Nutritional health benefits of canned food for a sustainable world

FRUCOM Project

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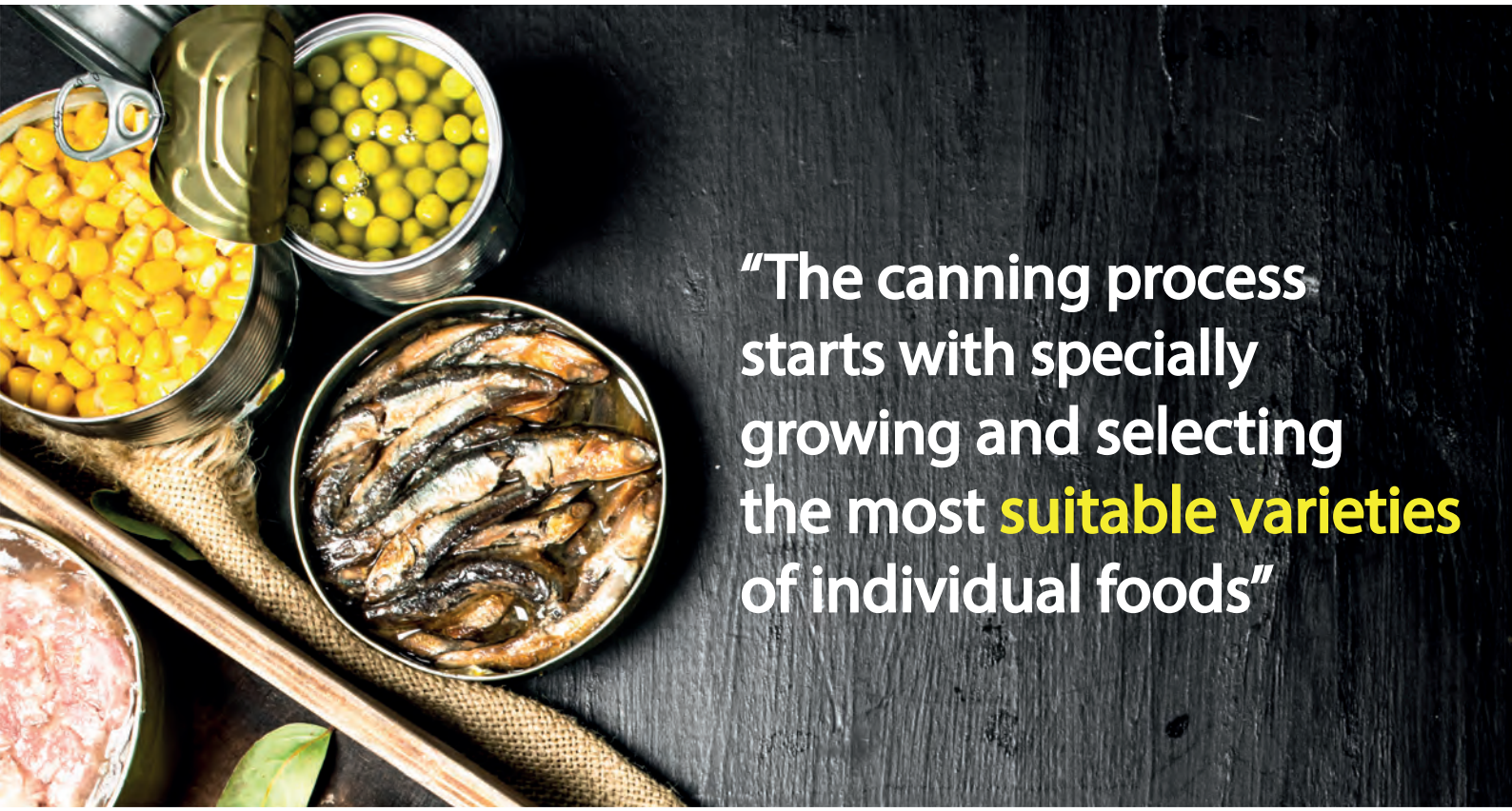
History & process of canning

Preserving foods has enabled mankind to maintain good nutrition all year round and to support ever growing populations. Canned (or tinned) food for example was first developed (early 1800s) to provide safe food for large, mobile armed forces. Despite the perception that fresh is best, food processing, such as drying fruit, canning and freezing fish, vegetables and fruits are essential contributors to nourishing the planet, even with sustainability in mind. Popular examples include **canned tuna**, **sardines**, **tomatoes** and **mandarin oranges**.

