

熟蔬菜在存放期間的 亞硝酸鹽含量變化

Changes of Nitrite Levels in Cooked
Vegetables during Storage

風險評估研究

Risk Assessment Study

2022年6月

June 2022



背景

蔬菜

- 豐富膳食纖維、維他命和礦物質
- 多吃蔬菜
 - 患心血管疾病和肥胖的機會較低
 - 降低某些癌症風險

Background

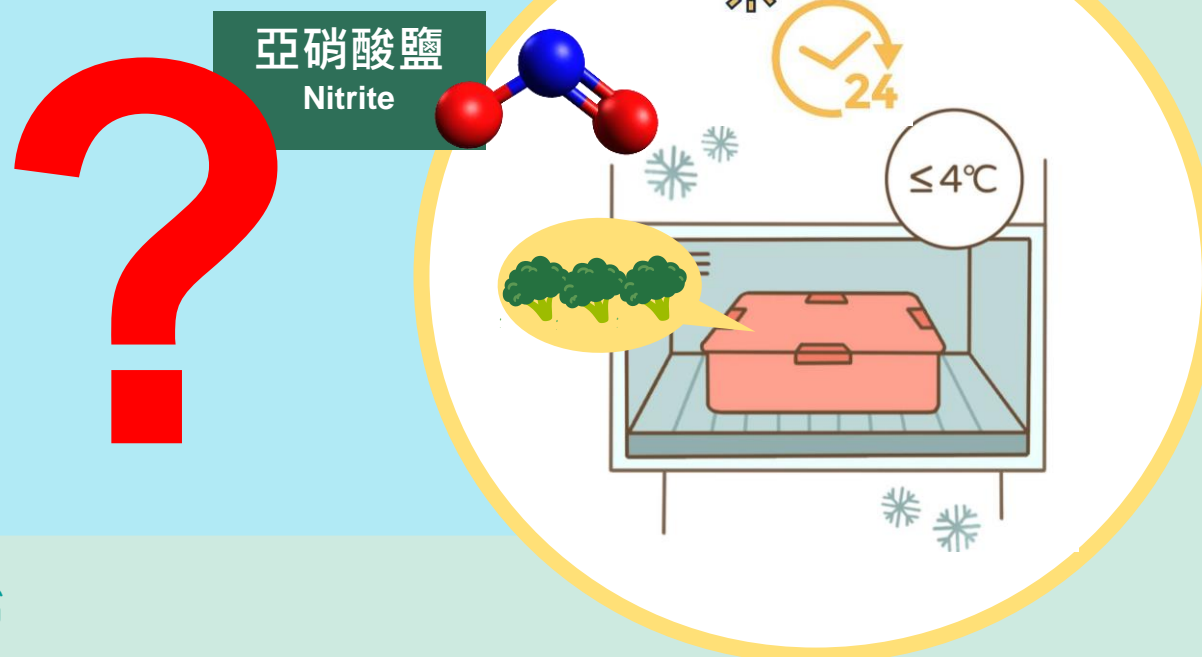
Vegetables

- Good sources of dietary fibres, vitamins and minerals
- Eat plenty of vegetables
 - Lower incidence of cardiovascular diseases and obesity
 - Reduce risk of certain cancers



背景

- 蔬菜有益健康
- 有人關注煮熟的蔬菜(熟菜)
 - 雪櫃裡存放一夜後(俗稱「隔夜菜」)
 - 傳聞**亞硝酸鹽**含量會增加



Background

- Vegetables have positive impact on health
- Some people concern about cooked vegetables
 - Stored overnight in a refrigerator
 - An alleged increased in nitrite levels



什麼是硝酸鹽和亞硝酸鹽？

- 植物吸收**硝酸鹽**
 - 製造生長需要的蛋白質
- **硝酸鹽**可轉化為**亞硝酸鹽**
 - 植物細胞中的酶
 - 環境中的細菌

What is Nitrate and Nitrite?

- Plants absorb nitrate
 - Produce proteins for growth
- **Nitrate** can be converted to **nitrite**
 - By an enzyme in plant cells
 - By bacteria in the environment



硝酸鹽
Nitrate (NO_3^-)

亞硝酸鹽
Nitrite (NO_2^-)

什麼是硝酸鹽和亞硝酸鹽？

新鮮蔬菜

- 硝酸鹽含量較高
- 含微量亞硝酸鹽

人類主要攝入途徑

- 硝酸鹽：進食蔬菜
- 亞硝酸鹽：體內由硝酸鹽轉化而成

What is Nitrate and Nitrite?

