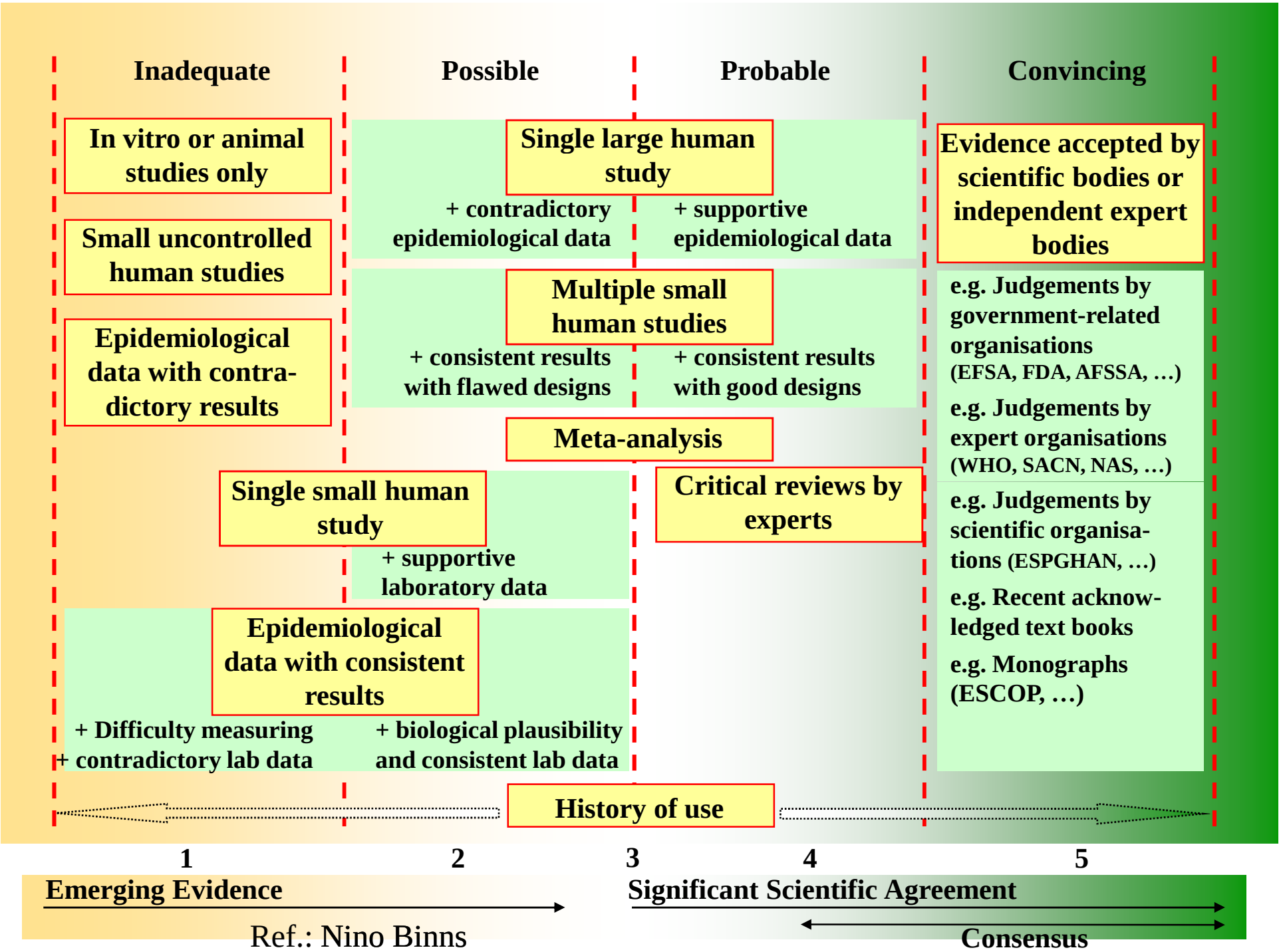
Regulation (EC) No 1924/2006 nutrition and health claims

Article 14

Reduction of disease risk claims

1. Notwithstanding Article 2(1)(b) of Directive/13/EC, reduction of disease risk claims may be made where they have been authorized in accordance with the procedure laid down in Articles 15 and 18 of this regulation for inclusion in Community list of such permitted claims together with all the necessary conditions for the use of these claims.

