Analysis of Organic Acids

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Definition of Organic Acids

- **No definitions from Codex**
- **Broadly speaking, all organic compounds having at least one carboxylic acid functional group**

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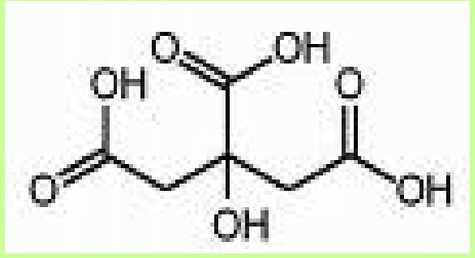
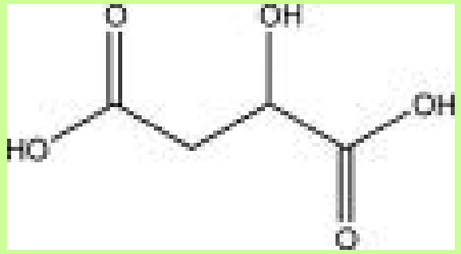
Important OAs in Food

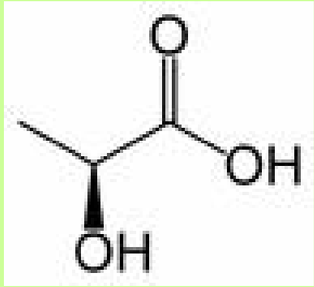
Citric acid



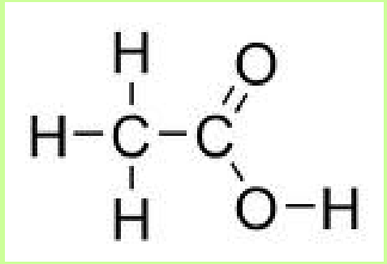
Malic acid



Lactic acid



Acetic acid



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Other OA can be found in Foods

- Formic acid
- Fumaric acid
- Maleic acid
- Malonic acid
- Oxalic acid
- Quinic acid
- Shikimic acid
- Succinic acid
- Tartaric acid

- No exhaustive list

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Relevancy of OAs in NL

energy (kcal in 100g) =	carbohydrate	x 4 +
	protein	x 4 +
	total fat	x 9 +
	ethanol	x 7 +
	organic acid	x 3

- May contribute in energy calculation
- Not a core nutrient but voluntary
  labeled value must be correct

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Analytical Methods

Q : **Can I determine the "organic acids" content by titration?**

A : **Not recommended since titration might:**

(1) over-estimate due to common additives such as benzoic acid, sorbic acid, sulphur dioxide, erythoric acid, etc. and

(2) no suitable conversion factor for calculation

LC methods are preferred

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Analytical Methods

Official method	Titles
AOAC 986.13	Quinic, Malic, and Citric Acids in Cranberry Juice Cocktail and Apple Juice
GB/T 5009.157-2003	食品中有机酸的测定 Determination of Organic Acid in Foods

- … and any other suitable methods for the food matrix concerned.

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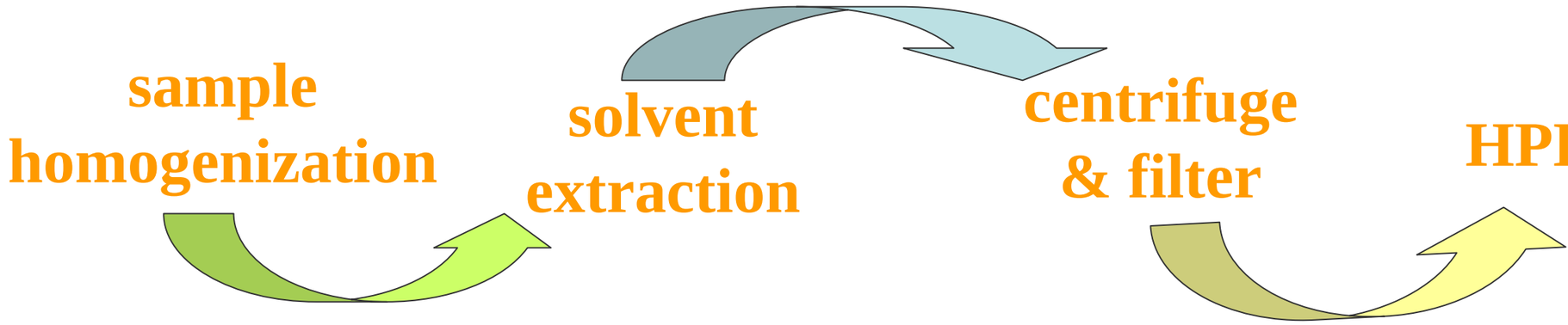
FRL Method Workflow