The canning process starts with specially growing and selecting the most suitable varieties of individual foods, e.g. tomatoes are selected to maximise flavour and performance. Processing (peel, slice, chop, pit, bone, shell, or cook) and sealing in cans is followed by heating, to kill harmful bacteria and prevent spoilage, resulting in a long shelf life (1–5 years+). Canned and frozen fish, fruit and vegetables should not be confused with the so-called ultra-processed foods, which are typically high in energy, sugars, unhealthy fats and salt; low in essential nutrients including dietary fibre, protein, vitamins and minerals; and, by some definitions, with more than 5 ingredients. An added benefit of heat-treated be replaced by water (for tuna, vegetables). canned food is that additional preservatives are generally not needed, for instance even brine can be replaced by water (for tuna, vegetables).



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Nutritional effects of canning

It is assumed that much of a foods nutritional merit is lost on processing, but in fact, canning food locks in nutrients. Generally, protein, fats, carbohydrates, fat soluble vitamins and many minerals are little changed on canning. Canned tuna and sardines remain high in protein and omega-3 fatty acids. The loss of some water soluble and oxygen-labile vitamins (vitamins C & B), during high temperature canning is inevitable, but such losses also occur when fresh foods are stored, prepared and cooked!

Despite some thermal breakdown of nutrients during canning, a food-specific optimal blanching time (to both soften fruits/ vegetables and inactivate enzymes that would otherwise cause oxidation and microbial spoilage) is determined to maximise shelf-life, whilst preserving nutritional quality. Hence the remaining nutrients are much more stable over time compared to those in fresh or frozen products. For example, although vitamin C, folate and total antioxidant levels initially reduce on processing peaches, levels then stabilise and, at three-months values are higher in canned vs fresh peaches.

Canned mandarins and **canned tomatoes** are both high in vitamin C which contributes to the protection of cells from oxidative stress. It is too simplistic to judge nutritional quality only by a product's vitamin C content however and the full potential of canned foods must take account of the array of health-protective phytonutrients, some also with antioxidant properties, which may be around 50% more prevalent in canned foods vs their fresh equivalent.

Cooking or thermal processing of vegetables and fruits can increase, decrease, or change the form of the phytochemicals naturally present. High molecular weight phytochemicals break down to several smaller, low molecular weight compounds, thereby increasing the total phenolic contents and resultant antioxidant activities in the processed end-product. For example, thermal processing can increase the presence of certain natural carotenoids, such as lycopene, responsible for the red colour in tomatoes. Hence, cooking tomatoes, such as during canning (also ketchup, purees) makes lycopene more bioavailable than from fresh tomatoes, as heat breaks cell walls releasing the lycopene, ready for absorption. Lycopene's antioxidant properties have been the subject of much research to determine the scope of its health protective benefits.

Also, several canned fruits and vegetables, including tomatoes and mandarins have higher beta-carotene levels compared to fresh, which, along with beta-cryptoxanthin is responsible for the orange colour of citrus fruits. Similarly, dehydration helps maintain the stability of anthocyanins, responsible for the purple colour in prunes, which have a higher antioxidant capacity compared to fresh plums. It is also worth noting that moisture content changes during processing, cooking and storage, so making true comparison of a food across different formats more challenging. Comparisons based on the dry weight equivalents would reflect the true position.

Exactly how the phytonutrient profiles (and antioxidant status) of canned foods translate to health benefits will be dependent on the final bioavailability and consequent pathway of such compounds within the body and research continues to fully appreciate the health potential of these important compounds. We already know however that **canned sardines** and **tuna** are high in selenium; and **canned sardines** are a source of vitamin E, riboflavin and zinc, which, together with selenium all contribute to the protection of cells from oxidative stress.

