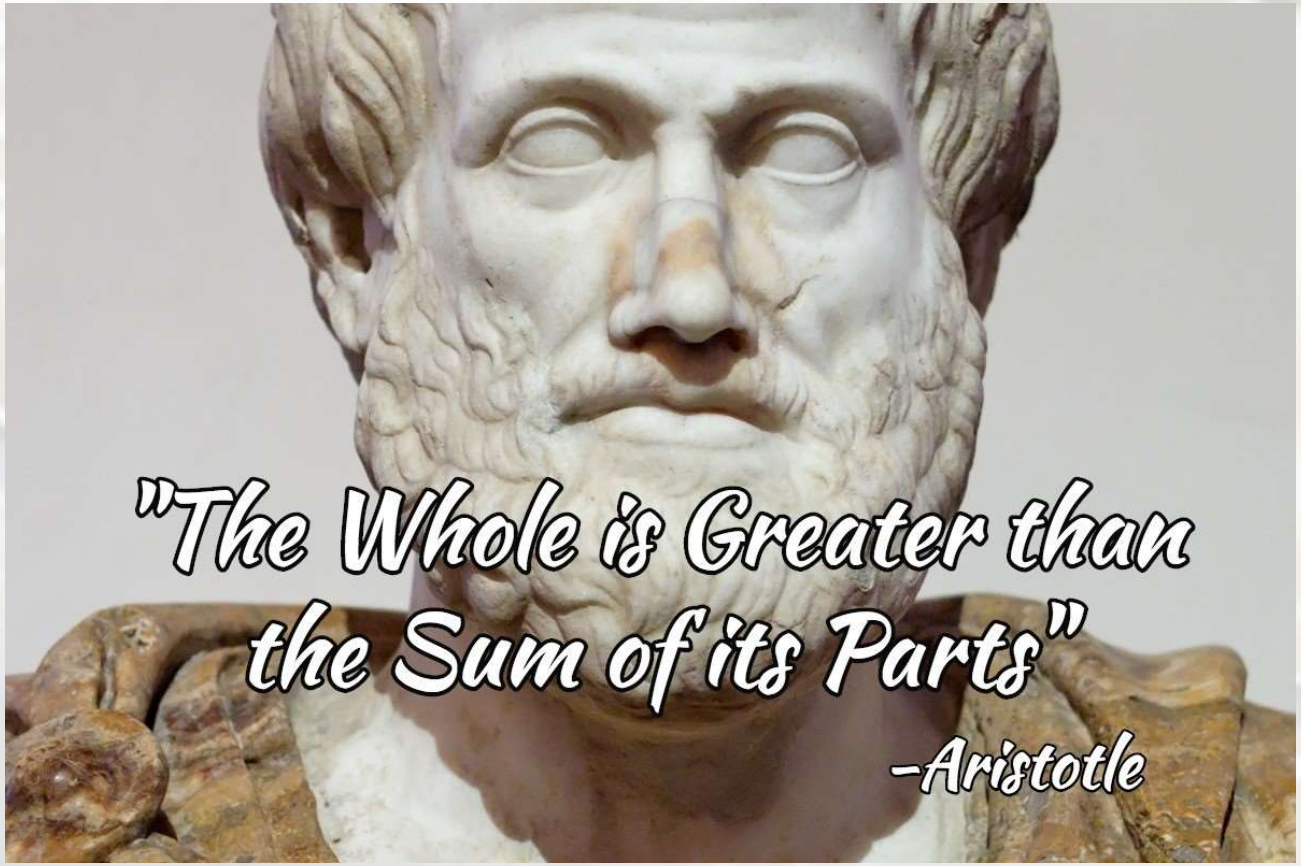

THE
MATRIX

Food is more than the sum of its nutrients

The Dairy Matrix

rediscover dairy™ 3-A-DAY

The ancient wisdom of Aristotle

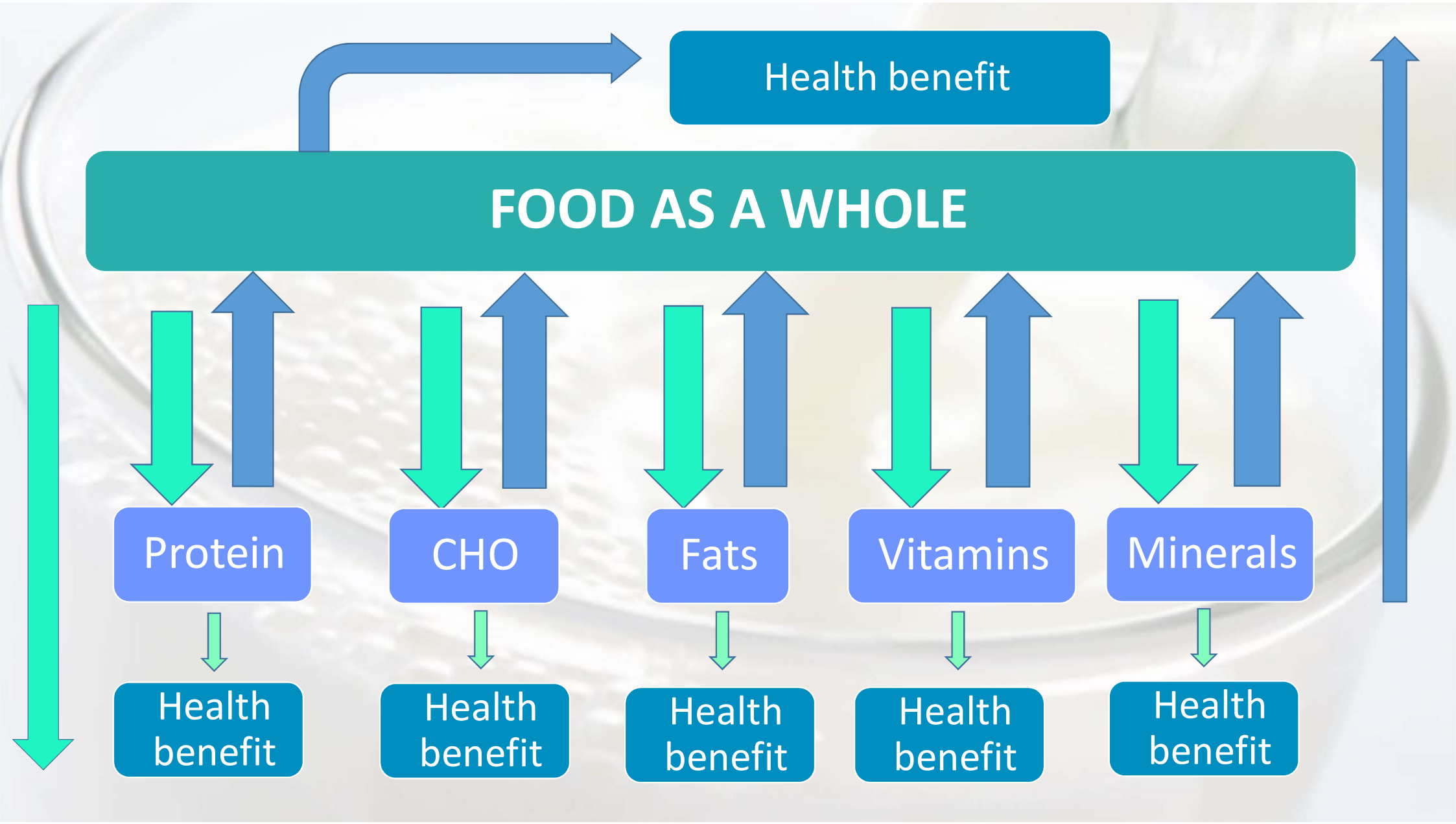


What is the WHOLE?

Sum of the parts making up a matrix

Nutrition is moving into a new direction

Moving beyond SINGLE nutrients


Health benefit
FOOD AS A WHOLE
Protein
CHO
Fats
Vitamins
Minerals
Health benefit
Health benefit
Health benefit
Health benefit
Health benefit

Traditionally the study of nutrients and health – “reductionist” approach

Oversimplification of nutrition

Leading to classification of some foods based of one piece of information as

- negative
- super foods

THE **FOOD** MATRIX

Food consist of a large number of different nutrients within a complex structure

This matrix will determine each nutrient's

- digestion
- absorption
- the overall nutritional properties of the food

THE **DAIRY** MATRIX

Nutrients in milk or other dairy products do not work in isolation but in synergy

A dairy matrix explains health effects of individual nutrients that have a greater effect when combined

The interaction of nutrients in dairy forms a winning team.