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Equipment

homogenizer

centrifuge

nitrogen evaporator

HPLC

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Protocol for Liquid Samples

mixing or blending

↓

aliquot, add buffer, make up

↓

centrifuge 3000 rpm 10 min

↓

filter supernatant, HPLC

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Protocol for Solid Samples

10 g homogenized sample + 20 ml 80% EtOH

↓

homogenize, 3000 rpm 10 min, collect supernatant

↓

extract 2x with 80% EtOH, combine supernatants

↓

aliquot, dry by N_2 (50°C), add buffer, make up

↓

filter supernatant, HPLC

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HPLC Conditions

Instrument:	**HPLC-DAD/PDA**
Column:	**two C18 (15cm, 25cm) + one Dionex OA**
Guard column:	**C18 (7mm)**
Mobile phase:	**$MeSO_3H$ & $NaSO_4$ buffer (pH 2.8)**
Temp:	**25 ℃**
Flow:	**0.5 mL/min**
Injection vol:	**20 μL**
UV (λ):	**220 nm**
Runtime:	**40 min + 10 min post-run**

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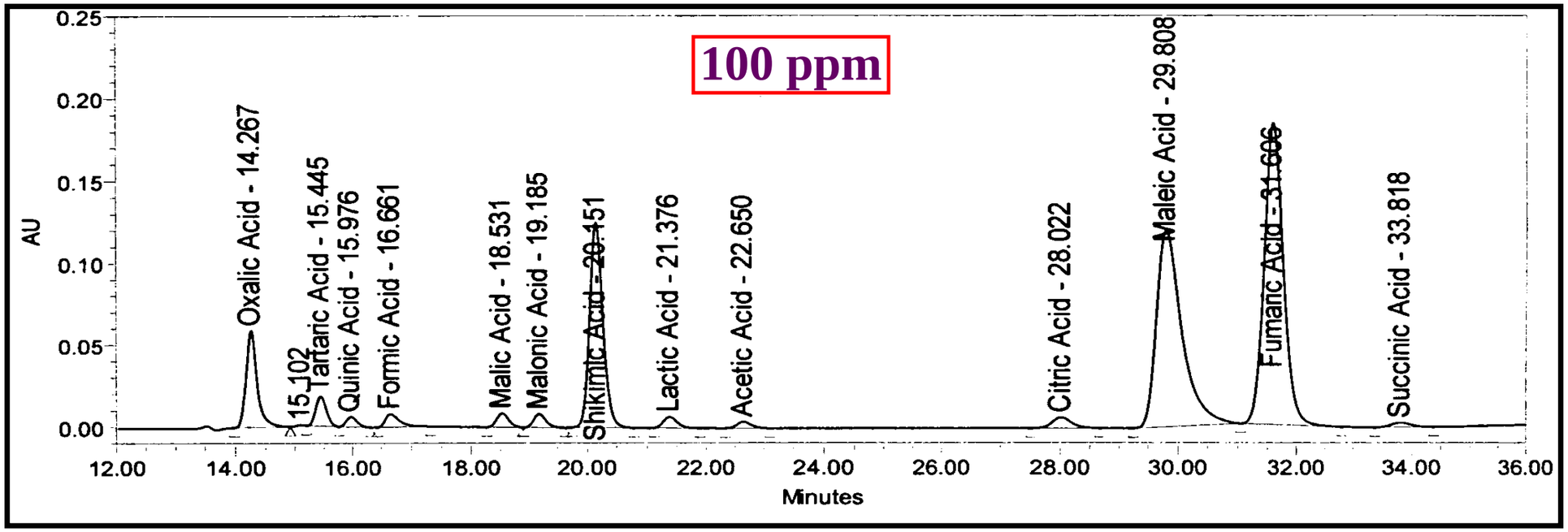
Chromatogram



- **All 13 OAs separated**
- **Frequent interferences :**
  ascorbic acid and some anions

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Calculation of Available Carbohydrate when OAs is of concern

Carbohydrate (available) = 100 g – (water + ash + DF + protein + fat + ethanol + organic acid)

Q : How would energy content be affected?

