

Results from LYCOCARD project

Food product studies

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Food Product studies

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-



The LYCOCARD project in brief

LYCOCARD investigates the role of lycopene in reducing the risk of cardiovascular diseases

LYCOCARD Consortium Members: www.lycocard.com

ROLE OF LYCOPENE FOR THE PREVENTION OF CARDIOVASCULAR DISEASES

Cardiovascular disease and cancer are the main mortality causes in Europe and its developed territories. Lycopene is a plant pigment found in high concentration in tomatoes, other cruciferous vegetables and berries. Tomatoes are Europe's second most important agricultural crop and tomatoes and tomato products are the main source of lycopene in the diet.

Some persuasive data from several epidemiological studies suggest that lycopene may provide important protection against cardiovascular disease and cancer. However, because of the limited and processed tomato products and lycopene's beneficial effects have not been sufficiently documented in the scientific literature.

For further details contact: angelika@lycocard.com

GOALS:

- Establish improved **nutritional guidelines** (help consumers to select **healthy foods**)
- Design and development of healthy new foods based on tomatoes (**strengthen food industry**)

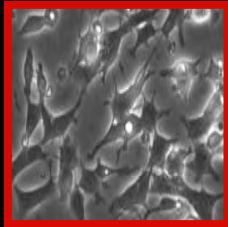


Specifically points to clarify the following:

1. Effects of technological processing on lycopene
2. Interactions between different food ingredients
3. Molecular aspects of absorption and metabolism of lycopene
4. Biological effects of lycopene isomers and lycopene metabolites.



The LYCOCARD project in brief



In vitro studies

CHARITE BERLIN

UNI DEBRECEN

UNI LIVERPOOL

INRA MARSEILLE

UNI ROME

INRA AVIGNON

UNIMURCIA

JUVER

AGRAZ

CONESA

CONSERVE ITALIA

Food product studies

UNI JENA
(co-ordination)

NUTRIUNIT ROME

CALEDONIAN
SCIENCE PRESS

In vivo studies

HERZSTIFTUNG

AMITOM

Nutritional guidelines
& Dissemination





Food Product studies



Objectives:

- To analyze the bioactive compounds in tomatoes
- To analyze the effect of processing and storage
- To develop new tomato-based products for nutritional improvement



TOMATO BIOACTIVE COMPOUNDS

ANTIOXIDANTS

- ✓ Carotenoids
- ✓ Phenolic compounds
- ✓ Vitamin C
- ✓ Vitamin E

Antioxidant activity (\ominus oxidative stress)

- ↓ CVD
- ↓ Cancer
- ↓ Inflammatory diseases
- ↓ Neurodegenerative diseases

NON ANTIOXIDANTS

- ✓ Folates

**Essential vitamins
(B9-Folic acid)**

Deficiency → ↑ **Risk of:**

- Neural tube defects
- Colorectal cancer
- CVD (\uparrow [homocystein] > 15 μ M)



CVD risk factor: A 5 μ M homocystein increase raises the risk of CVD by ~ 20% (Ueland 2000, Ford 2002)



EXPERIENCE 1

Characterization of tomato varieties for industrial use





EXPERIENCE 1

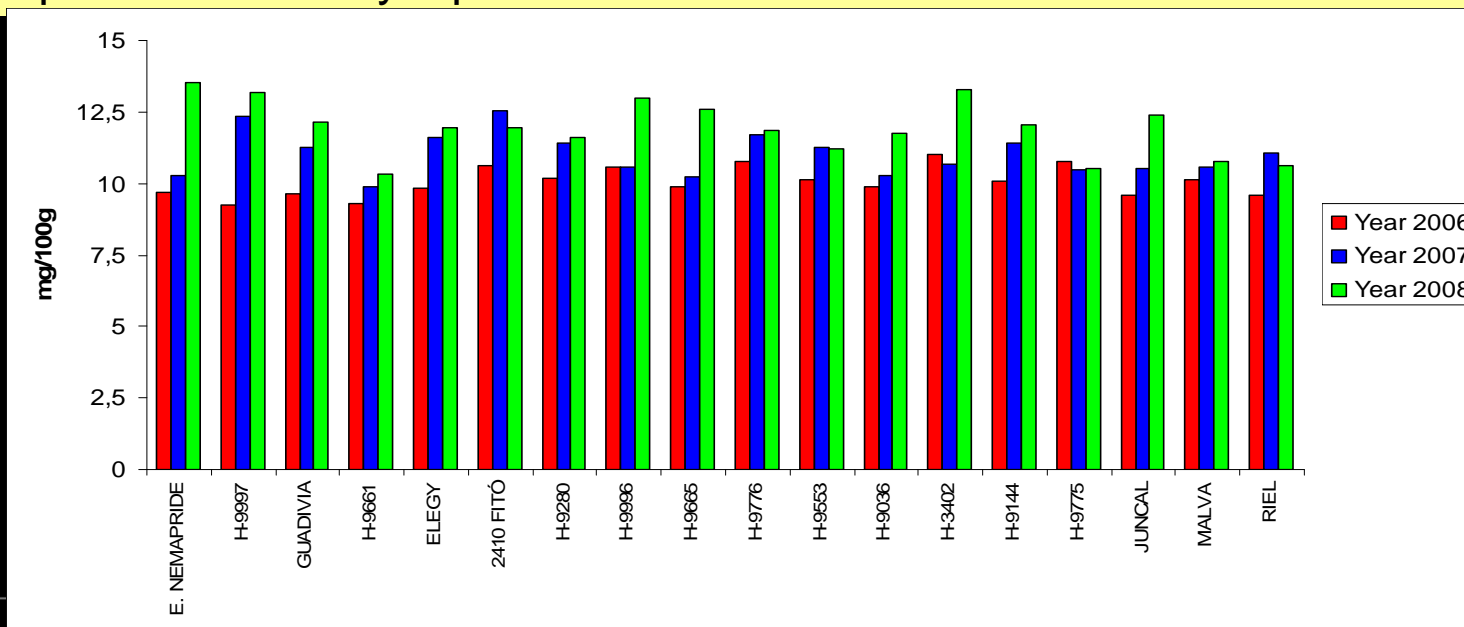


Characterization of tomato varieties for industrial use

Data on 36 tomato cultivars:

Lycopene content		
6-8 mg/100g	10-11 mg/100g	12-14 mg/100g
REVOLUTION (6.8) JERIEX (7) HIPACK (8)	MALVA (10) CAPEA (10) H-9665 (11)	ASPEN (12) H-9997 (13) CDX-255 (14)

Comparison of total lycopene content in different cultivars from 2006 to 2008



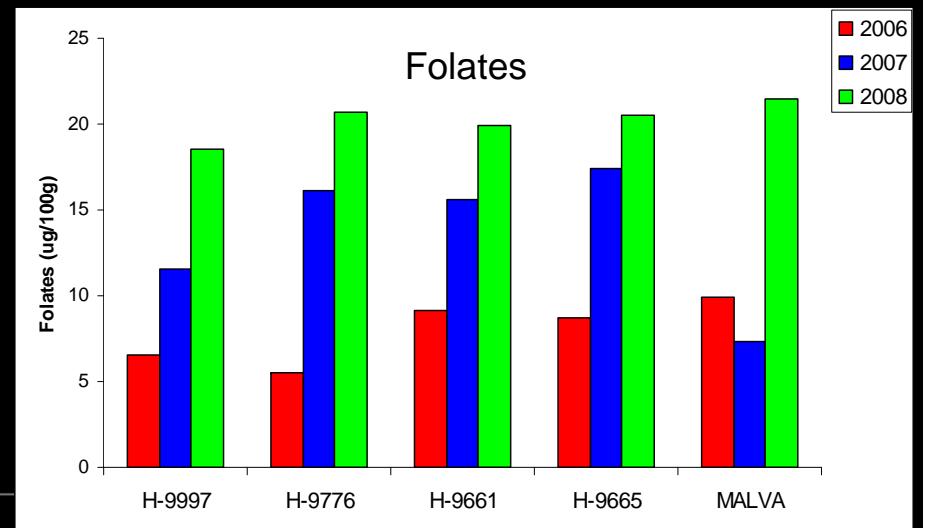
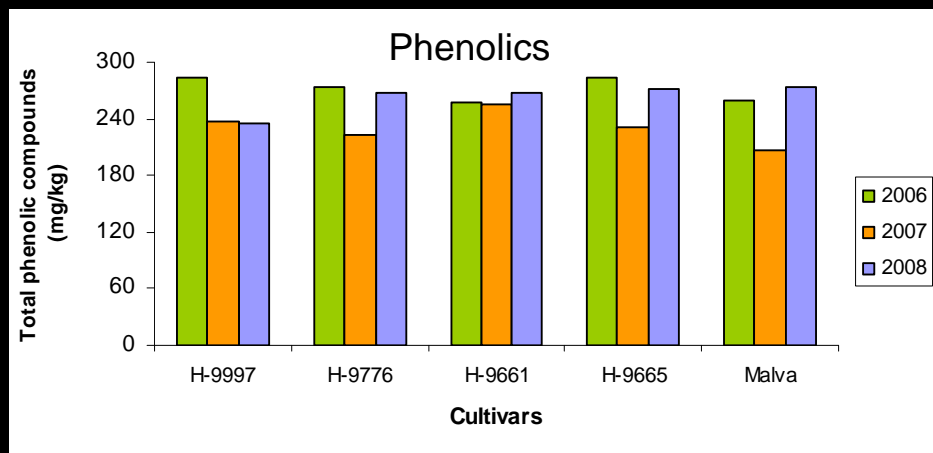
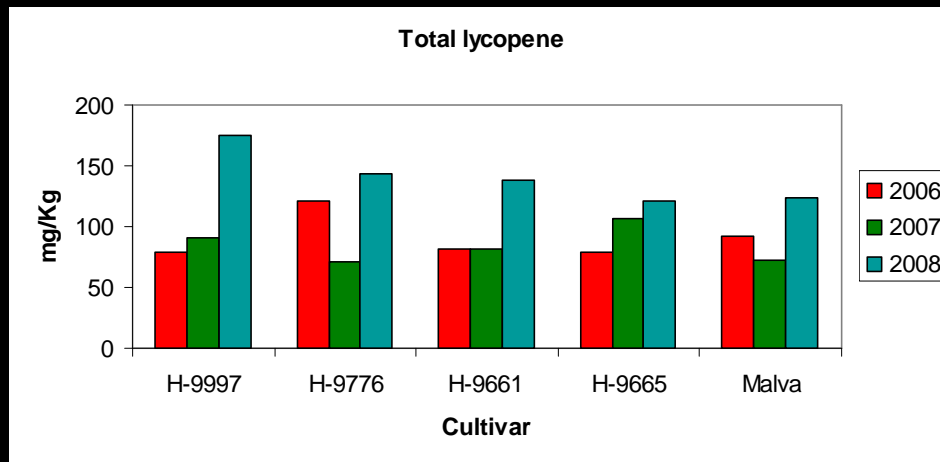