The whole is more than the sum of the parts

DAIRY PRODUCTS ≠ FORTIFIED FOODS

The matrix effect of **DAIRY**

CHEESE: despite SFA and salt content, studies show cheese consumption does not increase risk of CVD - may be beneficial

"Food matrix" effect

Health effects of a food are more complex than single nutrients

Function of both a food's structure and its nutrient composition, as well as interaction

Milk: Consider the WHOLE as well as the parts

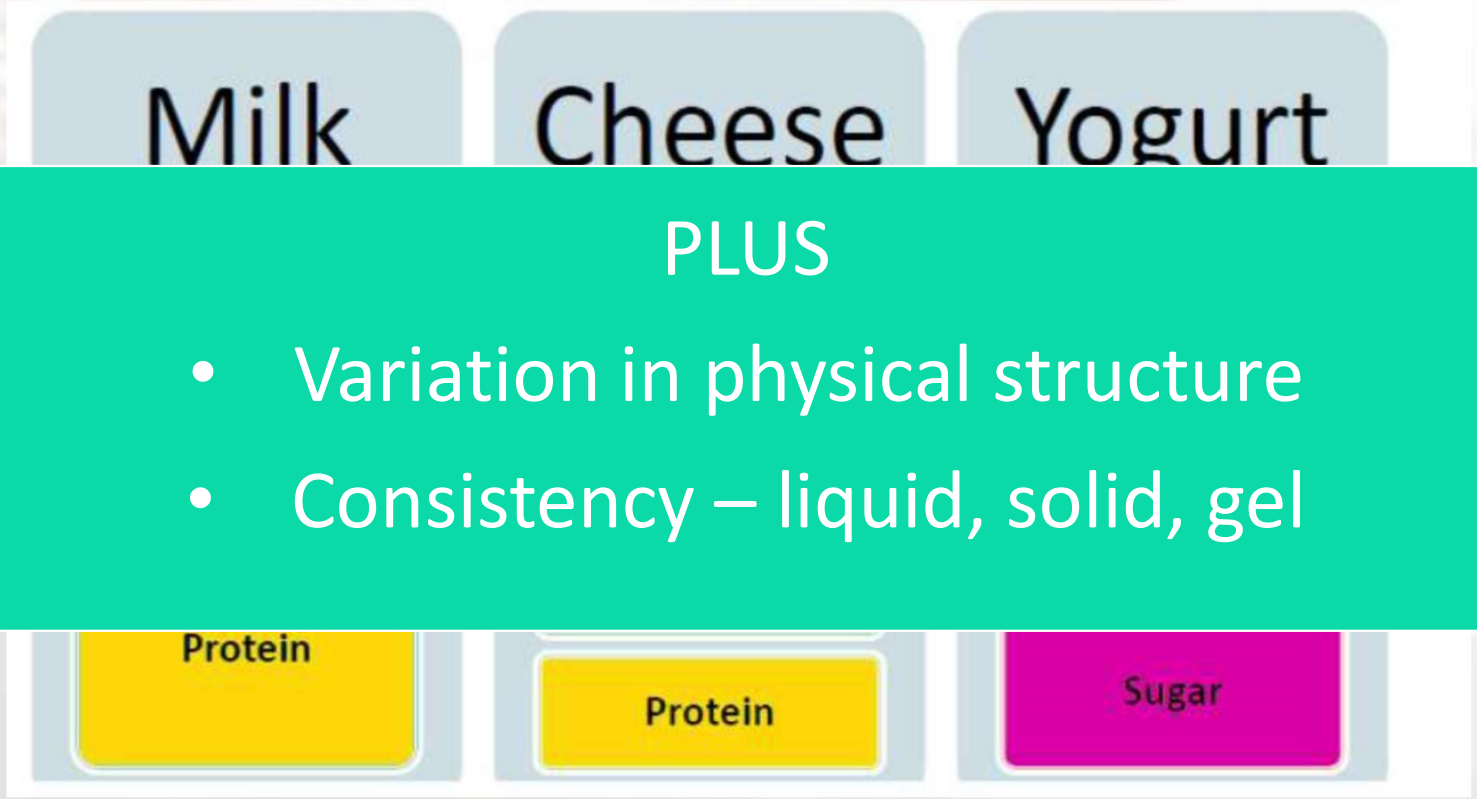
- More than just CALCIUM
- High quality protein
- Bioactive peptides
- 400 different fatty acids
- Lactose
- > 8 vitamins
- > 5 minerals
- Fermented products with unique composition