Canned tuna & sardines and heart health

International dietary guidelines generally recommend consuming fish (particularly oily fish) twice per week, due to its beneficial role in reducing risk of cardiovascular disease (CVD). Canned oily fish is a useful, lower cost option for meeting this healthy eating goal, being more readily available, particularly in landlocked countries. **Canned tuna** is an especially useful option as it may appeal even to reluctant fish-consumer. Tuna is low in saturated fat. Reducing consumption of saturated fat contributes to the maintenance of normal blood cholesterol levels. Significantly, canned tuna in water is high in omega-3 fatty acids and a generous portion (115g) provides over 250mg of eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), which contribute to the normal function of the heart. (Tuna contains 25 mg EPA and 197 mg DHA per 100g). Tuna is also high in vitamin B12 and a source of vitamin B6, which contribute to normal homocysteine metabolism.

Sardines are high in omega-3 fatty acids. A daily intake of 250 mg of EPA and DHA contribute to the normal function of the heart and sardines contain 1100 mg EPA and 920 mg DHA per 100g. A recent randomised, controlled, intervention study has shown that consuming 200g/week **canned sardines** had a greater overall effect on reducing risk of developing type 2 diabetes (T2DM) and CVD in Spanish subjects, over 65yrs, with prediabetes, as measured across a broad range of parameters. Both groups received the same T2DM-prevention nutrition advice, but only one group also consumed canned sardines. Although both groups reduced their energy intakes and body weight over the 12 month study, only the group receiving the sardines also decreased blood pressure and increased their intakes of useful nutrients including omega-3 fatty acids, calcium, iodine, zinc, phospho-

Canned fish for bone health (tuna & sardines)

Canned tuna is high in protein, and a source of phosphorus and vitamin D, which contribute to the maintenance of normal bones. Vitamin D also contributes to the normal absorption and utilisation of calcium and phosphorus.

Canning sardines whole softens their bones, making them more edible. As such **canned sardines** are classed as high in calcium, which is needed for the maintenance of normal bones. They are also high in protein, phosphorus and vitamin D, and a source of zinc, which all contribute to the maintenance of normal bones.