EXPERIENCE 1



Characterization of tomato varieties for industrial use

Seasonal variations



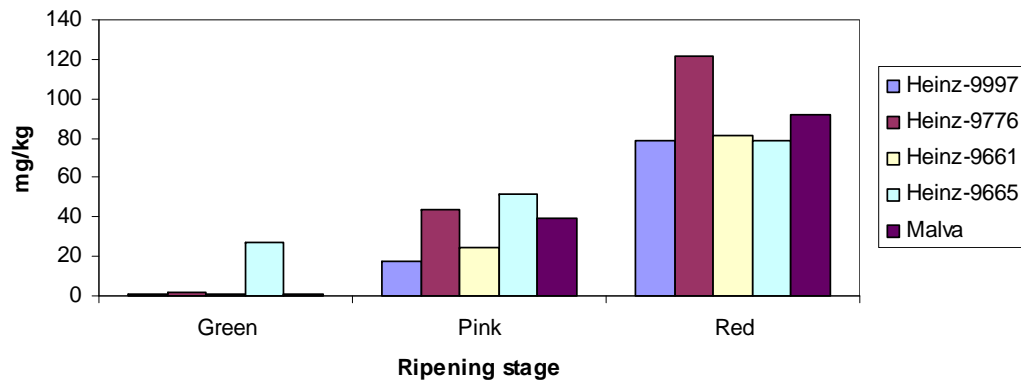


EXPERIENCE 1



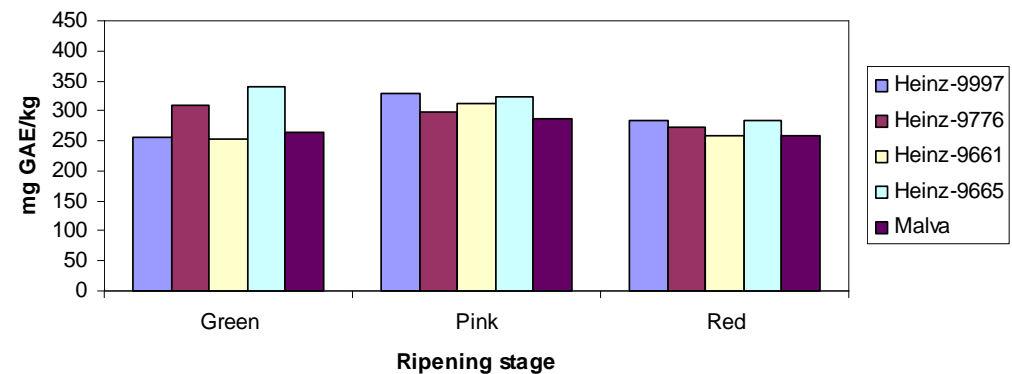
Characterization of tomato varieties for industrial use

Lycopene



Changes in bioactive compounds during ripening

Total phenolic compounds





EXPERIENCE 2

Effect of processing and storage on bioactive compounds

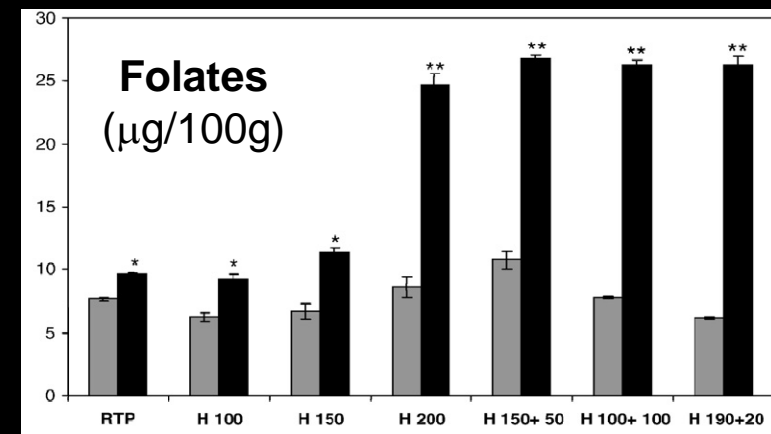
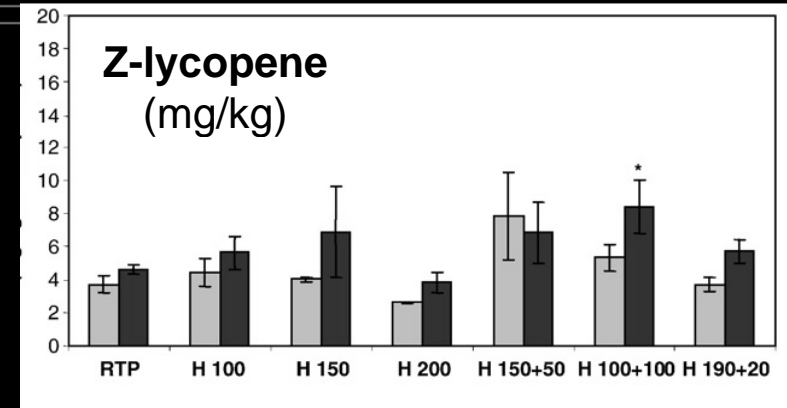
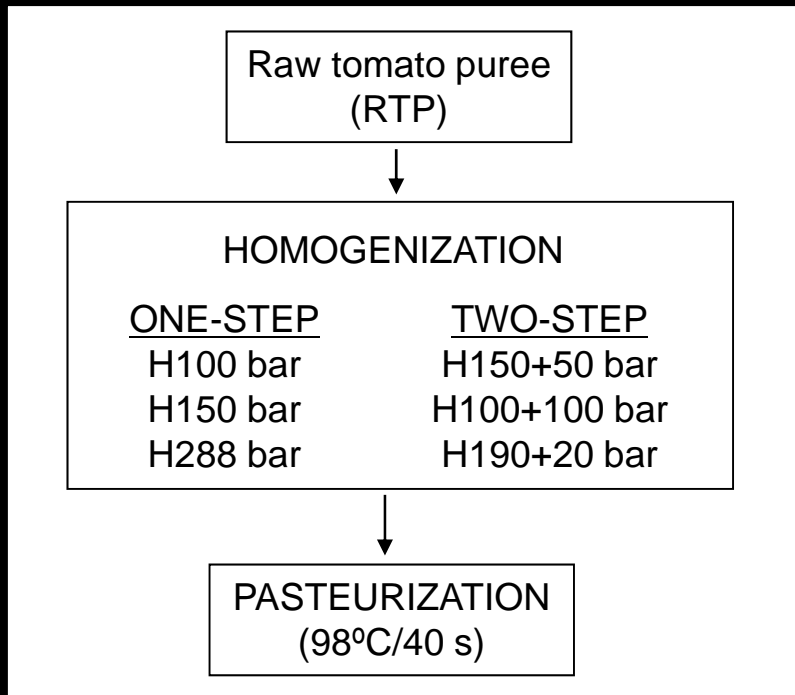




EXPERIENCE 2



Effect of homogenization and thermal processing



Mean losses after thermal treatment:

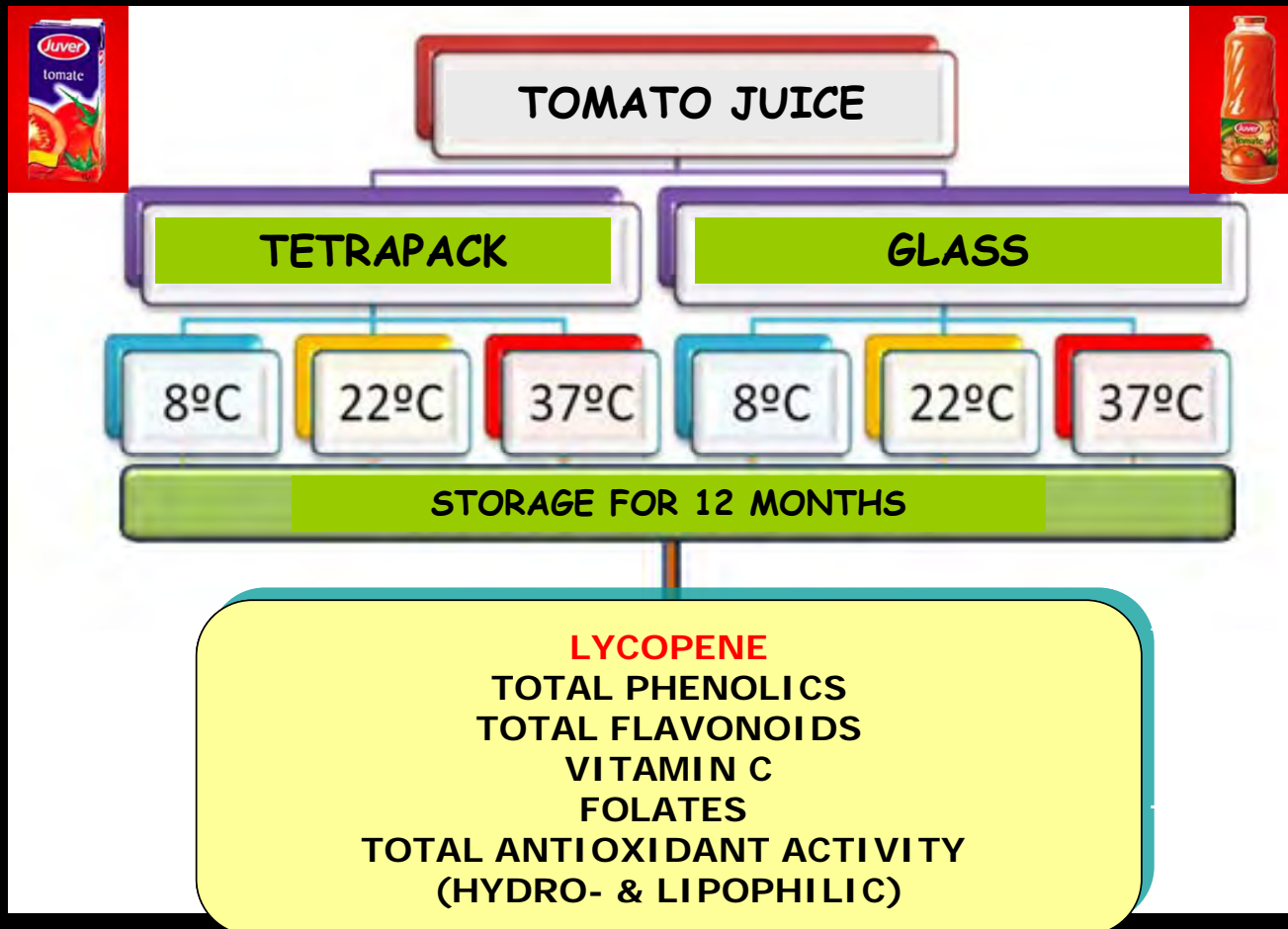
- Lycopene (no significant changes)
- Total phenolics and vitamin C (10-15%)



EXPERIENCE 2



Stability of tomato bioactive compounds during storage





EXPERIENCE 2

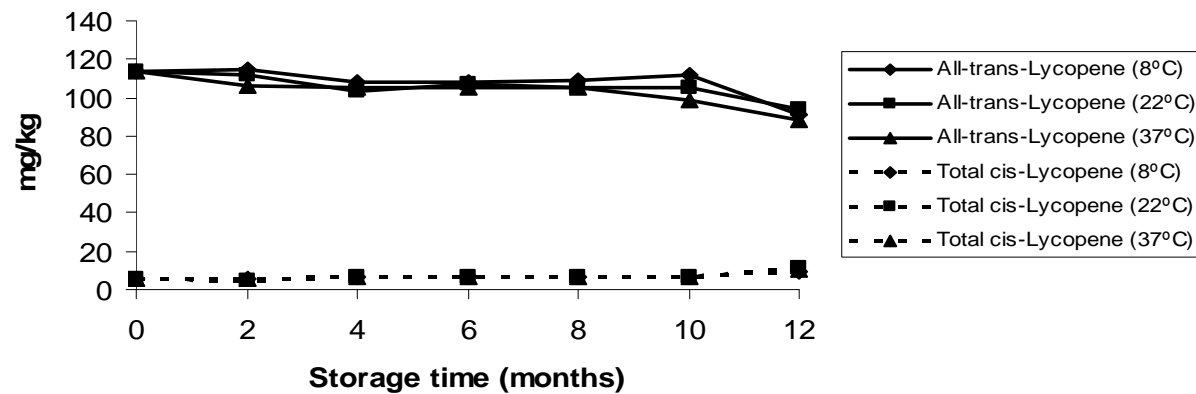
Stability of tomato bioactive compounds during storage



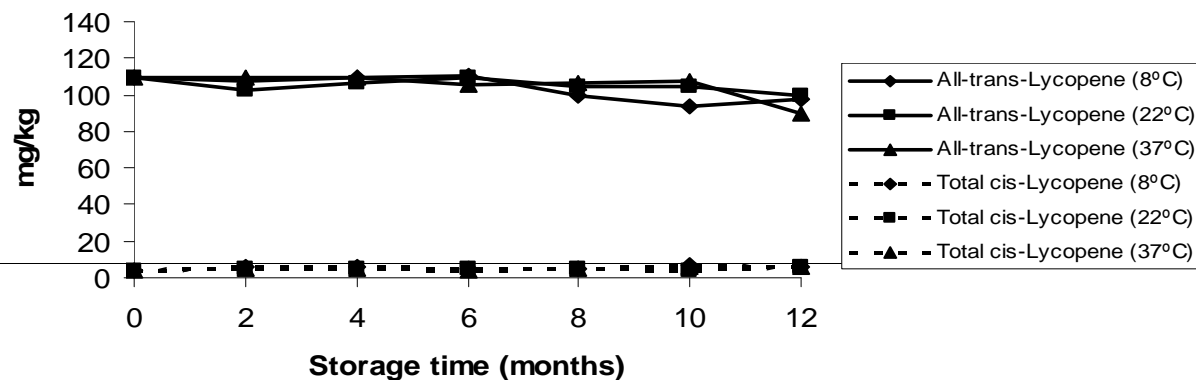
LYCOPENE AND ITS ISOMERS



LYCOPENE ISOMERS (Tetrapack)