Milk: Consider the WHOLE as well as the parts

Some nutrients are not easily replaced by other foods without reducing the overall nutritional quality of diet

Modelling dietary patterns to remove dairy and replace with substitutes for calcium, resulted in lower amounts of several other nutrients

All Dairy is **not** created equal

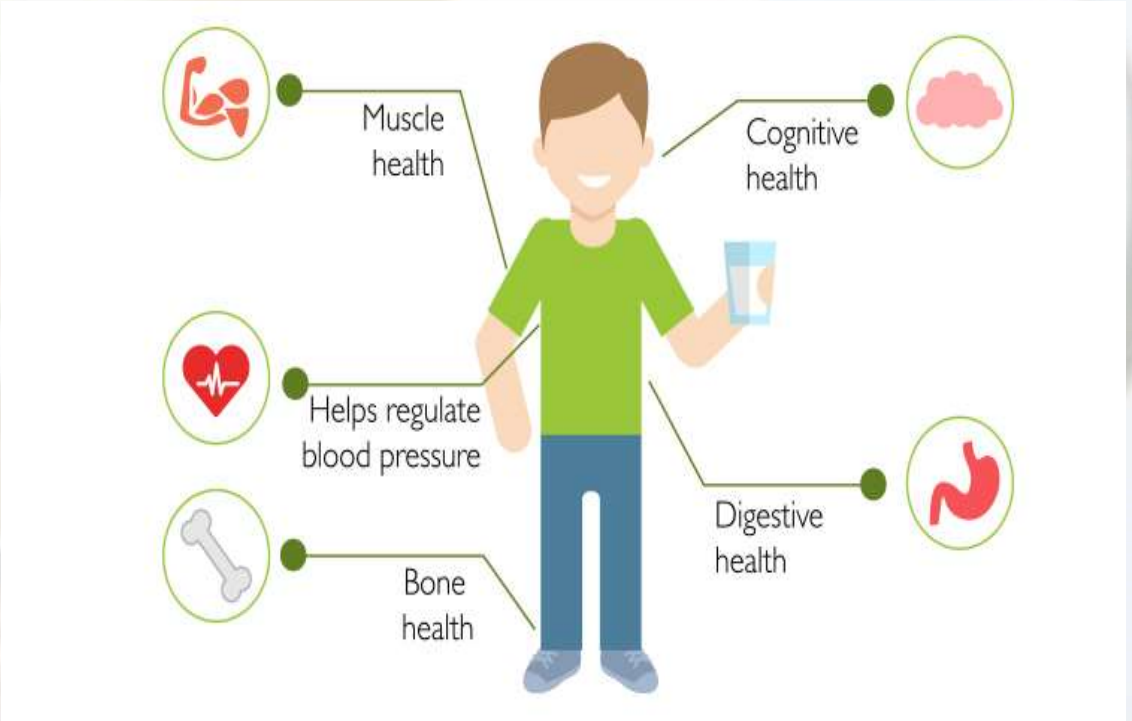


PLUS

- Variation in physical structure
- Consistency – liquid, solid, gel

Effect of the Dairy Matrix effect on health

- Bone health
- Sarcopenia
- Muscle strength
- Weight management
- Cardiovascular disease

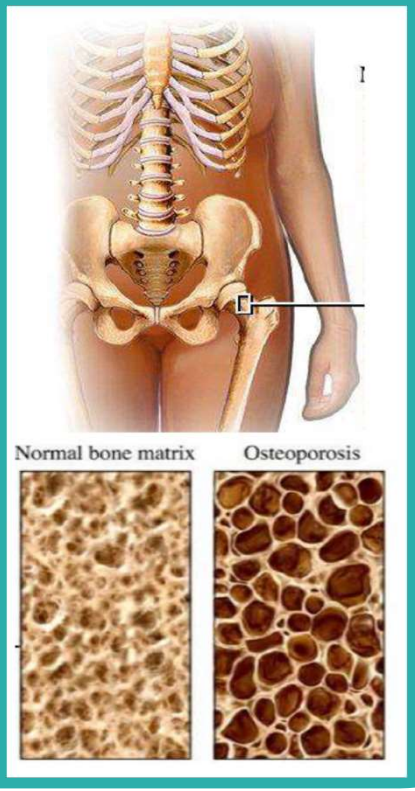


Bone Health: Evidence of the matrix effect

- Bone strength refers to
  - Quality
  - Structure
  - Mass
  - Turnover of bone