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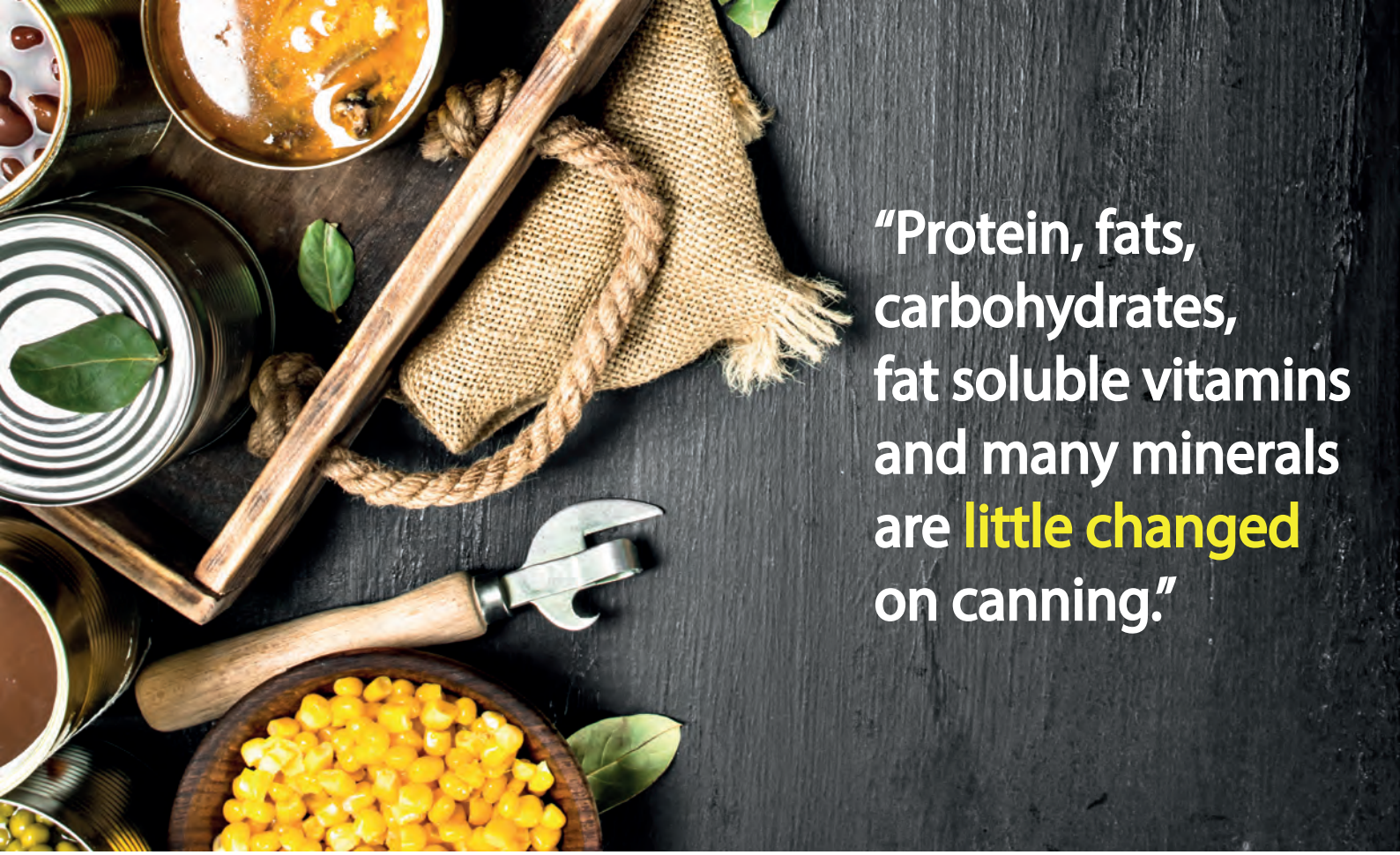

Canned food can improve diet quality

Evidence suggests that including canned food frequently into a healthy diet results in higher overall intakes of a wide range of nutrients, including those often failing to meet daily requirements e.g. fibre, calcium, potassium.

A US study demonstrated that children and adults who ate 6 or more canned items per week had higher intakes of 17 essential nutrients, compared with those who ate 2 or fewer canned items per week. Furthermore, consuming canned foods was associated with a greater likelihood of consuming nutrient-dense food groups such as fruits, vegetables, dairy and protein foods. Therefore, in addition to fresh foods, nutrient-dense canned foods have a legitimate place within healthy diet plans, augmenting nutrient intakes and diet quality.

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Salt, sugar, and preservatives

International healthy diet recommendations promote reducing salt and sugar intakes due to their association with increased risk of non-communicable diseases. Dependant on brands, salt, sugar and other natural or synthetic preservatives may be added to canned foods. A good plus point for canned food is the clarity of ingredient labelling, so consumers can check for added ingredients.

There are now many more canned foods packed in water rather than brine, or juice rather than syrup. However, where such options are less available, it is very effective to drain and rinse excess salt and sugar before consuming- simply rinsing off the brine on canned vegetables can reduce sodium content by up to 41%.

Tuna is high in vitamin B12 and a source of vitamin B6

Sardines are high in omega-3 fatty acids

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Why canned food wins on convenience

- Generally processed immediately post-harvest, thereafter the nutritional value is essentially locked-in, whereas fresh fruits & vegetables lose vitamins & minerals during storage post-harvest and preparation
- Can be stored easily/safely for several years, whereas the eating quality of fresh plant foods is limited over time/ short shelf-life.
- Require minimal & easier preparation time /cooking time once opened, as already cooked
- Tend to cost less than fresh products
- Time saver for ensuring balanced, varied meals, e.g. during busy (work) schedules
- An excellent store cupboard food, for emergencies and during times when access to shops to purchase fresh is more limited (e.g. illness, lockdown, extra guests)
- Clean/germ-free at the point of opening the tin
- Ambient storage

Convenience & cost effectiveness

Globally a balanced and varied, nutrient dense diet is key to health and this includes plenty of fruit, vegetables and salad. Assuming fresh is best overlooks the practical convenience attributes offered by canned food, as summarised below. The multifaceted convenience of canned fruit, veg and fish justify their role as positively contributing to healthy diet advice, specifically by supplementing fresh produce. Namely to make up some of the shortfall on meeting recommendations for 5-a-day fruit & vegetables and 2 portions of (oily) fish per week.

