THE BENEFITS OF OATS

ceereal
European Breakfast Cereal Association

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EXECUTIVE SUMMARY

The health benefits of oat products are widely accepted and scientifically founded. However, their role as contributors to healthy diets and sustainable food systems is still undervalued. The aim of this brochure is to highlight the nutritional value of oats and oat products as well as their contribution to healthy soils and sustainable food systems.

It also sheds light on how these benefits can be communicated under current regulations to make the healthy choice the easy choice for people.

Breakfast cereal manufacturers and oat millers across Europe offer a wide variety of oats-based and other grain-based products responding to the needs of consumers regarding their dietary requirements, cultural habits and expectations regarding taste and structure.

Whereas the focus of this brochure will be on pure oat products, i.e., oats as an ingredient in breakfast cereals, it is worth noting that other oats-based products can make a substantial contribution to people's healthy diets.

This brochure puts forth three areas where oat products can make important contributions:

1. **HEALTHY DIET** describes the nutritional value of oat products. The intake of oats is associated with lower risks of cardiovascular disease, type 2 diabetes, obesity and promotes digestive health – to name but a few.

2. **HEALTHY CHOICE** explains which health claims can be used to communicate the benefits of oats towards consumers based on European regulations, and why consumers can barely find them on pack.

3. **HEALTHY SOIL** looks at the contribution of oats to sustainable soils and food systems: Oats require few inputs regarding fertilisers, weed and pest control. They can be used as natural herbicide and are suitable for various climates and poor soil.

The brochure concludes with recommendations how to foster an increased intake of oats products among the population, including by providing the right policy framework.

WHAT OATS ARE

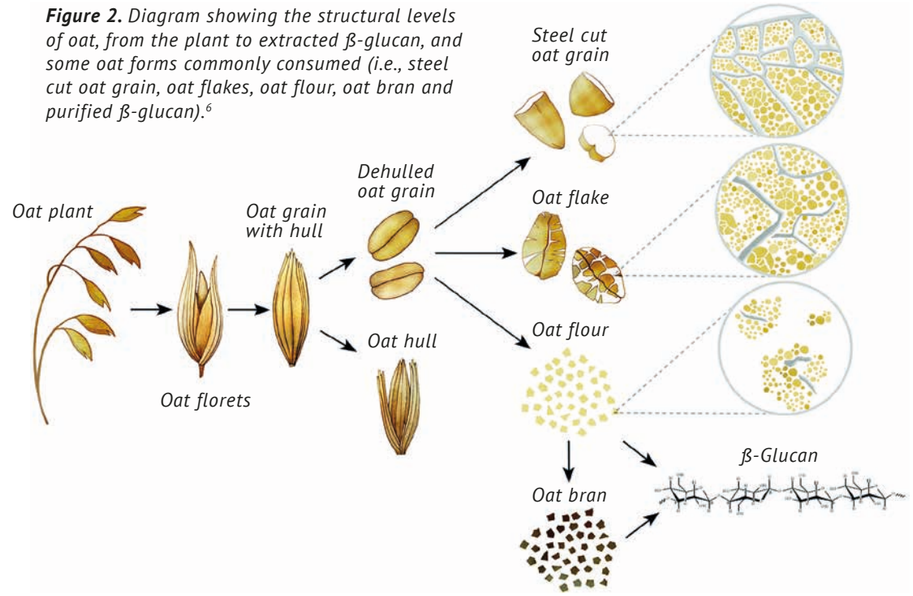
Oats are whole cereal grains coming from the Poaceae grass family of plants. They are nutrient-dense and a source of vitamins, minerals, fibre, and protein. They contain some unique components, in particular the beta-glucan soluble fibre, as well as bioactive substances, like avenanthramides and other phytochemicals.

