Kiwi fruit
The power packed fruit

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Overview

• What is kiwifruit
• Nutrition (phytochemicals)
• Agricultural practices (pre and post)
• Health and disease (science)
Kiwifruit (*Actinidia delicosa*)

- **Native**
  China → New Zealand → Worldwide

- **Description**
  Oval, fibrous skin, 2-3'' length

- **Cultivars**
  Green, red, & gold kiwifruits

- **Harvest**
  Late Oct. ~ early Nov. (Sweetness)
Fruit Diversity

7 - *A. chinensis* 'Hort16A' (Zespri Gold Kiwifruit)
11 - *A. deliciosa* 'Hayward' (Zespri Green Kiwifruit)

http://www.hort.purdue.edu/newcrop/proceedings1999/v4-342.html
Nutrition (phytochemical)

**Vitamin**
- Vitamin A
- Vitamin C
- Vitamin E

**Phenolics**
- Flavonoids

**Carotenoids**
- Green pigment
- Lutein, β-carotene

**Fiber**
- Pectin
- Oligosaccharide

**Potassium**

**Health benefits**
Nutrition

- **Vitamin C (ascorbic acid)**
  - Powerful antioxidant
    - Protect the body against cell damaging of free radicals
    - free radical: increase the risk of cancer
  - Need: 40 mg vit C/ person
    - Kiwifruit: over 50 mg (market fruits)

- **Vitamin E**
  - Fat soluble antioxidant

- **Dietary fiber**
  - Soluble fiber: heart disease, diabetes
  - Insoluble fiber: cancer
Nutrition

- **Flavonoids** (C₆-C₃-C₆)
  - Name is derived from the Latin word *flavus* (yellow color)
  - Biological polyphenolic compounds
  - Found in leaves, stem, fruits
  - Decrease of risk of inflammatory disease & cancer
Nutrition

• **Carotenoids**
  - Tetraterpenoids (C\textsubscript{40}): Major phytochemical
  - Orange, red, and yellow color pigments
  - UV light harvesting, and photo protection
  - Lutein, β-carotene, violaxanthin, neoxanthin
  - 6.3 ug/ g ripe kiwi fruit

![Lutein molecule](image)
Pre and Post harvest factors

Pre harvest -
- Genotype and Cultivars
- Canopy position
- Maturity and harvest time

Post harvest -
- Storage period and temperature
- Gamma irradiation
- Post harvest drying
Genotype and cultivars

- Phytochemical content differs in different genotypes and cultivars.

- Ascorbic acid higher in *Actinidia chinensis* cv chinensis than *Actinidia deliciosa* var Hayward (Esti et al, 1998)

- Comparison study of Hayward, Alison, Abbot, Bruno, Monty cultivars. (Zolfaghari et al, 2008)

- Bruno cultivar had highest ascorbic acid content (261.09 mg), Hayward cultivar had the lowest ascorbic acid content (106.68 mg) per 100g fresh weight
Canopy position

- Light intensity and fruit position affect ascorbic acid and chlorophyll content.
- Increase in photosynthetic sugars increases ascorbic acid content. (Remorini et al, 2007)
Canopy position

Total chlorophyll content

Ascorbic acid content

(Remorini et al., 2007)
Maturity and Storage period

**Maturity and harvest time**
- Early harvested fruits had more ascorbic acid and carotenoids than late harvested fruits
- No change in antioxidant capacity and phenol content

**Storage period and temperature**
- Storage period and temperature influenced carotenoids, ascorbic acid and antioxidant activity
- Cold storage increased total phenolics – phenol metabolism, increase in PAL (phenylalanine ammonia lyase)

(Tavarini et al, 2008)
Maturity and harvest time

Ascorbic acid content

(Tavarini et al, 2008)
Maturity and harvest time

Carotenoids content

(Tavarini et al, 2008)
Post harvest factors

**Gamma irradiation** -
- commonly used to avoid pathogenic microorganism contamination
- detrimental effect on ascorbic acid and antioxidant activity (Kim & Yook, 2009)

**Drying** –
- extend shelf life and store the fruits
- Degradation of vitamin C increased with increase of drying air temperature (Kaya et al, 2009)
Strategies

• Developing varieties having higher levels of bioactive compounds.

• Optimization of cultivation and post harvest practices

• Enhancing and maintaining the nutritional value of kiwifruits.
Kiwifruit: Health & Disease

- Packed with a healthy amount of various nutrients
- An ideal fruit for better health
Health Benefits of Kiwifruit

• Promotes heart health
• Repairs damaged DNA
• Relieves wheezing, especially in children
• Works as a laxative, especially in older people
Heart Health

• Consumption of 2 kiwifruits each day significantly reduces;
  - The amount of fats in the blood
  - The formation of blood clots that can lead to a heart attack or stroke.

Heart Health

- People who ate 2 or 3 kiwifruits every day for a month reduced;
  - Their triglycerides by 15 %
  - Their risk of a blood clot by 18 %
compared to people who did not eat any kiwifruits.

Kiwifruit: DNA Repair

- Daily kiwifruit consumption, combined with dietary advice and physical activity, promoted a significant increase in repair of damaged DNA.

- It is assumed that the antioxidant content of kiwifruit could play a big role in the DNA repair.

(Collins et al, 2003)
A Wheezing Suppressant

- Children eating more kiwifruit and citrus (5~7 times per week) experienced less occurrence of wheezing.

- 44% less occurrence compared to children eating the least kiwifruit and citrus (less than once a week)

(Forastiere et al, 2000)
A Wheezing Suppressant

• More kiwifruit and citrus consumption reduced;
  - Shortness of breath by 32%
  - Severe wheeze by 41%
  - Night time cough by 27%
  - Chronic cough by 25%
  - Runny nose by 28%

(Forastiere et al, 2000)
Kiwifruit: A Laxative

• Kiwifruit has laxative effects due to its high content of dietary fiber. (1.6 % of kiwifruit by weight)

• Daily consumption of kiwifruits (1 kiwifruit per 30 kg bodyweight) for 3 weeks improved serious constipation problems, especially in elderly people

(Rush et al, 2002)
• Kiwifruit plant cell walls (dietary fiber) swell greatly during fruit ripening. (around 3 ~4 times greater in ripe than in unripe fruit)

→ Ripe kiwifruit dietary fiber has an exceptionally high water-holding capacity. (an important parameter in faecal bulking & enhancement of laxation)

(Rush et al, 2002)
Actinidin

- One of the novel compounds, an enzyme, in kiwifruit
- Has been suggested to have the kiwifruit’s laxative property
- May be one of the most effective allergens in kiwifruit

(Rush et al, 2002)
Caution: Kiwifruit Allergy

- Kiwifruit could be a considerable food allergen that causes severe reactions.

- Most likely, severe symptoms (breathing difficulties, wheezing and collapse) occurred in young children with other allergies.

(Lucas et al, 2004)
Caution: Allergy

• The most common symptoms were itching and soreness of the mouth.
• The most common severe symptom was wheezing.
• 64 % of the subjects experienced suffering symptoms within 5 minutes.

(Lucas et al, 2004)
How to Eat Kiwifruit
Conclusion

- Kiwifruit is the most nutrient dense fruit which we want to eat more frequently, ideally daily, for better health.

- Still, be cautious about kiwifruit allergy. (Especially young children and those who have other allergies)