2. In addition to the general requirements laid down in this Regulation and the specific requirements of paragraph 1, for reduction of disease risk claims the labelling or, if no so such labelling exists, the presentation or advertising shall also bear a statement indicating that the disease to which the claim is referring has multiple risk factors and that altering one of these risk factors may or may not have a beneficial effect.



Ref.: Nino Binns

Health Claims

Regulation (EC) No 1924/2006 of the European Parliament and of the Council of 20th December 2006 **on nutrition and health claims made on foods**

does not concern fresh fruit and vegetables

European Commission Supports Promotion of Fruit and Vegetables Consumption in the Member States

and Research Concerning Health Aspects of FAV Consumption

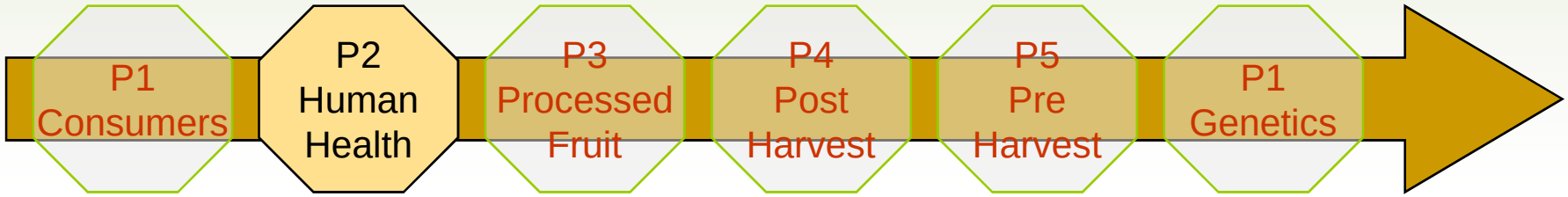
Numerous research projects are funded by EU Commission - one of them is ISAFRUIT