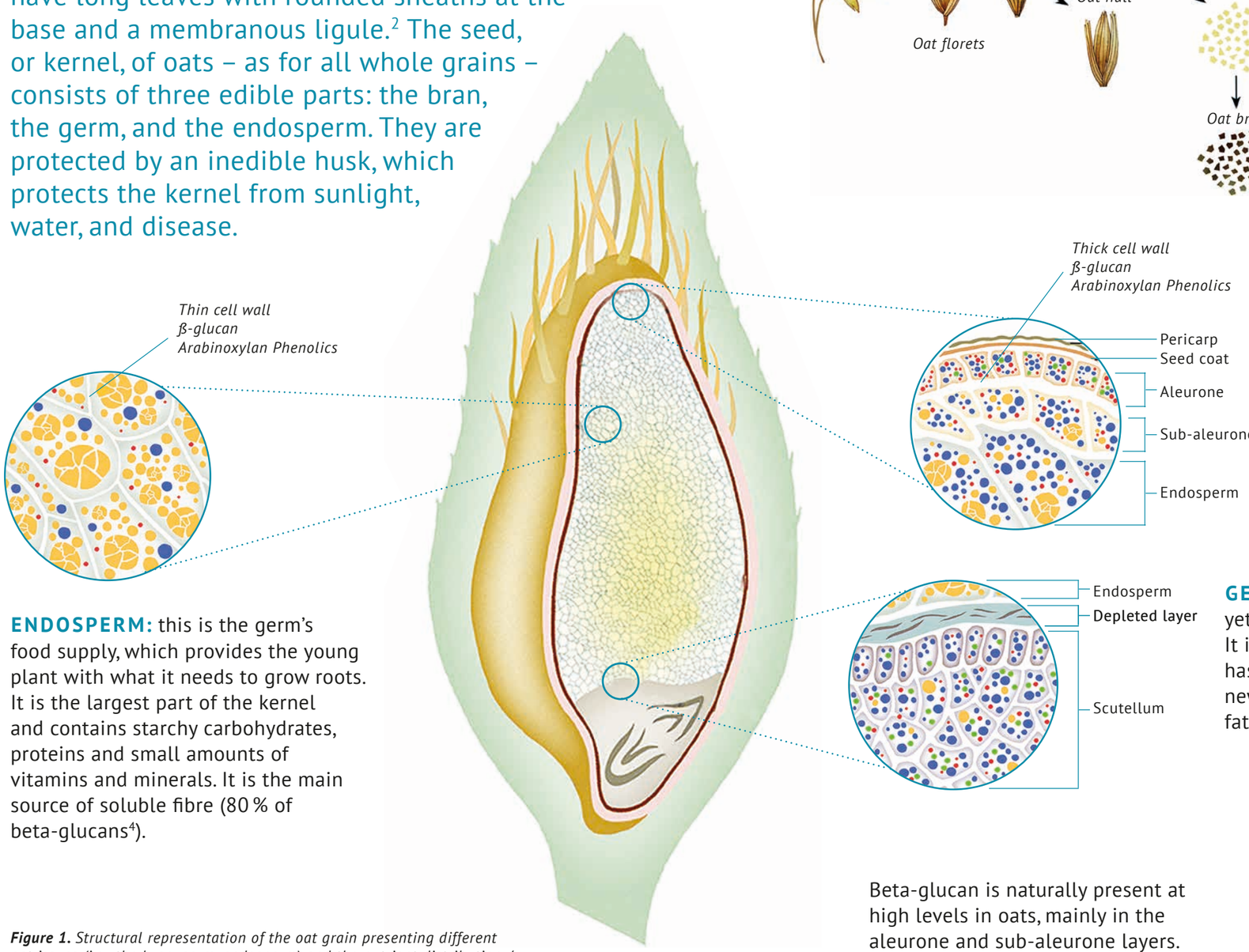
When we speak of oats, we mainly refer to Avena sativa and its grain, which is the edible seed of oats grass. Only four types of oats have been cultivated. However, there are many different species of wild oats.[1]

WHAT OATS LOOK LIKE

Oat plants can reach 1.5 metres in height and have long leaves with rounded sheaths at the base and a membranous ligule.[2] The seed, or kernel, of oats – as for all whole grains – consists of three edible parts: the bran, the germ, and the endosperm. They are protected by an inedible husk, which protects the kernel from sunlight, water, and disease.

Figure 2. *Diagram showing the structural levels of oat, from the plant to extracted ß-glucan, and some oat forms commonly consumed (i.e., steel cut oat grain, oat flakes, oat flour, oat bran and purified ß-glucan).*[6]





BRAN: the outer layer of the edible kernel, which is rich in fibre, B-vitamins and phytochemicals.

ENDOSPERM: this is the germ's food supply, which provides the young plant with what it needs to grow roots. It is the largest part of the kernel and contains starchy carbohydrates, proteins and small amounts of vitamins and minerals. It is the main source of soluble fibre (80 % of beta-glucans[4]).