Bone Health

- 80-90% of Bone Mass content = Calcium and Phosphate
- Bone Mass also requires
- Protein
- Vitamins A, C , D and K
- Mg, Zn, Cu, Fe and Fluoride



Calcium in Dairy: Effect of matrix

- Contain favourable Ca:P ratio (1:0.8) and range of interacting nutrients

- Appears more beneficial than other forms of calcium
- Stimulates renal resorption of calcium
- Implies it has a longer-lasting effect

Calcium in Dairy

Protein in dairy may enhance calcium balance by promoting absorption

Casein phosphatides and lactose enhance calcium absorption

Fermented dairy has additional benefit in enhancing calcium absorption

Adults need **1000mg calcium per day**

Calcium sources from food = **300mg calcium**

1 glass (250ml)

2 tubs (200ml)

2 slices (40g)

1 tin sardines with bones

2 cups cooked spinach

7 cups cooked broccoli

9 cups of cooked cabbage

3 cups of baked beans

Sarcopenia: Evidence of the matrix effect

- Progressive decrease in lean body mass with age
- Affects up to 45% of individuals > 60 years

↑ fatigue ↓ appetite and quality of life

- Cause physical impairment, disability and dependence on others
- Impairs metabolic adaption to illness and disease

Sarcopenia

- Increased protein intake minimises risk
- Milk protein proven to be specifically beneficial for increasing muscle protein synthesis in older people

- Whey protein support rapid increases in muscle protein synthesis
- Casein supports sustained increase in muscle protein synthesis and decrease in muscle protein breakdown

Sarcopenia

Milk is a significant source of leucine

Leu especially important in stimulating muscle protein synthesis

Anabolic effect of milk may:

- Maintain muscle mass and strength in the healthy elderly
- Contribute to fast recovery in the frail elderly

Nutrient density of milk also beneficial for older people

Sport and performance:
Evidence of the Matrix effect

PERFORMANCE NUTRITION

Ideal Rehydration
- Fluid, Sodium, Potassium
- Slow gastric emptying

RECOVERY AFTER EXERCISE

Muscle recovery and repair
- High quality protein
- Essential amino acids
- Branch chain amino acids
- Skeletal amino acid uptake

GLYCOGEN RE-SYNTHESIS

Weight management:
Evidence of the matrix effect

Whey proteins in milk and dairy affect levels of satiety

- Low GI
- Appearance of AA in plasma help decrease excessive food intake

Dairy's BCAA's enhance

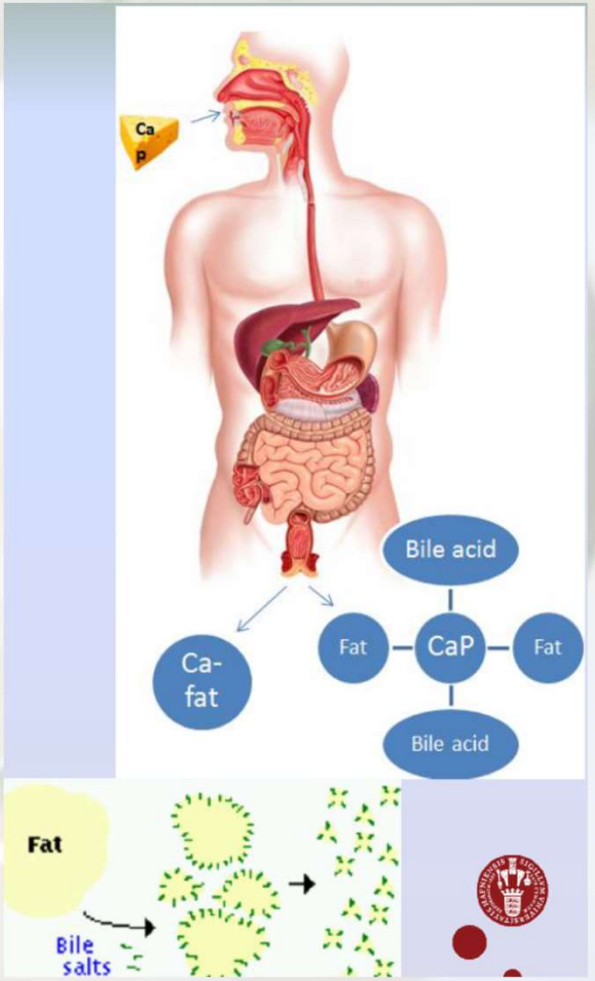
- Muscle protein synthesis and muscle mass
- Protect against loss of lean mass during weight loss