Fresh vegetables have

- Relatively high **nitrate** levels
- Very low **nitrite** levels

Human exposure

- **Nitrate** : through consumption of vegetables
- **Nitrite** : conversion from nitrate in the body



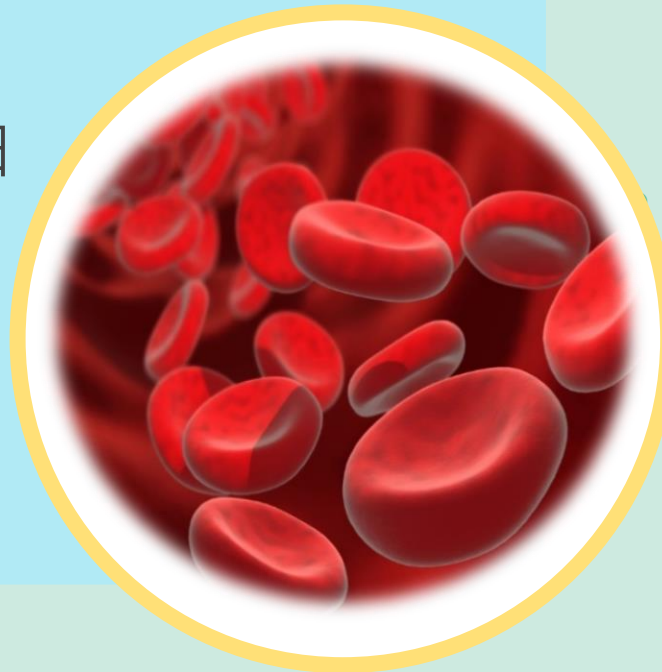
對健康的影響

硝酸鹽

- 是安全的

亞硝酸鹽

- 過量 → 有害
- 可氧化紅血球中的血紅蛋白
 - 血紅蛋白不能攜帶氧氣
- 健康人士很少受影響



Health Effects

Nitrate

- is safe

Nitrite

- Excess → harmful
- Can oxidise haemoglobin in red blood cells

- Haemoglobin cannot carry oxygen

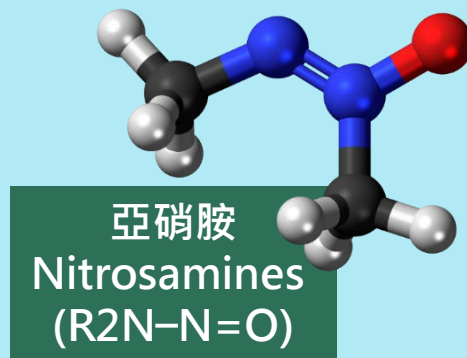
Healthy individuals rarely affected



對健康的影響

亞硝酸鹽

- 可在體內形成亞硝胺
- 亞硝胺可使動物患癌



科學數據

- 無證據證明從飲食攝入亞硝酸鹽可令人患癌[#]

[#] 聯合國糧食及農業組織 / 世界衛生組織食物添加劑聯合專家委員會
The Joint FAO/WHO Expert Committee on Food Additives (JECFA)

Health Effects

Nitrite

- Produce **nitrosamines** in the body
- **Nitrosamines** cause cancer in animals

Scientific information

- No evidence that nitrate and nitrite intake through diet are carcinogenic in humans[#]



益處 vs 風險

- 吃蔬菜對健康的益處大
- 降低患上
 - 心血管疾病(包括高血壓、冠心病和中風等)
 - 某些癌症風險(例如口腔癌和大腸癌)
 - 肥胖的機會
- 消費者
 - 應多吃蔬菜
 - 應吃不同種類的蔬菜



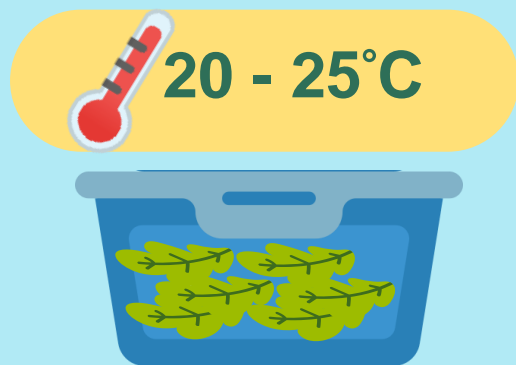
Benefits vs risk

- Great benefits to health of eating vegetables
- Reduce
 - Risk of cardiovascular disease (including hypertension, coronary heart disease and stroke, etc.)
 - Risk of certain cancers (such as oral and colorectal cancer)
 - Chance of obesity
- Consumers
 - Should eat more vegetables
 - Should eat a variety of vegetables



研究目的

- 研究熟菜存放期間**亞硝酸鹽**含量的變化
 - 室溫(20 - 25°C);
 - 冷凍溫度(0 - 4°C)
- 建議處理剩菜的方法



VS



Objectives of the Study

- Study changes in **nitrite** of cooked vegetables stored at
 - Room temp (20 - 25°C);
 - Refrigerated temp (0 - 4°C)
- Advices on handling leftover vegetables