A : (1) Due to different conversion factors for carbohydrates & OA (i.e. 4 vs 3)

(2) The extent depends on cases

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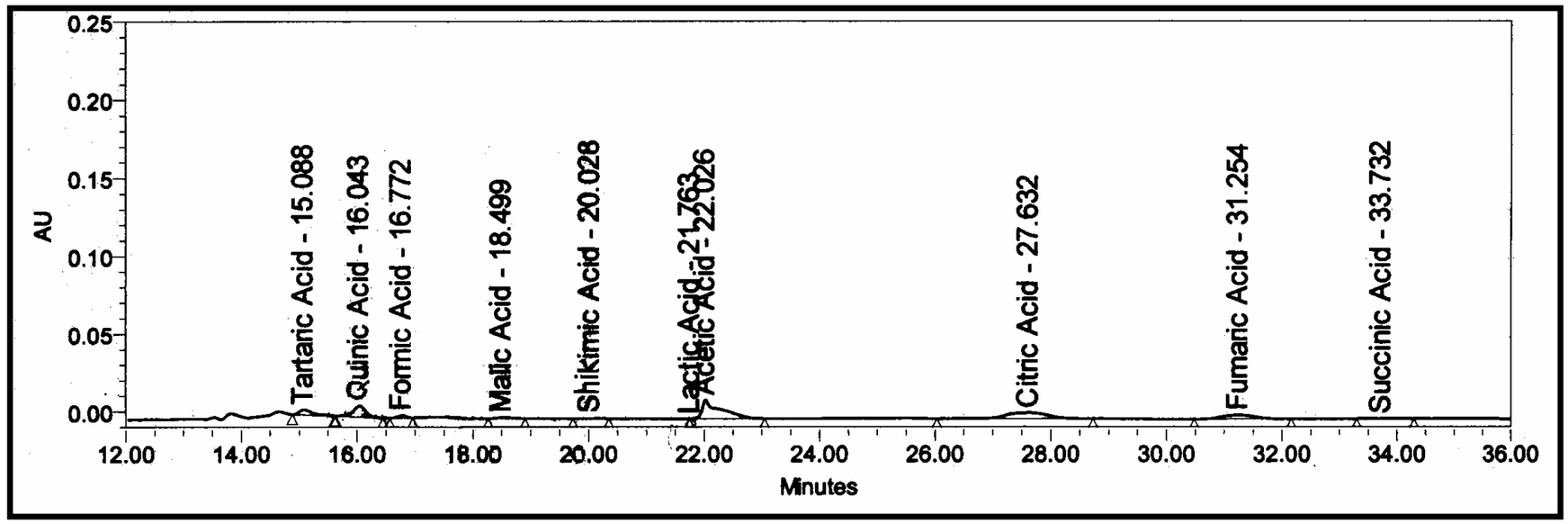
Example 1 – Thousand Island Sauce



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Example 1 – Thousand Island Sauce

Nutrient (g/100 ml)	original	revised
Protein	1.1	1.1
Fat	45.5	45.5
Carbohydrate	12.3	11.3
Organic acid	Not determined	1.0
Ethanol	0.0	0.0
Energy (kcal/100ml)	463	462

Difference = 0.2 %

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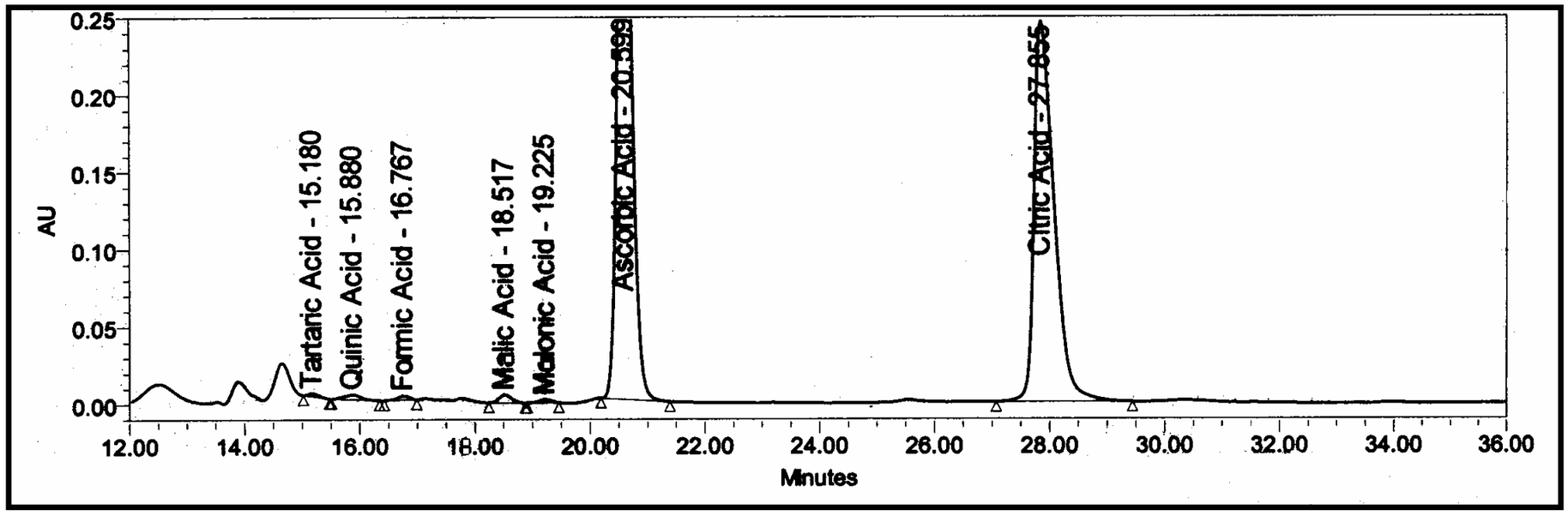
Example 2 – Grapefruit Juice