http://www.isafruit.org/Portal/index.php

ISAFRUIT Project
Pillar 2 Fruit and Human Health

General aim

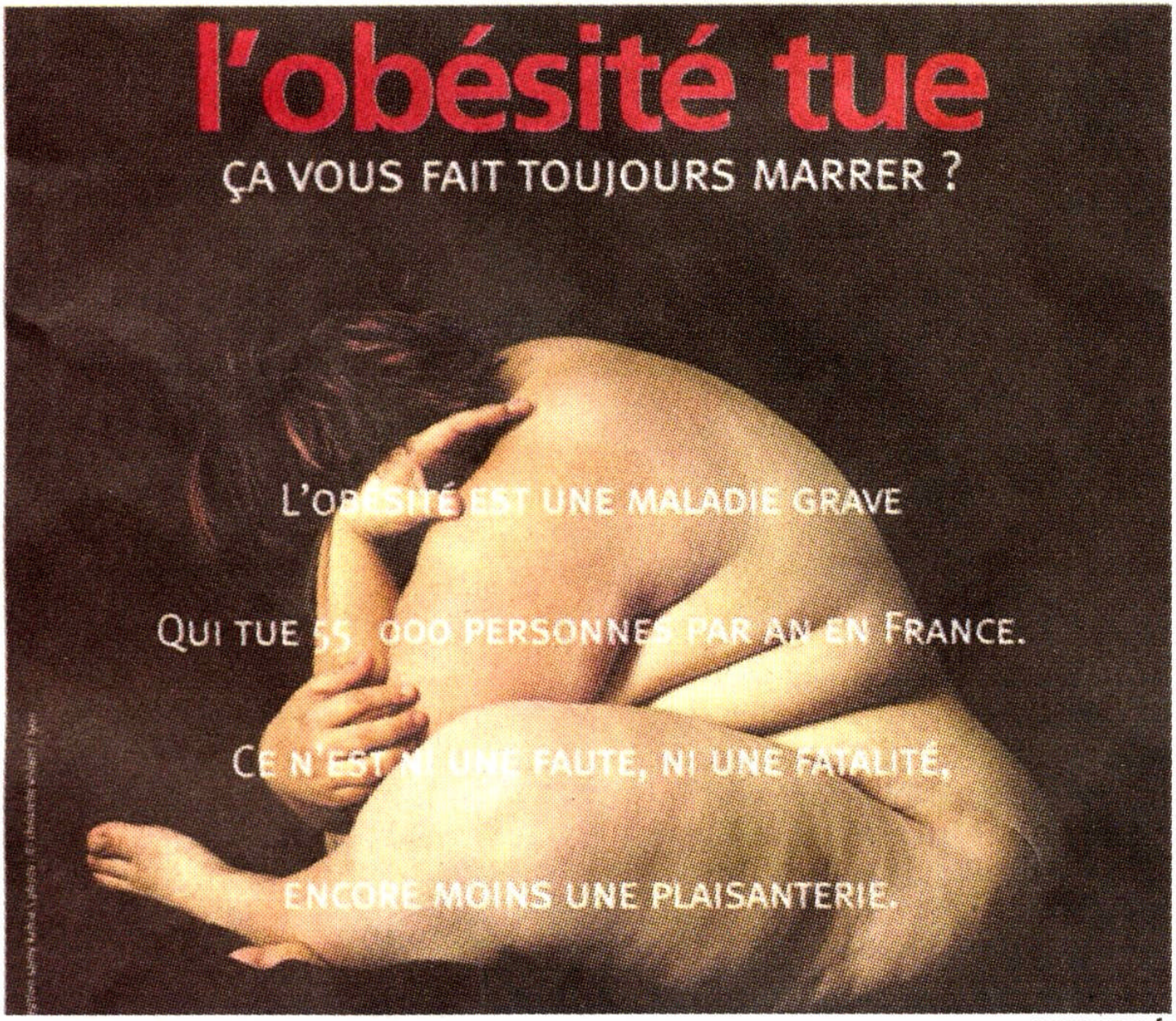
- **To raise consciousness of consumers by generating and disseminating knowledge on the short- and long-term effects of fruit consumption on human health**
- **To identify low allergenic cultivars and to monitor and document safety of new production methods**



Health problems of contemporary societies

1. Cancer;
2. Cardiovascular diseases;
3. Obesity;
4. Diabetes;
5. Allergies;
6. Other.

Above mentioned problems are related to nutritional behavior and some of them also to environment contamination



www.cnao.fr

OBESITY IN FRANCE — The problem has led health authorities to warn people of the dangers of getting too fat. The poster reads, "Obesity Kills."