採樣和樣本處理

收集蔬菜樣本

- 街市攤檔
- 超級市場



莧菜
Amaranth



白菜
Pak-choi



唐生菜
Chinese lettuce



菜心
Flowering white
cabbage



翠玉瓜
Zucchini

Sampling and Preparation

Vegetable samples collected from

- market stalls
- supermarket



採樣和樣本處理

經徹底清洗

- 放入沸水中烹煮
- 快炒



沸水煮 Boiling



快炒 Stir-flying

Sampling and Preparation

After thoroughly washed, cooked by

- boiling in water
- stir-frying

化驗分析

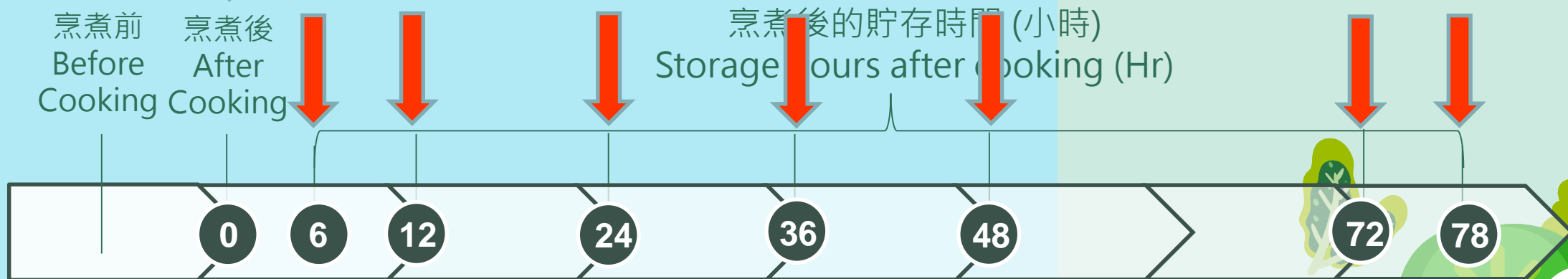
蔬菜烹煮後

- 分成兩組存放

- 室溫(20 - 25°C)

- 冷凍溫度(0 - 4°C)

- 測定蔬菜的亞硝酸鹽含量



Laboratory Analysis

After cooking,

- Samples divided into 2 groups and stored
 - Room temp (20 - 25°C)
 - Refrigerated temp (0 - 4°C)
- Determine nitrite content of vegetables

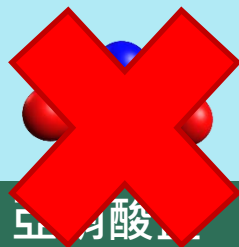
研究結果

烹煮前、剛烹煮後

- 所有蔬菜均未檢出亞硝酸鹽



烹煮前
Before cooking



亞硝酸鹽
Nitrite (NO₂⁻)



烹煮後
After cooking

Results

Before /immediately after cooking

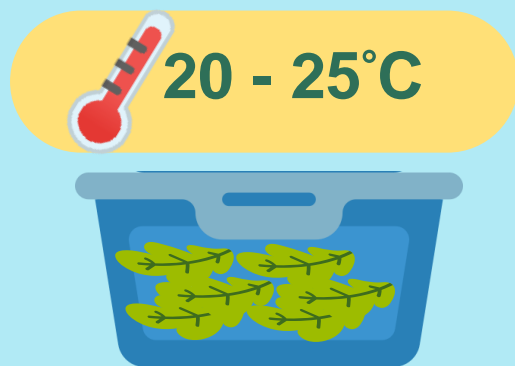
- **Nitrite** not detected in all vegetables samples