GERM: the most nutrient-rich part yet makes up only 4 % of the kernel. It is the "embryo" of the plant, which has the potential to sprout into a new plant. It contains proteins, healthy fats, B-vitamins and minerals.[3]

Beta-glucan is naturally present at high levels in oats, mainly in the aleurone and sub-aleurone layers.

- Compound starch granule
- Single starch granule
- Protein
- Lipid
- Phytin

Figure 1. *Structural representation of the oat grain presenting different oat issues (i.e., the bran, germ, endosperm) and the nutrient distribution / organisation within these tissues.*[5]

HOW OATS ARE PREPARED

When the raw oats arrive at the mill, they are cleaned and sieved in order to remove any other grain variety or seeds, which may have found its way into the delivery. The oats are then dehulled because the outer, inedible husk is tightly connected to the kernel.

Depending on the desired final product, oats are then kilned, steamed and dried again. The drying changes their physical properties in a way that the grains can then be rolled into flakes.

HOW OATS ARE CONSUMED

Unlike most other cereals, oat products are almost always consumed as the whole grain either in the form of whole rolled oats, oat flakes or oatmeal. This is the case whether they are consumed directly (e.g., as oat porridge) or when they are consumed as an ingredient in other foods (e.g., muesli). Oats come in a variety of forms:

OAT GROATS/ KERNELS:
These are the most intact form of oats and take the longest time to cook. Their kernels are cleaned, and only the inedible hull is removed. The germ, endosperm and bran are still intact.

STEEL-CUT OATS:
The oat groats/kernels are cut in two of three smaller pieces using a steel blade. For the typical Scottish oatmeal, oats are stone-ground instead of steel-cut.

ROLLED OATS:
The oat groans/kernels are steamed, rolled, and flattened into flakes, then dried to make them shelf stable. The longer they are steamed and the thinner the pieces they are rolled into, the faster they cook.

OAT FLOUR is often used in baking, e.g., to make cookies or puddings, or for thickening soups and stews.

OAT BRAN is primarily the bran, without the germ or endosperm, and is not considered whole grain.

OAT MUESLI:
Rolled oats are mixed with other ingredients.

OAT GRANOLAS:
Rolled oats are toasted and combined with other ingredients into a crunchy cluster.

OATS ARE ALSO USED FOR PRODUCTS, such as oat drinks, meat-replacing products, or oat bread. These oat products can be made from a variety of oat ingredients. For example, oat drinks can be made from whole kernels, steel-cut oats, rolled oats or oat flour.

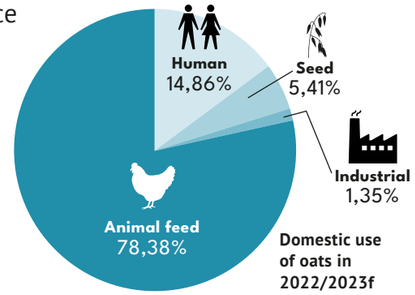
WHERE OATS COME FROM

Archaeological discoveries found that oats have been consumed by humans for a long time, and far before they were being domesticated.[7]
In Italy, traces of wild oats were found in a cave of hunter gatherers approximately 32,000 years ago. Oats are believed to have made their way to Europe as a "stowaway" or admixture of the wheat and barley seed trade and were viewed as weeds. Yet, they were soon found to be well adapted to Europe's cool and wet environment, and by the first century became a prominent crop. The Romans introduced oats to the British Isles, and they particularly flourished in Scotland.
In the early 17th century, oats travelled to North and South America with European immigrants.[8]
With industrialisation, oats production decreased significantly, and has more than halved in land area dedicated to oat production since 1960.[9]

OATS IN EUROPE

Although oats are grown worldwide, they are predominantly produced in temperate regions, such as Northern Europe, Russia, the USA, and Canada.[10,11] In the past, however, hardly any oats from countries outside the European Union (EU) were processed in the EU due to an import duty.