Weight management

- **Calcium m**ay alter fat cell function and fat oxidation:
  - stimulating lipolysis (fat breakdown)
  - reducing lipogenesis (fat synthesis)
  - increasing fat oxidation

Weight management

- Precipitation of calcium and fatty acids into insoluble fatty acid soaps
- Precipitation of Ca and P into amorphous calcium phosphate
- Increased faecal excretion of bile acids
- Decreased fat (and therefore calorie) absorption



Weight management

- Milk proteins may also influence gut hormones by stimulating hormones involved in satiety
- Increase the hormone ghrelin that suppresses appetite
- Increase thermogenesis, thus increasing resting energy expenditure

CVD: Evidence of the matrix effect

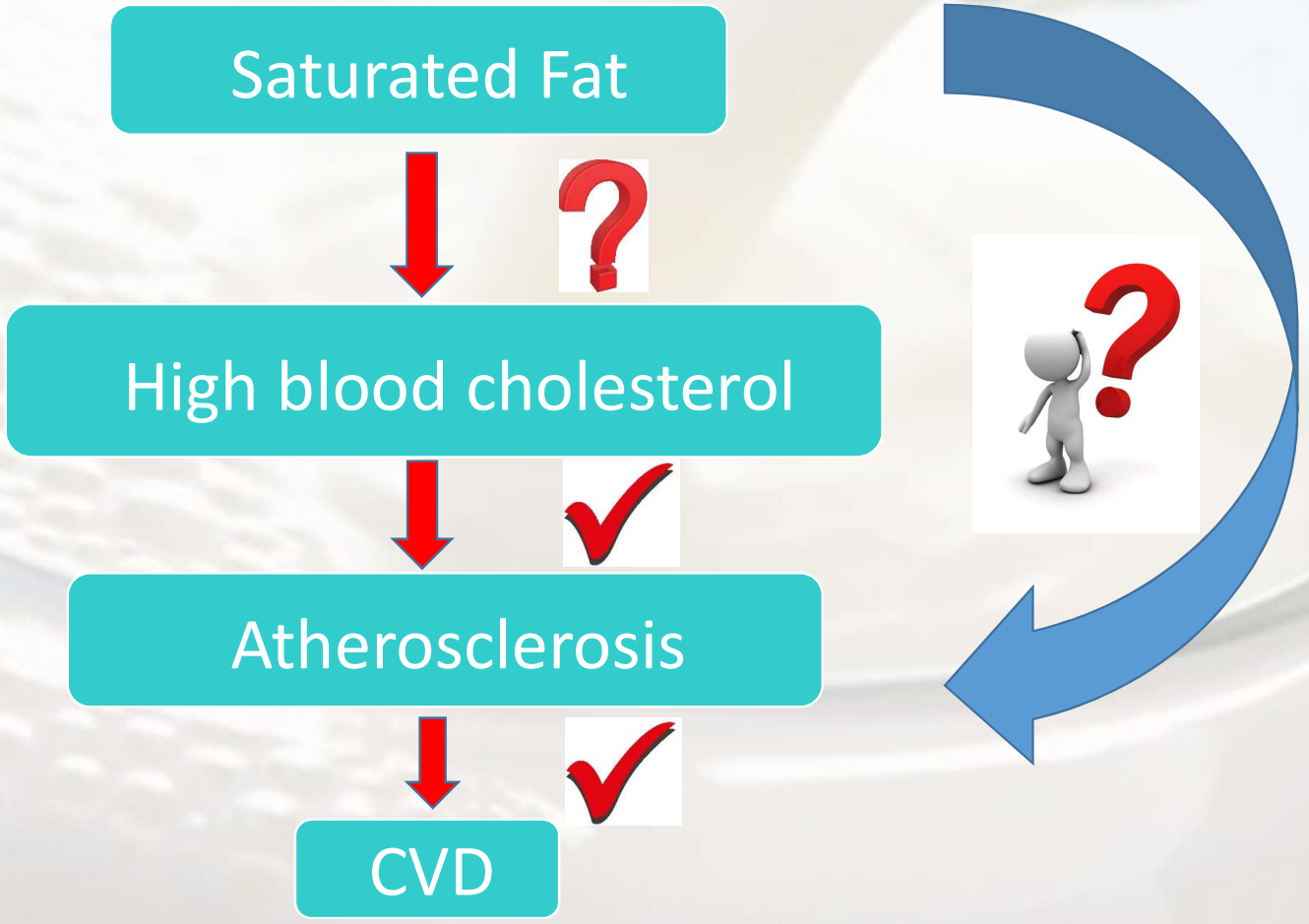
Milk nutrients

- Calcium
- Protein
- Fatty acid profile
- Vitamins
- Magnesium
- Sodium
- Potassium
- Microbiota

Health benefits

- Reduced risk of stroke
- Reduced blood pressure
- Reduced circulating cholesterol
- Neutral to reduced risk for CVD

The lipid hypothesis and CVD



Meat and CVD

- Processed meat consumption had 18% higher risk for CVD mortality
- No association between red or white meat intake and CVD mortality

Dairy and CVD

Inverse relationship between dairy and CVD and stroke

Cardiovascular Disease

Bioactive peptides

- Inhibit Angiotensin-1-converting enzyme
- Slow down vascular smooth muscle constriction
- Increase NO production, resulting in vasodilation

Soap formation with fatty acids

- Decreases blood clot formation
- Decrease cholesterol levels

Cardiovascular Disease

Binds bile acids

- As more cholesterol converts to bile acids, circulating cholesterol is reduced

Casein matrix with calcium traps fat globules

Fermentation causes SCFA production

- Helps lower cholesterol levels

Dairy saturated fats increases LDL particle size

- Decrease ability to penetrate arterial walls

Type 2 DM: Evidence of the matrix effect

Evidence is building that dairy foods may help reduce risk of type 2 diabetes

Protective associations reported for:

- **Total dairy consumption**