研究結果

存放室溫的熟菜

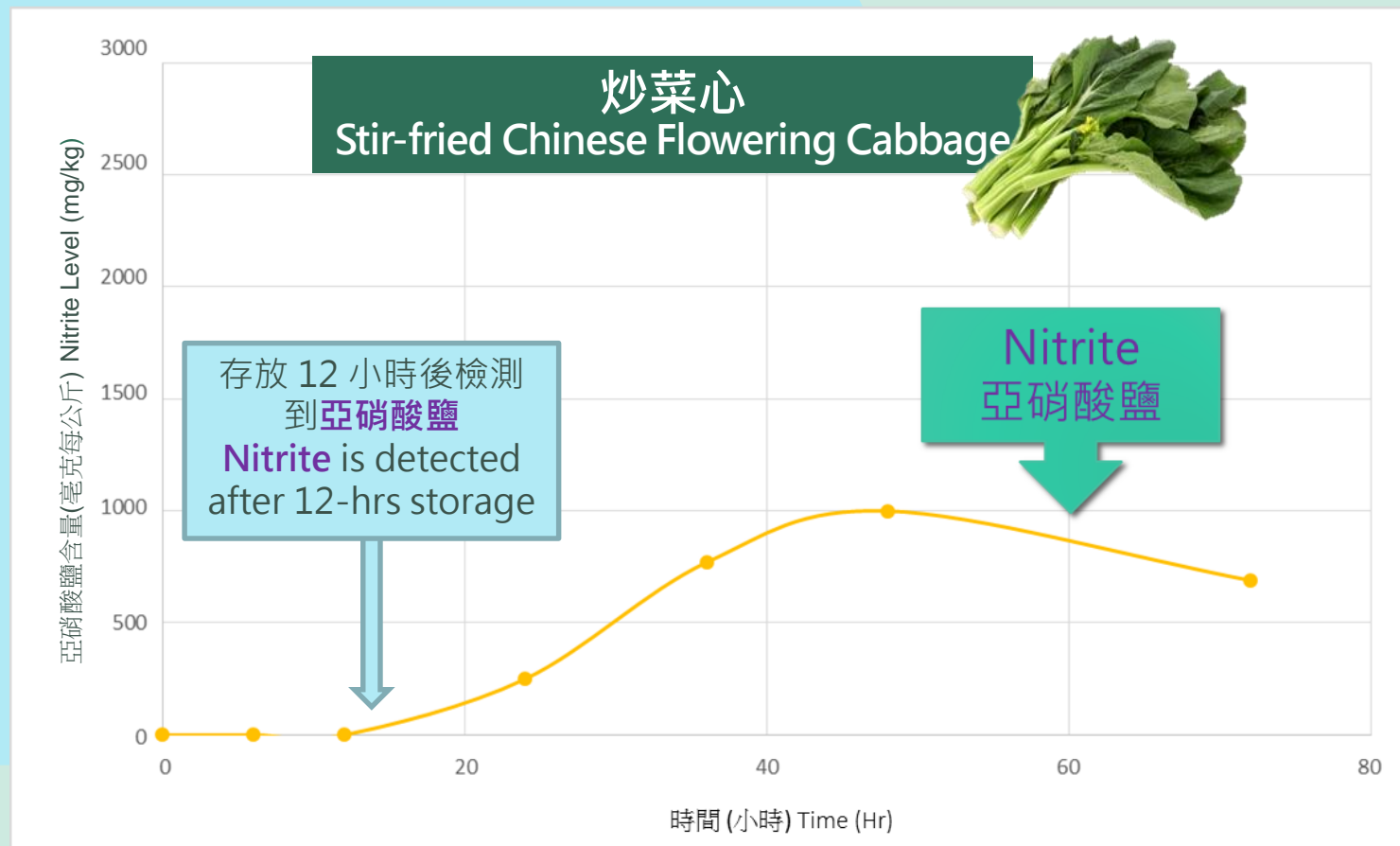
- 12小時後
- 亞硝酸鹽含量開始上升



Results

Cooked vegetables at room temperature

- After 12 hours
- **Nitrite** started to increase



研究結果

存放在雪櫃的熟菜

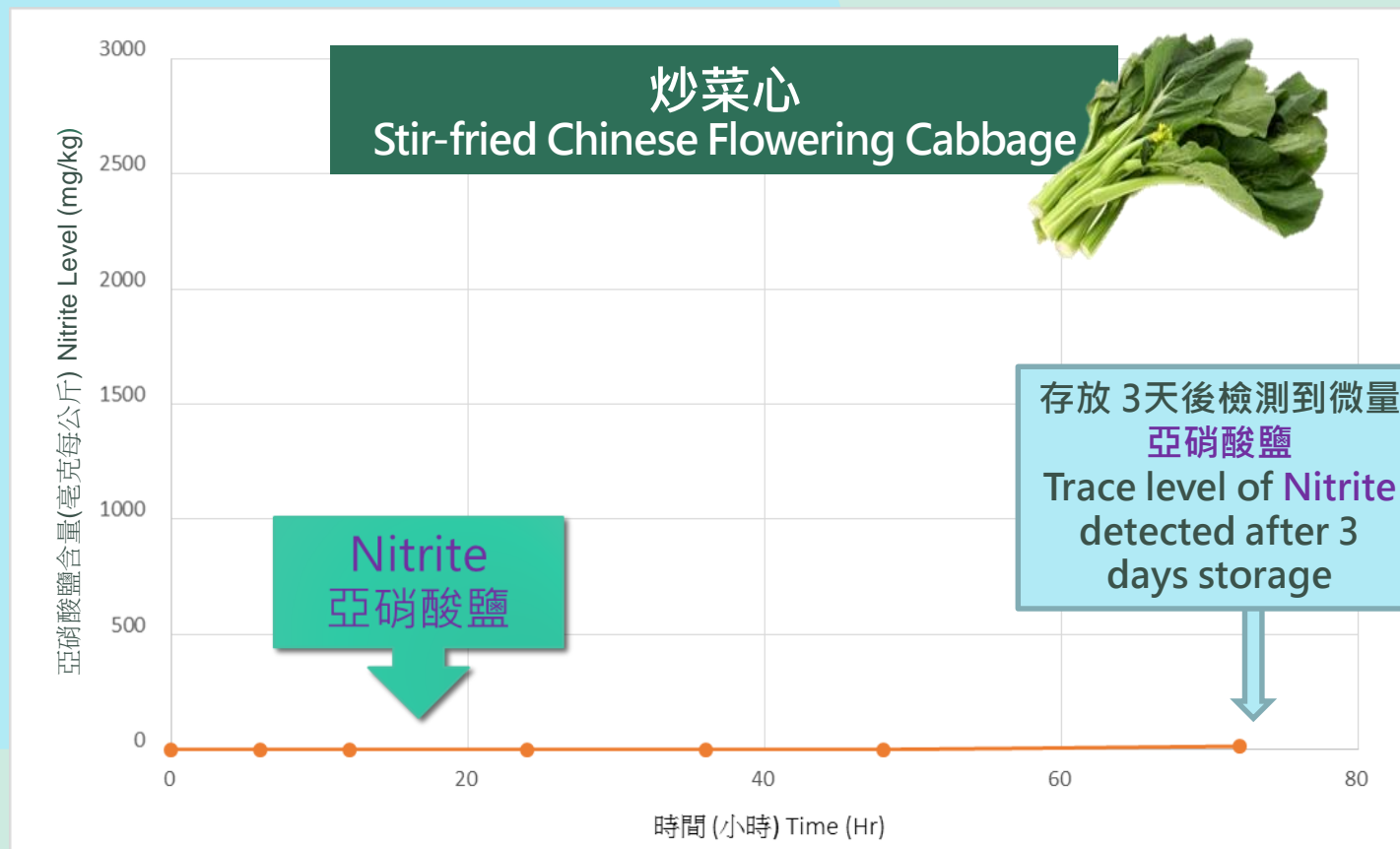
- 72 小時後
- 有樣本開始有微量亞硝酸鹽



Results

Cooked vegetables under refrigeration

- After 72 hours