In 2020, Poland, Spain, Finland and the United Kingdom were the biggest producers of oats (within the EU-27 plus UK). Of this, approximately 1 million tonnes (13 %) – grown mainly in Finland, Germany, Sweden, and Ireland – will be processed as milling oats, while the majority of over 5 million tonnes will be used as animal feed oats.[12] Spain and Poland mainly produce animal feed oats.[13,14]
In 2020, within the EU still including the United Kingdom, Poland, Spain, Finland, and the UK were the biggest producers of oats.[15]



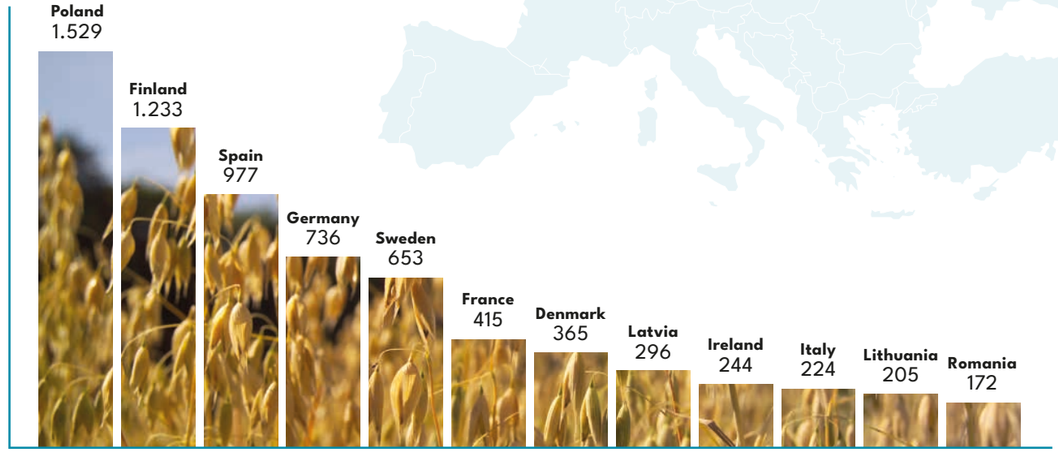
EU-27 OATS BALANCE SHEET

	2016/ 2017	2017/ 2018	2018/ 2019	2019/ 2020	2020/ 2021	2021/ 2022e	2022/ 2023f
Beginning stocks	**1,0**	**0,3**	**0,3**	**0,2**	**0,4**	**1,2**	**1,4**
Gross production	**7,3**	**7,3**	**6,9**	**6,9**	**8,5**	**7,6**	**7,7**
Usable production	**7,2**	**7,2**	**6,8**	**6,9**	**8,4**	**7,5**	**7,6**
Imports	**0,0**	**0,0**	**0,0**	**0,1**	**0,0**	**0,2**	**0,1**
Availability	**8,3**	**7,6**	**7,1**	**7,2**	**8,8**	**8,9**	**9,0**
Domestic use	7,8	7,0	6,8	6,5	7,4	7,3	7,4
– Human	1,0	1,2	1,0	1,0	1,1	1,1	1,1
– Seed	0,5	0,4	0,4	0,4	0,4	0,4	0,4
– Industrial	0,1	0,1	0,1	0,1	0,1	0,1	0,1
– Animal feed	6,3	5,3	5,3	5,1	5,8	5,7	5,8
Losses (excl. on–farm)	**0,1**	**0,1**	**0,1**	**0,0**	**0,1**	**0,0**	**0,0**
Exports	**0,2**	**0,2**	**0,1**	**0,2**	**0,1**	**0,2**	**0,2**
Total use	**8,0**	**7,3**	**7,0**	**6,8**	**7,5**	**7,5**	**7,6**
Ending stocks	**0,3**	**0,3**	**0,2**	**0,4**	**1,2**	**1,4**	**1,4**
– Market	0,3	0,3	0,2	0,4	1,2	1,4	1,4
Self–sufficiency rate (%)	***93***	***103***	***100***	***105***	***114***	***103***	***103***

Figure 4. *EU-27 oats balance sheet (million tonnes).*[16]

OATS GROSS PRODUCTION IN 2022

(thousand tonnes)