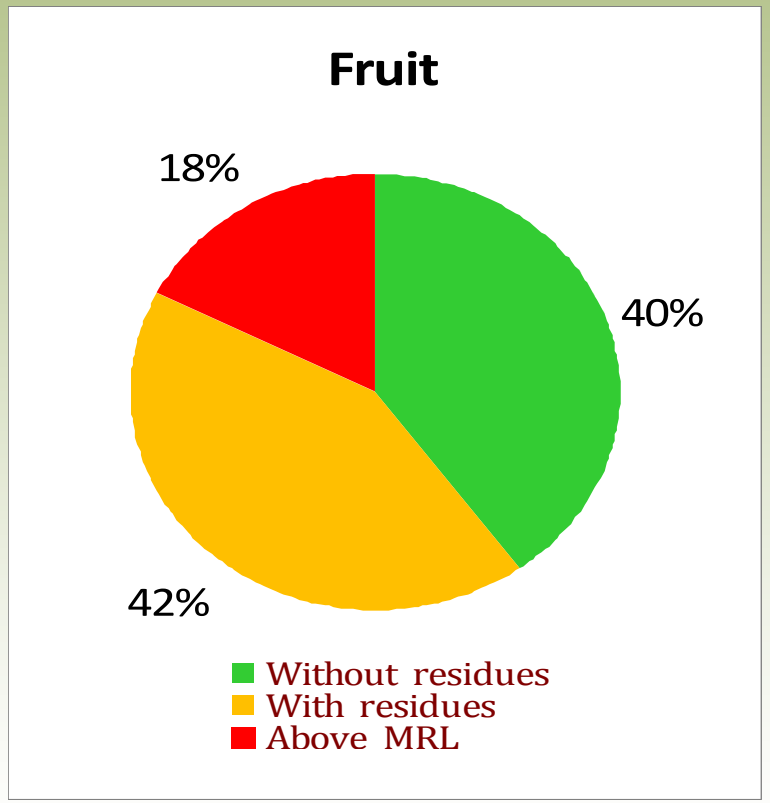
ISAFRUIT Project
Pillar 2 Fruit and Human Health

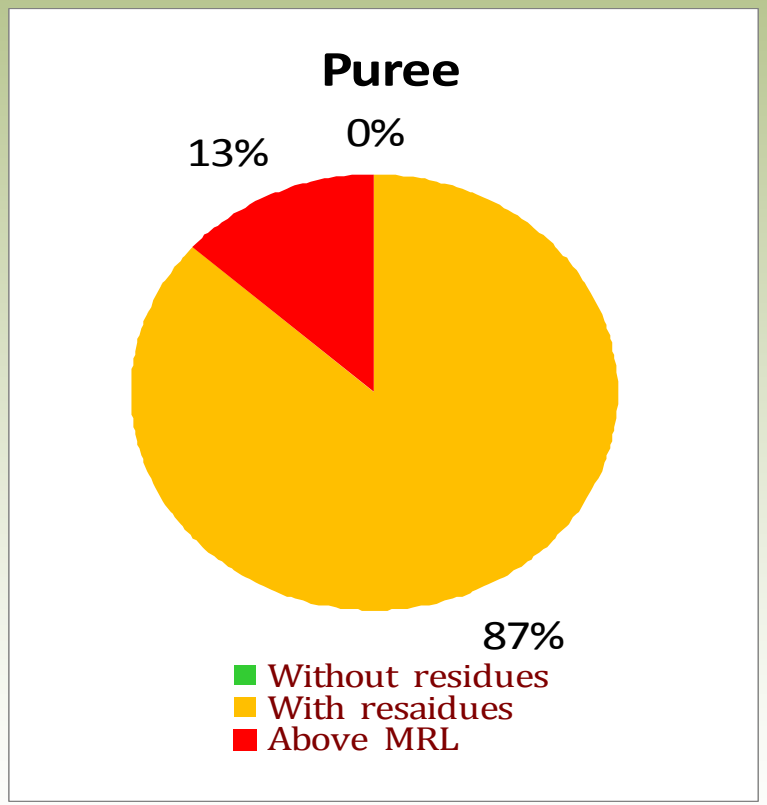
- WP 2.1 Fruiteffects – Health effects of whole and processed fruits
  - Sets as its main objective to provide the currently lacking knowledge about functional effects of processed fruit products in comparison to whole fruit on chronic disease prevention (colon cancer, Inflammatory Bowel Disease)
  - Nutrigenomics approach
- WP 2.2 Fruitslim – Fruit in the prevention of overweight
  - The objective is to establish the efficacy of work place fruit campaigns on weight management

ISAFRUIT Project
Pillar 2 Fruit and Human Health

- WP 2.3 Fruitsafe – Non allergy and low allergy fruit
  - Has as objective to investigate fruit varieties and GMO apples with low allergenic potential
- WP 2.4 Fruitclean – The safety of novel pre- and post-harvest procedures
  - The objective is to document the safety of new fruit production methods
  - New post-harvest rot treatments and new field spraying techniques will be evaluated regarding pesticide residues and micotoxin levels