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Example 2 – Grapefruit Juice

Nutrient (g/100 ml)	original	revised
Protein	0.0	0.0
Fat	0.0	0.0
Carbohydrate	13.5	12.8
Organic acid	Not determined	0.7
Ethanol	0.0	0.0
Energy (kcal/100ml)	54	53.3

Difference = 1.3 %

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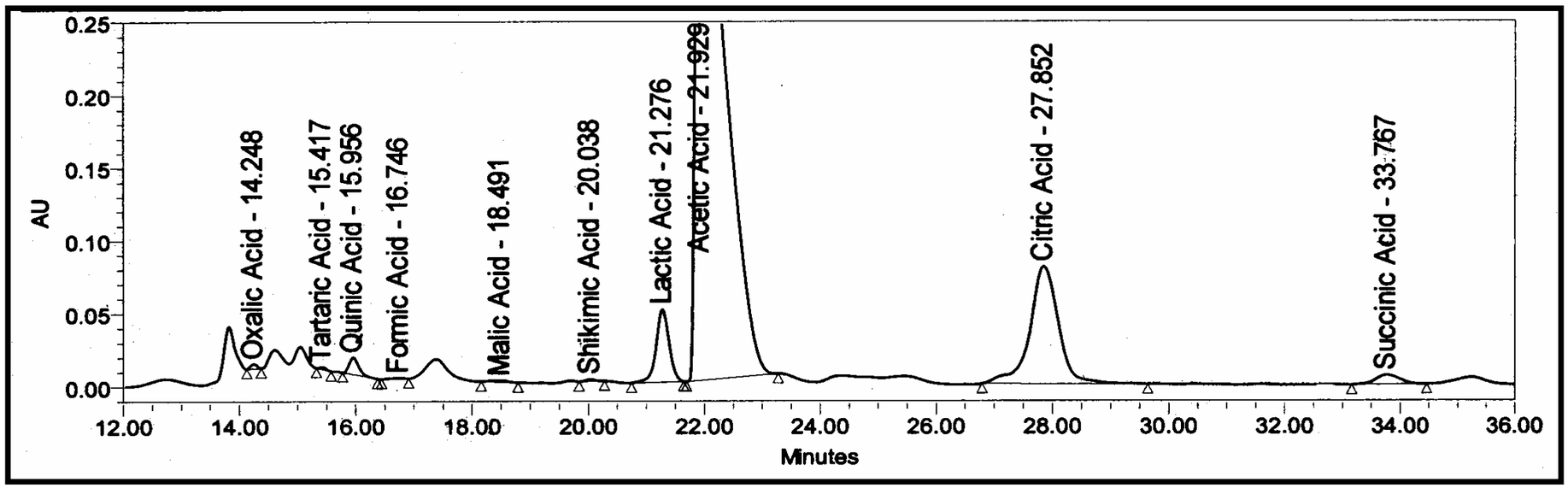
Example 3 – Chinese Red Vinegar



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Example 3 – Chinese Red Vinegar

Nutrient (g/100 ml)	original	revised
Protein	0.0	0.0
Fat	0.0	0.0
Carbohydrate	10.0	5.0
Organic acid	Not determined	5.0
Ethanol	0.0	0.0
Energy (kcal/100ml)	40	35

Difference = 12.5 %

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Points to Note

- **HPLC method is preferred for OA analysis**
- **Carbohydrate content should be recalculated after OA analysis**
- **OA analysis is only important for samples of low energy content or with high level of OA**

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THANK YOU

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