EU-27 OATS GROSS PRODUCTION

	2016	2017	2018	2019	2020	2021	2022f	VARIATION (%) 2022/ 2021	VARIATION (%) 2022/last 5-year av.
EU	**7.321**	**7.322**	**6.887**	**6.945**	**8.473**	**7.551**	**7.692**	**1,9**	**5,8**
Belgium	16	18	18	20	18	17	17	2,8	– 6,2
Bulgaria	31	32	24	31	30	24	27	14,5	– 5,0
Czechia	132	142	153	134	183	195	166	-14,6	4,3
Denmark	278	322	290	250	431	339	365	7,8	15,2
Germany	536	577	578	519	722	767	736	-4,0	17,6
Estonia	65	89	78	97	118	78	94	20,8	6,0
Ireland	183	205	122	203	190	237	244	3,0	22,4
Greece	118	95	81	79	78	75	74	-1,0	– 6,7
Spain	1.110	843	1.487	808	1.324	1.198	977	-18,5	– 12,9
France	346	537	428	407	390	486	415	-14,6	– 5,8
Croatia	80	68	45	58	65	59	58	-1,4	– 4,3
Italy	261	229	243	238	243	233	224	-4,0	– 5,8
Cyprus	0	0	0	0	0	0	0	12,0	– 2,3
Latvia	146	134	188	238	288	183	296	61,6	45,6
Lithuania	155	196	182	178	276	170	205	20,2	10,4
Luxembourg	5	6	7	7	8	7	7	5,3	3,5
Hungary	104	95	59	70	77	66	54	-18,5	– 24,2
Malta	0	0	0	0	0	0	0		
Netherlands	7	7	7	8	8	7	5	-36,7	– 36,0
Austria	95	77	75	78	84	89	84	-5,3	5,7
Poland	1.358	1.465	1.166	1.233	1.658	1.656	1.529	-7,7	5,4
Portugal	66	46	56	50	47	38	29	-25,0	– 40,0
Romania	381	408	384	362	197	245	172	-29,8	– 47,9
Slovenia	4	5	3	4	3	4	4	-0,9	6,0
Slovakia	36	35	30	32	33	38	26	-32,6	– 23,1
Finland	1.035	1.014	818	1.170	1.195	790	1.233	56,0	23,2
Sweden	772	676	364	671	808	552	653	18,2	3,1

Figure 5. *EU-27 Oats gross production (thousand tonnes).*[17]

HEALTHY DIET

Oats are unique in their nutritional density and composition. Oats are high in protein, are low in sugars and salt, and contain important vitamins and minerals, as well as phytochemicals. Many of the positive effects of oats are related to the fibre content, in particular the beta-glucan fibre. Oats are naturally whole grain and come with all the benefits related to whole grains.[18]

This gives oats an important place in people's diets. Research into the benefits of oats have found that they can play a protective role against major chronic diseases, such as obesity, high blood pressure, type 2 diabetes, cardiovascular disease, and metabolic syndrome.[19]

The consumption of oats is a convenient way to help populations meet dietary recommendations:

1. **MICRONUTRIENTS, I.E., VITAMINS AND MINERALS:** oats provide a rich source of manganese, biotin, phosphorus, magnesium, copper, and a source of iron, zinc, potassium, and folate.[20]

2. **PHYTOCHEMICALS:** whole oats contain various plant chemicals, including avenanthramides, which have anti-inflammatory qualities,[21] phenolic compounds and phytoestrogens that may contribute to reducing the damaging effects of chronic inflammation that is associated with various diseases like cardiovascular disease and diabetes.[22,23]

3. **FIBRE & BETA-GLUCANS:** Oat milling products are high in soluble fibre and are particularly rich in the non-starch polysaccharides beta-glucans.[24,25,26,27,28] Soluble fibre represents approximately 55% of oat dietary fibre, the majority of which is in the form of beta-glucans. Beta-glucans naturally occur in the bran of cereal grasses; in oats mostly in the endosperm.[29] Their main characteristics are solubility and viscosity. Scientific research has suggested a relationship between oat fibre and the following health benefits:

- Decrease of total and low-density lipoprotein (LDL) blood cholesterol levels, thereby contributing to a lower risk of cardiovascular diseases.[30,31,32,33,34]
- Maintenance of healthy blood glucose levels by stimulating a lower glycemic response,[35,36,37,38,39,40,41] thereby contributing to a lower risk of type 2 diabetes.
- Promotion of gut health.[42,43,44,45,46,47]
- Assistance with weight management though calorie and fat reduction in foods and promotion of satiety.[48,49,50,51,52,53,54]

Despite robust scientific evidence on the health benefits of consuming adequate fibre,[55] across the globe reported dietary intakes of fibre are substantially lower than recommended. Wholegrain oats are a simple way for populations to eat more whole grains and fibre in line with dietary guidelines.

