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# HEALTH IMPLICATIONS OF RANCID FATS AND OILS

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All food will deteriorate over time. For example, fresh fruits and vegetables can ferment, and fats and oils will go rancid.

There are concerns that consuming rancid fats and oils is damaging to health. Whilst more research is needed to establish impact of long-term consumption of rancid fats and oils, this article discusses some of the current evidence, factors that contribute to an oil becoming rancid and common sources of rancid oils.



## WHAT IS RANCIDITY?

Rancidity is the term used to describe the breakdown and deterioration of fats and oils. It involves various chemical reactions and results in unpleasant odours and flavours.<sup>1</sup>

The major mechanism through which a fat or oil becomes rancid is via “oxidative rancidity”. Oxidative rancidity arises from oxidation of unsaturated fats and oils. In this case, the oil breaks down due to exposure to oxygen and forms peroxides that subsequently are further transformed into products such as aldehydes, ketones and hydrocarbons.<sup>1</sup> These by-products contribute to the unpleasant flavours and aromas associated with rancid fats and oils.

## AN OIL IS MORE PRONE TO OXIDATION AND RANCIDITY IF IT IS:

- High in polyunsaturated fat – polyunsaturated fat is highly susceptible to oxidation due to double bonds, as this is where oxidative damage occurs.<sup>2,3</sup>
- Exposed to prolonged heat, light or oxygen.<sup>3</sup> Inadequate storage conditions for an oil can speed up oxidation through increased exposure to these factors.<sup>3</sup>
- Naturally low in antioxidants – antioxidants protect an oil from oxidising and are often added in limited permissible amounts to refined seed oils that are high in polyunsaturated fat to protect the oil from oxidising.<sup>4</sup>
- Refined or heavily processed – oil-processing methods affect an oil's oxidative stability through mechanisms such as removing antioxidants.<sup>3</sup>

## WHERE ARE RANCID FATS AND OILS FOUND?

Rancid fats and oils can be found in a variety of sources.

## WHAT SOURCES OF FATS AND OILS ARE MORE SUSCEPTIBLE TO RANCIDIFICATION?

Food sources of fats and oils that are more susceptible to rancidification include cooking oils that are higher in polyunsaturated fat as they are more susceptible to oxidative damage due to multiple double bonds.<sup>2,3</sup> Oils high in polyunsaturated fat include sunflower oil, corn oil, flaxseed oil and soybean oil. For a comparison of the fatty acid profile of common cooking oils, visit the Olive Wellness Institute at [olivewellnessinstitute.org](http://olivewellnessinstitute.org).

## HERBAL SUPPLEMENTS AND ESSENTIAL OILS

In terms of supplement products, herbal supplements and essential oils often contain “carrier oils”.<sup>5</sup> A carrier oil is the vehicle for the product, intended to preserve the potency and delivery of the active compounds within a substance.<sup>6</sup> For example, cannabidiol oil (CBD oil) is currently a popular supplement in the health and wellness world. It is extracted from the cannabis plant and then diluted with a carrier oil like coconut oil, hemp seed oil or extra virgin olive oil. Whilst coconut oil and extra virgin olive oil contain very little polyunsaturated fat, hemp seed oil is predominantly polyunsaturated fat, and therefore more prone to oxidation.<sup>7</sup> Additionally, extra virgin olive oil is high in natural antioxidants, which also protect oil from oxidation and rancidification.



## FISH OIL SUPPLEMENTS

Fish oil capsules are the most common non-vitamin, nonmineral supplement in the United States, taken by 10% of adults.<sup>8</sup> Fish oil is rich in omega-3, a polyunsaturated fat, and therefore readily oxidises. Multiple studies in countries such as Australia, the US, New Zealand and Africa show that many fish oil supplements readily available on supermarket shelves are oxidised.<sup>9-13</sup> All of these studies confirmed that the supplements tested were within stated expiration date.

A 2018 Australian study showed that **38% of 26 fish oil supplements** tested exceeded the limit for primary oxidation, as measured by Peroxide Value (PV), a key measure of an oils rancidity.<sup>9</sup> Supplements tested were bought off shelf, as consumers would purchase them, and mostly had at least one year until their expiry date.



38%

A comprehensive 2015 survey of fish oil supplements on the New Zealand market showed that **83% of 32 products** tested exceeded the recommended level of PV's, 33% by more than twofold.<sup>13</sup> A 2015 North American study looked at 171 fish oil supplement products and found that 50% exceeded the voluntary recommended levels for markers of oxidation.<sup>10</sup>



83%

## WHAT ARE THE HEALTH IMPLICATIONS OF CONSUMING RANCID FATS AND OILS?

Consuming rancid fats and oils may reduce the nutritive value of the food by destroying vitamins such as Vitamin A and E.<sup>14, 15</sup> There is also evidence to show that decomposition products produced by oxidised oil may be detrimental to health and have been linked to the development of neurodegenerative conditions such as Alzheimer's and Parkinson's Disease.<sup>16-19</sup>

In animal studies, exposure to oxidised oils and fats has been shown to cause harm including growth retardation, organ toxicity, accelerated atherosclerosis, reduced immunity parameters, high newborn mortality and increased maternal insulin resistance.<sup>20-23</sup>

Evidence into the impact of consuming rancid oils in humans is mixed. A 2016 Randomised Control Trial (RCT) in healthy subjects suggested that short-term consumption of oxidised fish oil may not have a negative impact at the molecular level.<sup>24</sup> On the flip side, more oxidised fish oils may be less effective in reducing chronic disease risk factors. A 2013 RCT found that consuming less oxidised fish oil reduced circulating cholesterol and triglycerides more so than more oxidised fish oil.<sup>25</sup>

The impact of long-term exposure to rancid oils (i.e. consuming for months or years) has not been investigated rigorously.<sup>25</sup> However, the current body of evidence suggests long term exposure to lipid oxidation products in doses seen in fish oil supplements, for example, are likely to have adverse effects on inflammation, oxidative stress and lipid metabolism.<sup>26</sup>

A longer running 2007 North African study looked at food items that were associated with Nasopharangeal Carcinoma (NPC) and found that rancid butter and rancid sheep fat were associated with significantly increased risk of NPC.<sup>27</sup> North Africa is one of the major NPC endemic regions. The large-scale case-control study looked at over 600 cases and 600 controls over a period of four years.



## CONCLUSION

Although the impact of consuming rancid fats and oils in humans is yet to be fully elucidated, animal studies indicate that consuming rancid oils is detrimental to health. Therefore, people should avoid consuming rancid oils where they can.

## WAYS TO ACHIEVE THIS INCLUDE:

- Select fats and oils from a reputable trusted source.
- Favour an oil that is lower in polyunsaturated fat such as extra virgin olive oil or coconut oil, as polyunsaturated fat oxidises more readily.
- Choose an oil that is high in natural antioxidants, such as extra virgin olive oil.
- Select a packaging size that allows full utilization of the oil within 4-6 weeks depending on family size and consumption patterns.
- Store cooking oils and oil supplements in a cool dry place and use within the best before date.
- In the case of fish oil supplements, look to the studies that review oxidation of specific brands in various countries, or look to meet omega-3-fat recommendations through food sources where possible.

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