A 2014 study measured the cost and nutritional contribution (using nutrients per calorie) for 10 common fruits and 8 common vegetables in fresh, frozen, and canned formats and compared to average costs. Nutrient scores were similar for the vegetables and variable for the fruits across the 3 packaging options. Additionally, **canned vegetables** had a lower cost per unit compared with frozen and fresh; and **canned fruits** were either lower or comparably priced per unit. This nicely illustrates that both canned and frozen fruits and vegetables are nutritious, cost-effective choices for beneficially contributing to a healthy diet.

The convenience of canned foods is exemplified by the fact that canned tomatoes have become an essential staple in most kitchens, with a repertoire of sauce-based dishes better suited to canned rather than fresh tomatoes! Being high in fibre and vitamin C, whilst low in energy, fat, sugar and salt, **canned tomatoes** contribute nutritionally and gastronomically to healthy eating plans.

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Sustainability and food waste

It is now recognised that sustainability must be considered alongside nutritional health and eating local, seasonal produce is a key goal for more sustainable eating. Canned food does not detract however from the seasonality message, in fact it can assist that mindset as fresh fruit and vegetables can be canned at the point of harvest, ensuring availability all year. The energy cost of processing vs fresh needs to be considered as part of the full chain from farm to plate. One important indicator of sustainability is food waste, pertinently when considering the wasted resources used to produce any uneaten food (e.g. agricultural land, irrigation water, fertilizers, pesticides, etc).

Globally, enough food is wasted every year to feed nearly 2 billion people a 2,100 kcal/day diet. Understanding how and where food is wasted in the food system is crucial to changing this staggering waste of resources. One US study suggests 30% of the daily calories available for consumption are wasted. Specifically, the largest contributors to food waste were fruits and vegetables and mixed fruit and vegetable dishes in the home-making up over a third of the total weight of food wasted. Likewise, it seems higher quality diets currently create more food, water and pesticides waste, but less cropland waste, compared to other foods. This is due largely to fruits and vegetables, which depend on smaller amounts of cropland, but substantial agricultural inputs (per unit of land).

Simultaneous efforts to improve diet quality and reduce food waste are necessary and the role of canned and frozen fruit and vegetables in this planetary health re-education is a practical approach, alongside increasing consumer knowledge around how to prepare and store fruits and vegetables, so wasting less of these precious foods. Canned and frozen fruit and vegetables can help to bridge the gap between availability of seasonal options in the home and also potentially contribute to reducing some of the international transportation of fresh produce. Also canning or freezing fresh produce excesses offer a cost-effective option to ensure food waste is minimised at the farm gate.

Canned tuna offers a convenient, low cost, high protein contribution to a nutritious and sustainable diet. Usefully, tuna contributes to the improvement of iron absorption when eaten with other foods containing non-haem iron (when at least a 50g portion is consumed). It is also high in vitamin B12, and a source of vitamin B6, which contribute to normal red blood cell formation. What's more, tuna is high in niacin, which together with vitamins B6 and B12 contribute to the reduction of tiredness and fatigue.

Conclusions

A combination of fresh, canned, frozen and dried foods can maximise nutrition and offer a more cost efficient, sustainable and varied diet than perhaps has been appreciated until now.

Canned and frozen foods offer a convenient solution to contributing to global efforts to reduce food waste, by complementing seasonal, local, fresh produce and so increase total fruit, vegetable and oily fish intakes. As such they beneficially contribute to achieving important dietary recommendations. Basic staples including **canned tomatoes**, **sardines**, **tuna** and **mandarins** fit perfectly into the healthy, nutrient-rich, sustainable kitchen cupboard.

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