- Low levels of **nitrite** detected in some samples



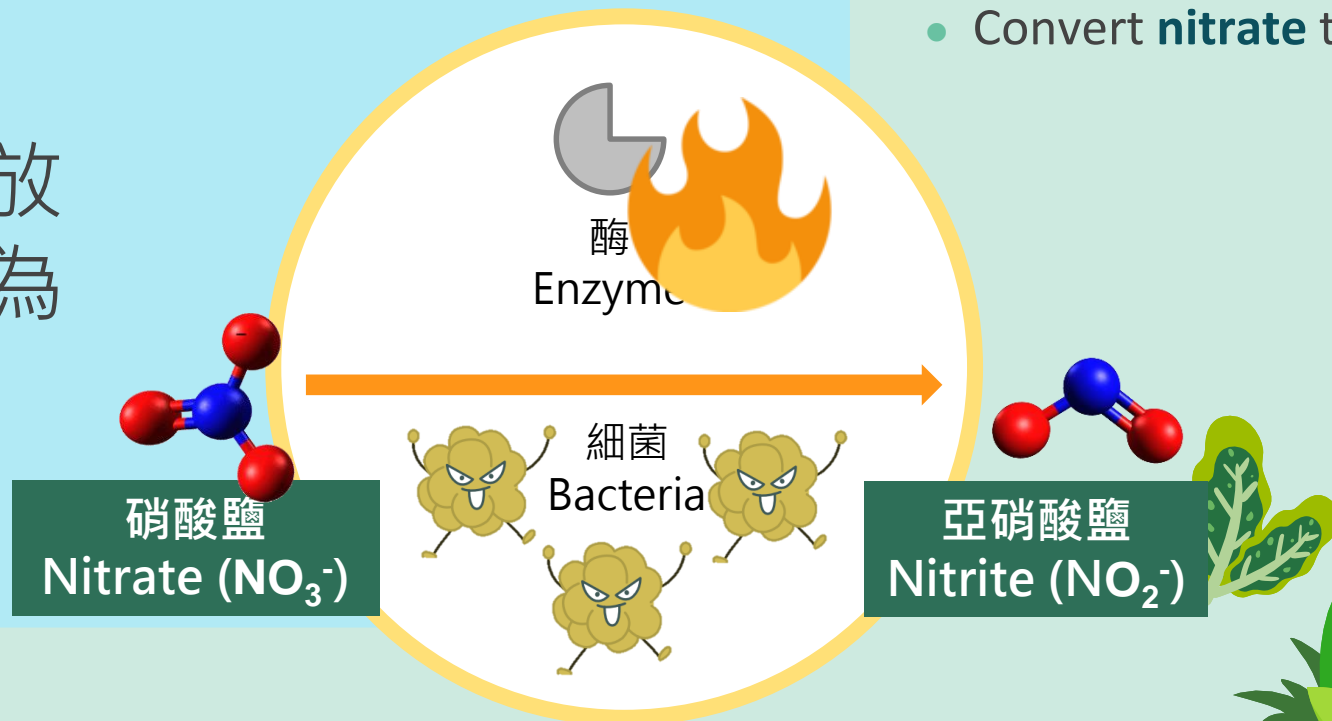
討論

烹煮

- 令酶失去活性

熟菜裏的細菌

- 室溫和冷凍存放
- 將**硝酸鹽**轉化為**亞硝酸鹽**



Discussion

Cooking

- Denatures the enzymes

Bacteria on cooked vegetables

- Storing at room temp and refrigerated temp
- Convert **nitrate** to **nitrite**