- **Both low-fat and regular-fat dairy**
- **Particularly pronounced for fermented products such as yogurt and cheese**

Type 2 Diabetes

Potential dairy matrix mechanisms:

- **Several components could potentially be involved in the protective relationship between dairy and type 2 diabetes**
- **Not mutually exclusive**
- **Combination of mechanisms may well produce beneficial effects on glycaemic control**

Type 2 Diabetes

- Dairy may indirectly modify diabetes risk through beneficial effects on weight, body fat and central adiposity
- Also on muscle mass and function
- Calcium and magnesium’s role in regulating insulin-mediated intracellular processes

Type 2 Diabetes

- Protein in dairy's effect on insulin secretion and blood glucose control
- Bioactive peptides from digestion of milk protein and fermentation process such as cheese, yogurt and fermented milk

Type 2 Diabetes

- Form of vitamin K (vitamin K2; part of the menaquinone family) is associated with fermented dairy linked to reduced risk

- Dairy fatty acids may play a role
  - Trans-palmitoleate
  - Odd chain SFA pentadecanoic acid (C15:0) and heptadecanoic acid (C17:0)

Type 2 Diabetes

- Dairy fatty acids may play a role
  - Short-chain fatty acids including butyrate (C4:0)
  - Branched-chain dairy fatty acid phytanic acid
- All reported to have anti-diabetic effects including increasing insulin sensitivity

Conclusion

The Dairy matrix exists

The matrix effect is a **combined function** of nutrient composition and food structure

Might be physical, chemical or associative effects – or all

Health effects of a food cannot be determined simply on the basis of the **individual nutrients** it contains

Conclusion

Dairy saturated fats increases LDL particle size
Decrease ability to penetrate arterial walls

The food matrix determines nutrient digestion and absorption, thereby also altering the overall nutritional properties of the food

Evidence to date suggests that the dairy matrix may have unique benefits for weight control, bone and muscle mass development, lower risk for type 2 DM and cardiovascular health