LYCOPENE ISOMERS (Glass)





EXPERIENCE 2

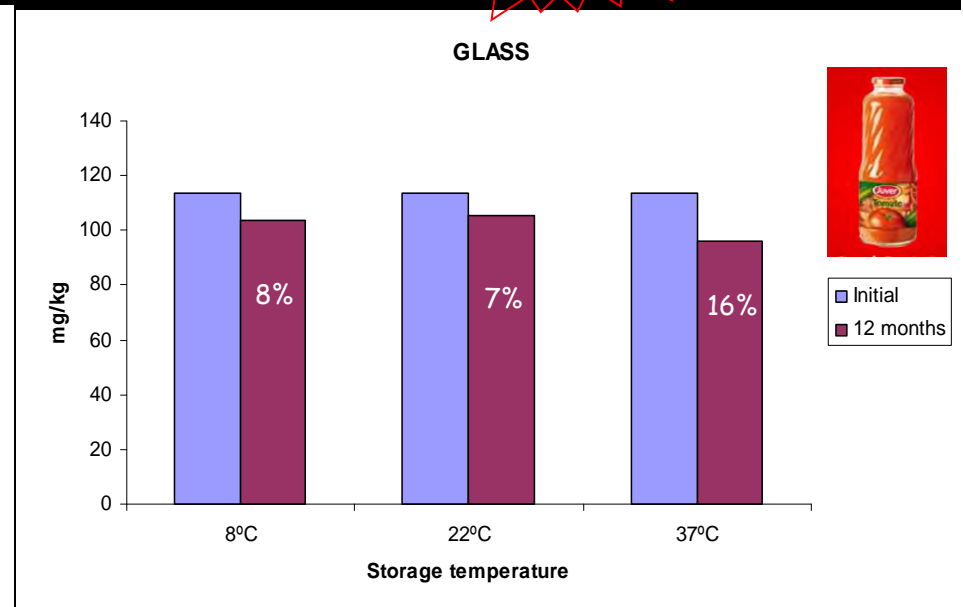
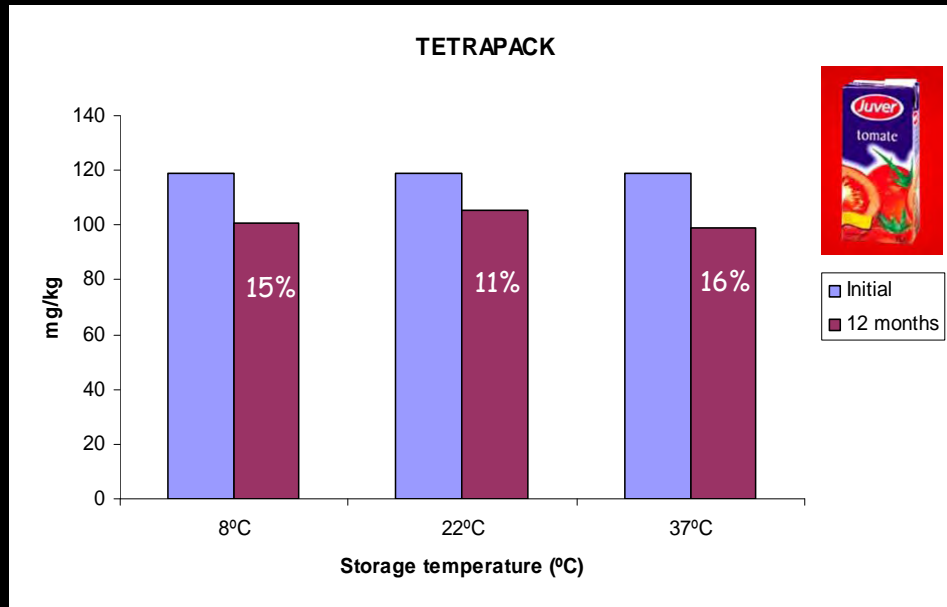
Stability of tomato bioactive compounds during storage



LYCOPENE AND ITS ISOMERS

Total lycopene losses at the end of the storage trial

<17%



Literature survey:

Reported lycopene losses 30-75% (tomato paste, tomato juice, canned tomato)
3 mo/4°C