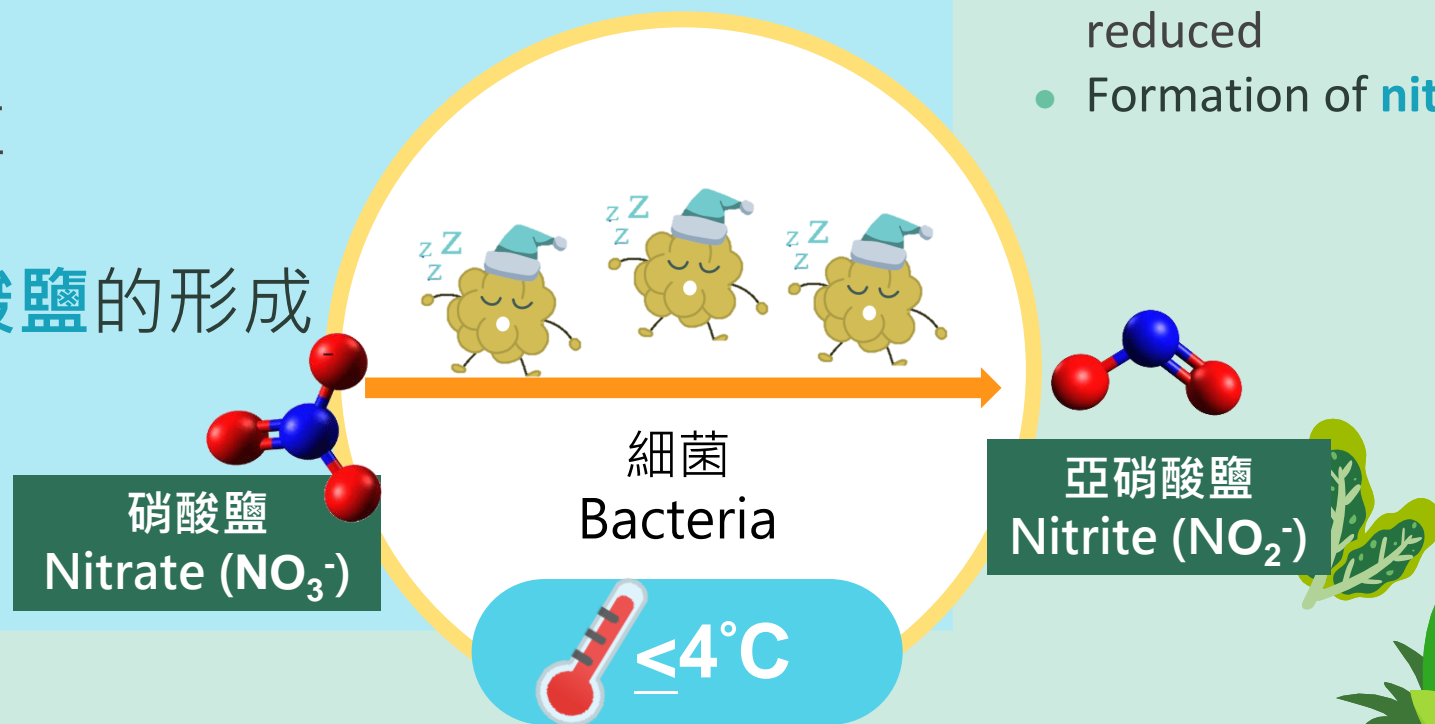
討論

貯存溫度

- 對細菌的生長和活力有很大的影響

在冷凍溫度下

- 抑制細菌滋生
- 降低細菌活力
- 延緩了亞硝酸鹽的形成



Discussion

Storage temperature

- Has a great effect on the growth and activities of bacteria

At refrigerated temperature

- Growth and activities of bacteria reduced
- Formation of **nitrite** delayed

討論

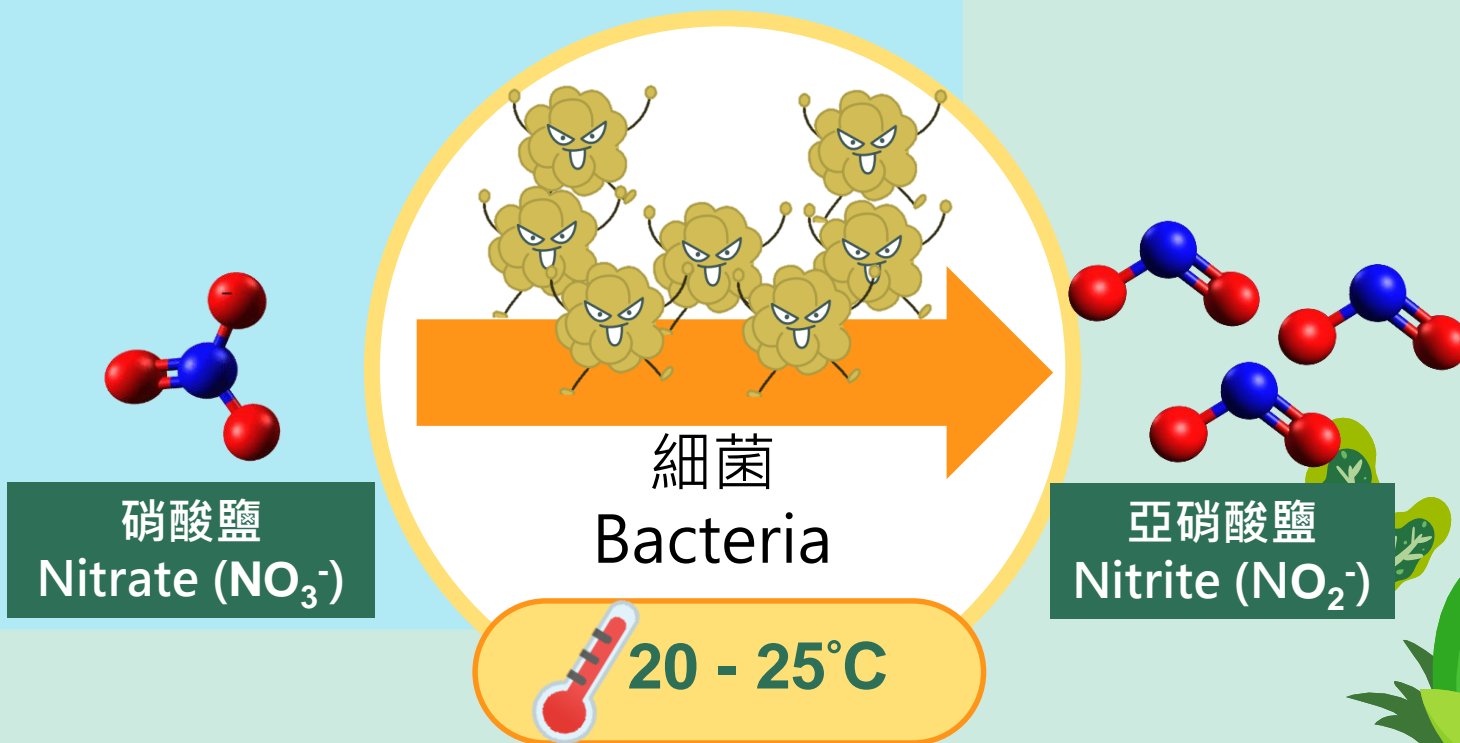
相對之下，在室溫下

- 細菌滋生快和活躍
- 較快把硝酸鹽轉化為亞硝酸鹽

Discussion

In comparison, at room temperature

- Bacteria grow quickly and active
- Convert **nitrate** to **nitrite** rapidly