Raspberry (102 samples) – pesticide residues





Source: Dr. A. Miszczak, Research Institute of Pomology and Floriculture, Skierniewice, Pl

Raspberry – % of samples with residues in fruit and puree

Pesticide	MRL	Fruit	Puree
% samples with residues		60%	100%
Cyprodinil	2.0 (N*)	7,5%	3,3%
Fludioksonil	2.0 (N*)	5%	-
Fenheksamid	10	12,5%	3,3%
Dithiocarbamate	**10**	**12,5%**	**10,0%**
Pirymetanil	10	27,5%	46,7%
Procymidon	10	35,0%	95,0%
Karbendazym	0.1	2,5%	3,3%
Tolilofluanid	5	2,5%	1,6%

Note: (N) – national requirement for MRL, no longer valid (now would be OK.)

Source: Dr. A. Miszczak, Research Institute of Pomology and Floriculture, Skierniewice, Pl

Key elements of food safety

Food Safety Management System

Good Practices

- Agricultural (GAP)
- Manufacturing (GMP)
- Distribution (GDP)
- HACCP

ISO 22000 integrated requirements of HACCP, GMP, and operation programs into one system of food safety management.

Ignoring Good Agricultural Practice may create a problem with microbiological safety

Major sources of contamination of fruit

- Water
- Manure and municipal biosolids
- Worker health and hygiene
- Field sanitation
- Packing facility
- Sanitation
- Transportation
- Sanitary facilities

Preventive means:

- Strict adherence to Good Agricultural Practice, HAAC, codes, guidelines, etc. Has been absolutely necessary,
- Records keeping,
- Control by independent inspection organizations
- Traceability (ability to trace origin of supplied goods) - required not only for the final products but also for all used raw materials (from fork to farm).

Major sources of microbiological contamination

- Contamination of fresh products may occur at any stage on the way from a field to the table. The major source have been human and animal excrements.
- Hygiene of workers and strict adherence to sanitary rules during production, picking, sorting, packing and transportation are decisive factors to minimize probability of food infection.

Traceability requirement

- Traceability systems are obligatory for all businesses in the food chain in the EU from 1st January 2005 (however, there are no legal requirements for in-company traceability).
- This means that a business must be able to identify all its suppliers of food, food products and feed and all businesses it has supplied food or feed to.
- In the USA a similar requirement regarding establishment of records was laid down in 2005.
- Traceability covers all stages of food chain according to a saying:

„From fork to farm"

Raw product safety - primary concern

GLOBAL G.A.P (earlier EUREP G.A.P) found application on all continents;

Beside GLOBAL G.A.P. there are also other certified systems of primary production (e.g. integrated production);

FDA developed „Guide to minimize microbial food safety hazards for fresh fruits and vegetables in October 1998 (http://www.cfsan.fda.gov/~dms/prodguid.html) which covers similar areas of production as GLOBAL G.A.P.:

Fruit processing industry has been interested in raw material quality and safety – EQCS has signed an agreement with GLOBAL G.A.P. during the ANUGA Fair in Cologne (13 - 17.10.2007)

Fruit and Vegetables 5 x a day in Poland

Authorities in nutrition in Poland and in the whole world recommend consumption of fruit and vegetables at least 5 times a day (5 + a day)

FUNDACJA PROMOCJA ZDROWIA

1 2 3 4 5

5 razy dziennie warzywa i owoce

http://www.promocjazdrowia.pl/

5 x a day in USA

5 x a day in Spain

5 x a day in Germany

CONCLUSSION

In general:

Fruit and vegetables comply with most requirements for an ideal product considering nutritional & health value.

All superlatives may be used for their advertising.

In particular:

Raspberries deserve special attention considering their nutrition and health attributes.

Thank you