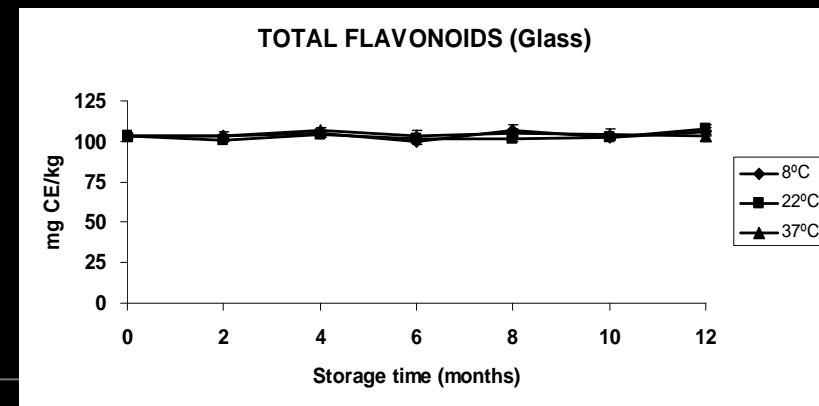
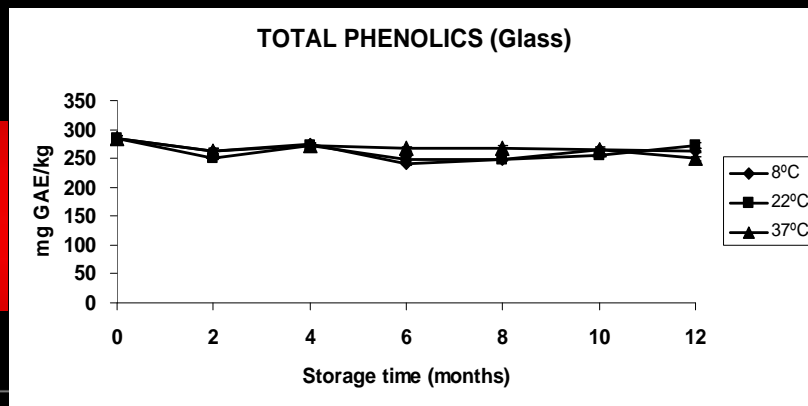
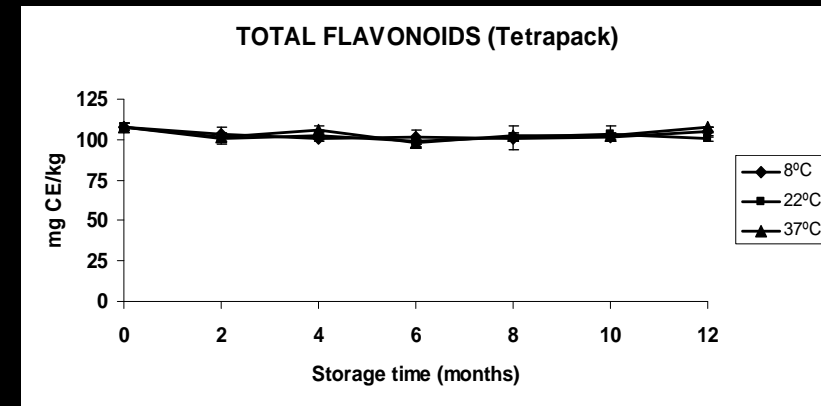
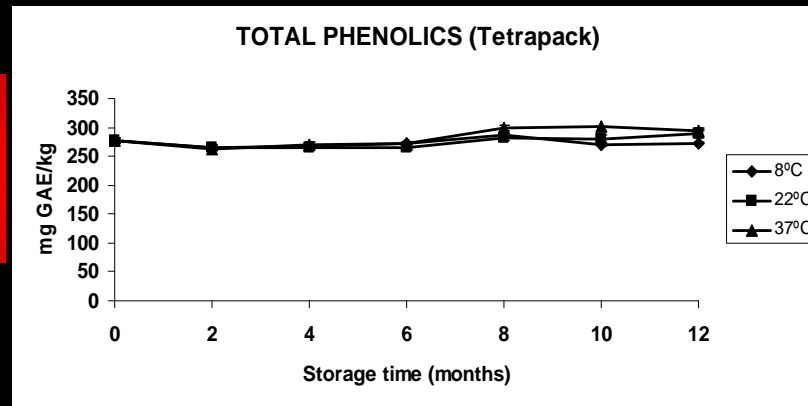


EXPERIENCE 2

Stability of tomato bioactive compounds during storage



TOTAL PHENOLICS AND FLAVONOIDS





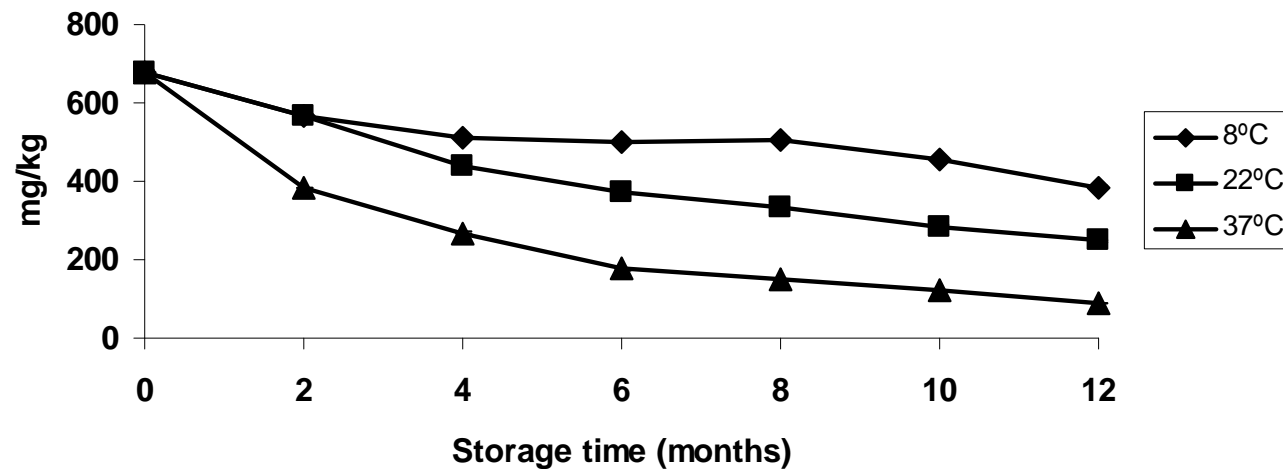
EXPERIENCE 2

Stability of tomato bioactive compounds during storage



VITAMIN C

Vitamin C (Tetrapack)



- ✓ No vitamin C detected in glass-bottled juice
- ✓ Vitamin C is ADDED to the juice in Tetrapack (Vitamin C-enriched)
- ✓ Stability depends on storage time & temperature

T (°C)