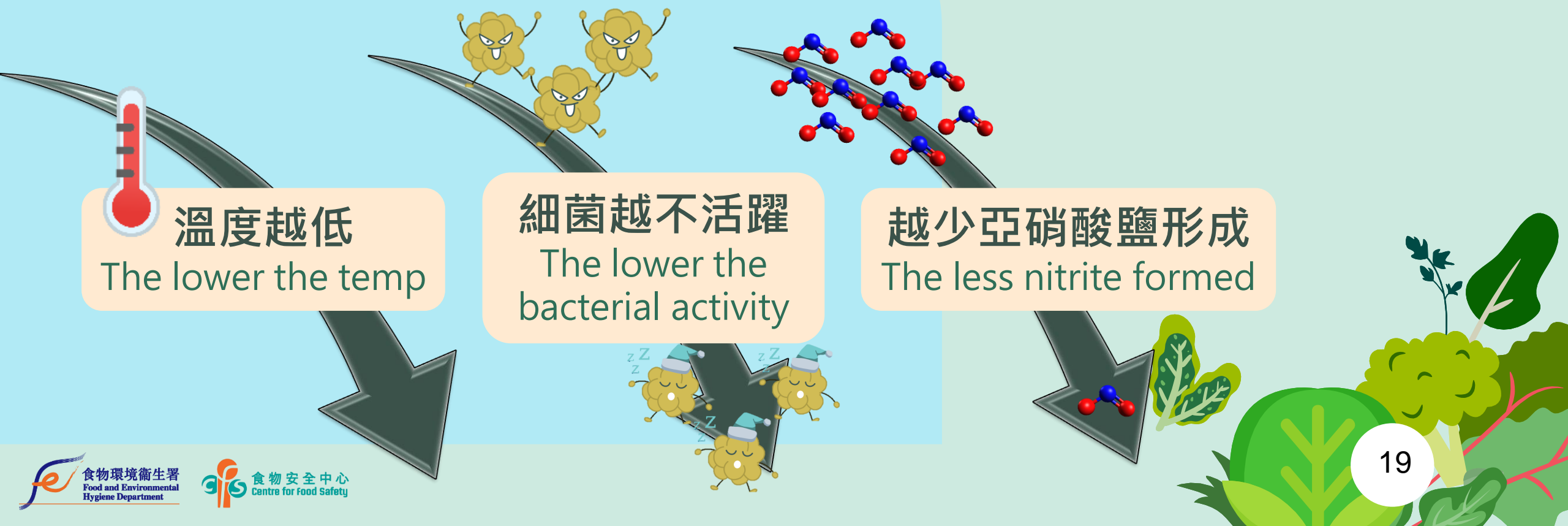


結論

- 亞硝酸鹽增加與細菌有關
- 細菌活力與溫度有關

Conclusion

- Nitrite formation is related to bacteria
- Bacterial activity is related to temperature



結論

- 熟菜在雪櫃存放一夜
- 亞硝酸鹽含量不會增加

Conclusion

- Cooked vegetables stored in refrigerator overnight
- Nitrite contents do not increase



建議

處理剩餘的食物(包括家中自備餐盒)

- 剩菜應在烹煮後2小時內放進雪櫃貯存
- 為確保食物安全，應盡快食用



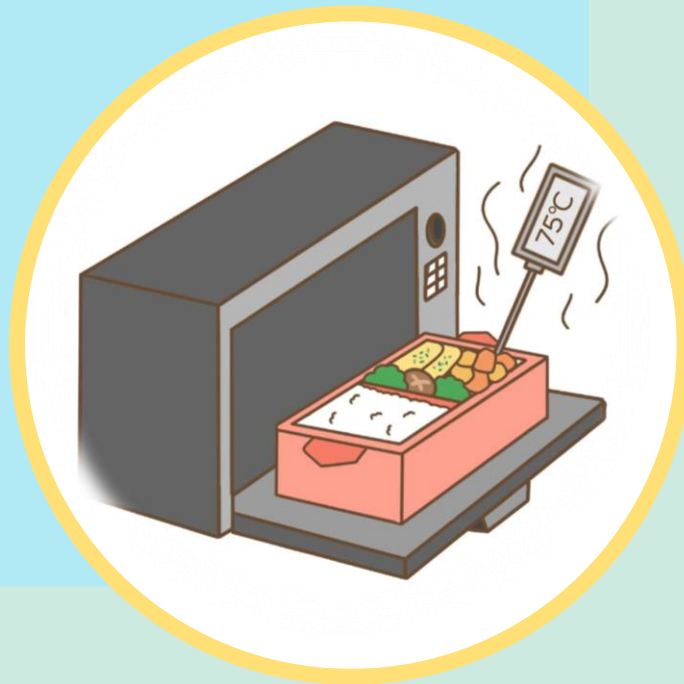
Recommendations

- **Handling of leftovers (including homemade lunchbox)**
 - Leftovers should be refrigerated within 2 hours after cooking
 - To ensure food safety, consumed as soon as possible



建議

- 處理剩餘的食物(包括家中自備餐盒)
 - 食用前，徹底翻熱至中心溫度達攝氏75度
 - 不應翻熱超過一次
 - 如熟食置於室溫超過4小時，便不應食用



Recommendations

- Handling of leftovers (including homemade lunchbox)
 - Thoroughly reheat leftovers until the core temperature reaches 75oC before eating
 - Do not reheat more than once
 - Do not consume cooked food if they have been held at room temperature for more than 4 hours



謝謝 Thank you

食安仔提醒你

餐盒中的熟蔬菜於貯存一夜後

可以安全食用

蔬菜有益健康

市民應進食不同種類的蔬菜

保持均衡飲食