% losses

8°C

45%

22°C

65%

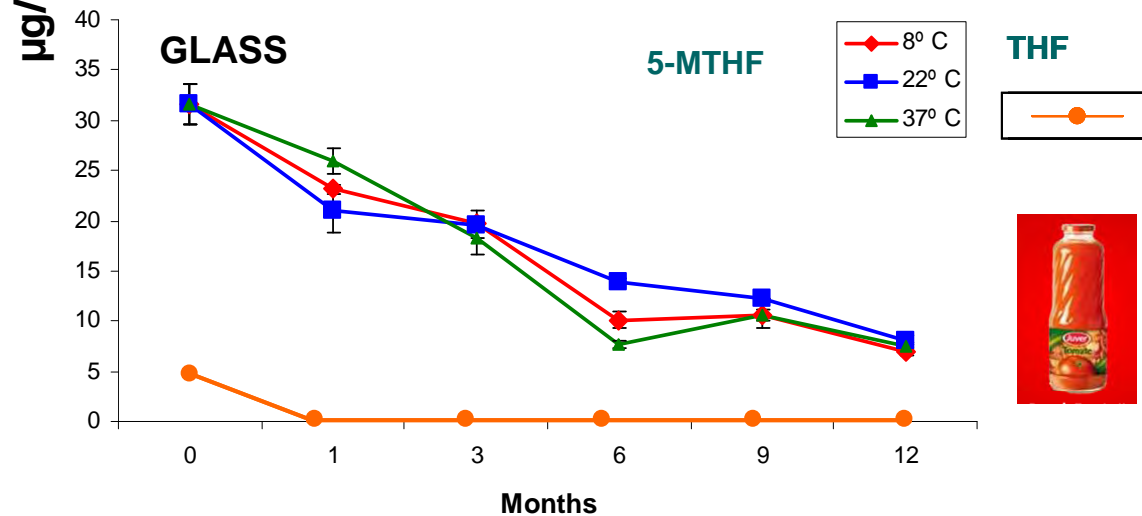
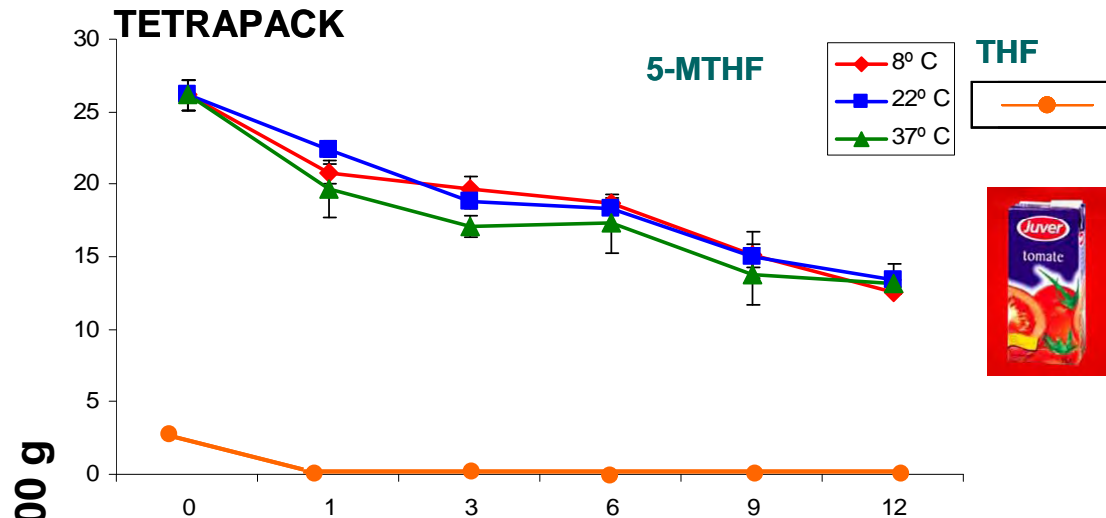
37°C

85%



EXPERIENCE 2

Stability of tomato bioactive compounds during storage



FOLATES

Final losses ~ 50%

Does Vitamin C prevent folate oxidation?

Final losses ~ 80%



EXPERIENCE 3

Development of new tomato-based products





EXPERIENCE 3

Development of new tomato-based products



Ketchup with improved nutritional profile

Modified formula

- More tomato (lycopene)
- Less sugar
- Less salt (Na⁺)



Tomato juice enriched with vitamin C and folic acid



- 20 mg lycopene/serving (200 mL)
- Improved lycopene absorption (2 homogenization steps)
- Cover 60% of RDA* vitamin C and folic acid/serving

In vivo
(human studies)



Friedrich-Schiller-Universität Jena

*Commission Directive 2008/100/EC on nutrition labelling for foodstuffs as regards recommended daily allowances, energy conversion factors and definitions.

Human feeding studies still in progress



SUMMING UP

- Bioactive compounds markedly affected by cultivar and year of harvest.
- Highest levels of lycopene in full-ripe tomatoes but not all the biologically active compounds necessarily increase in tomatoes harvested at full ripeness.
- 2-step homogenization led to increased lycopene isomerization and folate release from tomato matrix → Design of new products.
- Lycopene and phenolic compounds remain essentially stable during storage.
- Vitamin C and folates are the most labile compounds and they are markedly affected by storage conditions.
- Room temperature (22°C) is appropriate to keep lycopene and phenolic compounds. As for Vitamin C and folates even refrigeration temperatures lead to important losses.
- Tetrapack material better preserves folates but the use of glass or tetrapack makes no difference in the case of lycopene and phenolic compounds.

Thanks Merci Gracias Danke Obrigado Grazie



Related publications:

- Iniesta MD et al. (2009). *J Agric Food Chem.* 57:4739-4745
- Pérez-Conesa et al. (2009). *IFSET.* 10:179-188
- García J et al. (2009). *J Agric Food Chem.* 57:6815-6822

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Ralph Rühl

Presentation Estoril 2010

"Tomatoes, lycopene and CVDs"



Aim of LYCOCARD



LYCOCARD[®]
BRIDGING THE GAP



HEALTHY FOOD
BIOACTIVE CHEMICALS

FOOD PRODUCTS
HEALTHY DIETS
NUTRITIONAL GUIDELINES

HEALTH BENEFITS
DISEASE PREVENTION





Clinical studies within LYCOCARD



1. Rome study

- healthy obese patients 100 g tomato passata per day for 9-15 months

→ **no main alteration of inflammatory parameters**

→ **just acute phase response proteins are significantly down-regulated**

2. Berlin study

- human intervention study examining endothelial functions in healthy post-menopausal women with 70 g tomato puree (46 mg LYC) per day for 2 weeks

-> **no significant alteration of endothelial function**

3. Jena study (in process)

- human intervention study with newly developed tomato products

- tomato juice / tomato puree per day for 6 weeks (20 mg LYC per day)

-> **in progress**

4. Marseille study (in process)

- post-prandial experiment with tomato puree-rich meal (50 mg LYC per day)

- transcriptomics in adipose tissue, PBMCs

-> **in progress**

→ **SO FAR NO REAL POSITIVE CORRELATION BETWEEN TOMATOES CONSUMPTION AND ATHEROSCLEROSIS**



Additional value from LYCOCARD studies



- 1. Lycopene and adipose tissue (Marseille)**
 - mouse study and cell culture study with lycopene
 - > **downregulation of proinflammatory markers IL1 β , IL6, MCP1**
 - > **does not modulate adipogenesis (adiponectin)**
- 2. Lycopene in a rabbit atherosclerosis model (Berlin)**
 - fat induced atherosclerosis in NZW rabbits
 - > **no alteration in plaque volume**
 - > **cholesterol and LDL-cholesterol significantly lower**
- 3. Lycopene and nuclear receptors (Debrecen)**
 - reporter animal and reporter cell culture studies
 - > **lycopene has strong pro-vitamin A activity and also activates nuclear receptors responsible for lipid homeostasis and metabolism**
- 4. Lycopene and cell cycle / apoptosis (Rome)**
 - lycopene can interfere with cell cycle and induce apoptosis
 - > **importance for cancer**



Perspectives beyond LYCOCARD



1. Lycopene on low-grade inflammation

- potential long term protective effects in diseases in which involve chronic inflammation like diabetes, atherosclerosis, atopic diseases (asthma), chronic lung diseases (COPD, asthma, etc.)

-> lycopene has the potential to ameliorate various diseases in which chronic inflammation plays an important role

2. Lycopene on diabetes

- lycopene is active in obese people to down-regulate pro-inflammatory markers. This is one major trigger leading from obesity to diabetes.

-> lycopene has the potential to ameliorate or even stop this process

3. Lycopene and cancer

- lycopene has been shown to interfere with cell cycle / apoptosis

-> lycopene has a potential to ameliorate or even reverse various kinds of cancers (prostate)

4. Lycopene and asthma

- lycopene and inflammation in the lungs

-> lycopene might have the potential to ameliorate or even stop chronic inflammatory diseases in the lung (COPD, asthma)



How can we help you?

Re-evaluation and valorization of LYCOCARD data



We still have serum and PBMCs from various LYCOCARD clinical studies !

1. Lycopene on low-grade inflammation

- PBMCs from 2 clinical studies
- QRT-PCR of inflammation markers
- LC-MS determination of pro- / anti-inflammatory lipid mediators
- LC-MS of nutritionally relevant lycopene metabolites

2. Lycopene on diabetes

- QRT-PCR of diabetes markers
- LC-MS determination of pro- / anti-inflammatory lipid mediators
- LC-MS of nutritionally relevant lycopene metabolites

3. Lycopene and asthma

- QRT-PCR of pro-inflammatory markers
- LC-MS determination of pro- / anti-inflammatory lipid mediators
- LC-MS of nutritionally relevant lycopene metabolites
(animal study in process in our labs in Hungary)

-> LYCOPENE / TOMATOES are / maybe protective against these diseases !



How can we help you?



KEY TARGETS FOR LYCOPENE / TOMATOES AND HEALTH :

Evaluate the human intervention studies for potential correlations:

1. Lycopene on low-grade inflammation and on lipid metabolism.
2. Lycopene on diabetes.
3. Lycopene on asthma.



Future perspectives



We need to understand how lycopene / tomatoes might act:

- A. We need to identify nutritional-relevant metabolites !**
- B. We need mechanisms how they are synthesized and distributed !**
- C. We need response mechanisms how these lycopene metabolites activate nuclear hormone response pathways !**
- D. We need to understand how these lycopene metabolites interfere with lipid metabolism and inflammatory pathways !**



Our “Hungarian” competences



1. Lipidomics:

A. Lycopene metabolites

B. Pro- and anti-inflammatory lipid mediators

2. Reporter animal models:

- for nuclear receptors involved in lipid metabolism and inflammation

3. Transcriptomics:

Robotic QRT-PCR and arrays for:

- lipid metabolism target genes

- lipid transport target genes

- pro- and anti-inflammatory targets

- markers for asthma, diabetes and etc.



Take home message



1. Lycopene is no wonder-drug against atherosclerosis
2. Lycopene can inhibit / ameliorate low-grade inflammation
3. Lycopene can mediate (positively) pro-inflammatory lipid metabolism
4. Lycopene can be potentially beneficial for diabetes induction
5. Lycopene can be potentially beneficial for chronic inflammation in the lung (asthma, COPD, etc.)
5. Lycopene / tomatoes and prostate cancer (mechanism still unknown: maybe apoptosis / cell cycle control)

Thank you for your attention !!



rruehl@dote.hu



The LYCOCARD Industrial Platform: An opportunity to promote tomato products

Sophie Colvine
General Secretary, AMITOM



LYCOCARD

Dissemination targets

Scientists

- Research results

Industry

- Competitive advantage

Health Profession

- Nutritional guidelines

General public

- Increased consumption



LYCOCARD communication

Scientists

Industry

Health
profession

General
public

Conferences

Peer reviewed
articles

Annual reports

Training





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Tomato+HealthSearch



Heart Health Nutrition Resources from LYCOCARD



LoveHeartFood


Expert advice on how to enjoy quick and easily prepared, great tasting nourishing meals that help to keep your heart healthy.

Feature Articles


Read our rich and tasty articles with interviews, scientists and menu suggestions plus cooking tips from the top chefs on the planet.

Newsdesk


Help yourself to as much as you like, plenty of regularly updated writers' materials, stories, general info, photos and biogs.




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Health & Nutrition
The food on your plate how it changes you



Martha Rose Shalman - Celebrated food writer
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Presskit
Materials and resources for writers
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Languages versions

English

- www.tomatoandhealth.com

German

- www.tomateundgesundheit.de

Italian

- www.pomodoroessalute.it

Spanish

- www.tomateysalud.es

Other languages possible



Promotion opportunities

Limitations on what companies can say

- strict health claim legislations
- consumers weary of companies' claim

Opportunities for generic promotion

- EU flag
- LYCOCARD provides public focus and scientific credibility
- Independence and brand neutrality
- Link with cereals industry – other industries? (olive oil, ...)



Proposed communication on packaging



For more information on the
place of tomato products in the
Mediterranean diet:

www.tomatoandhealth.com



We support international
research on tomato:

www.tomatoandhealth.com





Research

- Opportunity to discuss results with scientists
- Work together to make research results more applicable for industry
- Members may decide to fund additional work (health claim application?)



LYCOCARD

Industrial Platform

Aims:

- To create a forum to discuss research results with LYCOCARD scientists and potentially commission further research
- To promote the general consumption of tomato products while helping members to get competitive advantage
- To forge closer relations within the industry and to foster strategic alliances with natural partners in the food industry that offer synergistic promotional opportunities - such as cereals, olive oil and other groups like patient care and regional health care.



LYCOCARD Industrial Platform

Until March 2011, costs are:

- 1,500€ for SMEs
- 4,000€ for other first stage processors
- 10,000€ for larger companies

Amount tax deductible as communication expenses

Fund managed by University of JENA and released
by agreement of a steering committee



Join them today!