NUTRITIONAL COMPOSITION OF ROLLED OATS AND OATMEAL

Nutrients		Rolled oats (100g)	Rolled oats (40g)	Oatmeal (100g)
Energy	kcal	368	147	388ww
	kJ	1550	620	1644
Protein	g	13.5	5.4	14.2
Fat	g	7	2.8	7.15
Carbohydrate	g	58.7	23.5	67.9
of which sugars	g	0.7	0.3	0.61[57]
Dietary fibre	g	10	4	5*
Sodium	mg	6.8	2.7	6
Potassium	mg	397	158.8	268
Calcium	mg	43	17.2	55
Magnesium	mg	130	52	131
Phosphorus	mg	430	172	405
Iron	mg	5.8	2.3	4.2
Copper	mg	0.53	0.21	0.23[57]
Zinc	mg	4.3	1.7	3.3[57]
Selenium	µg	9.7	3.9	8.6[58]
Vitamin E	mg	1.5	0.6	0.94[57]*
Thiamin	mg	0.59	0.24	0.56
Riboflavin	mg	0.15	0.06	0.12
Nicotinamide	mg	1	0.4	0.93
Vitamin B_6	µg	160	64	200
Folic acid	µg	87	34.8	60*

**tocopherol equivalent*

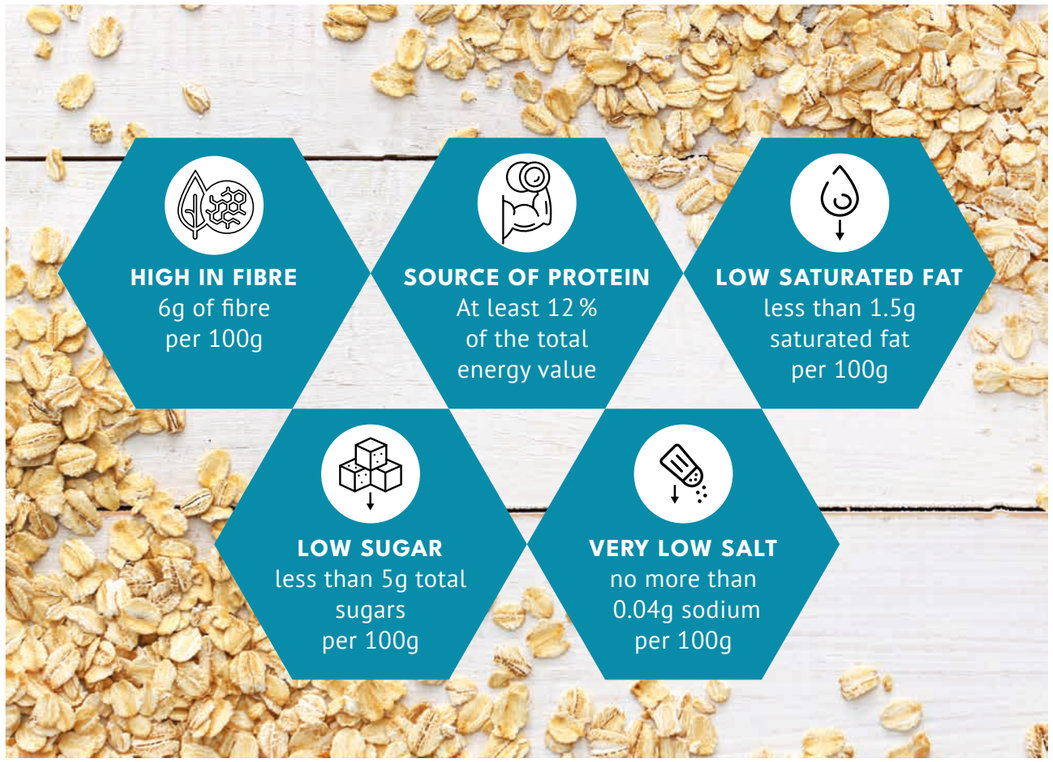
Figure 6. Nutritional composition of rolled oats and oatmeal.[56]

HEALTHY CHOICE

Claims about the relationship between food and health (health claims) and claims that suggest that a food has beneficial nutritional properties (nutrition claims) are regulated by the European Union and need authorisation to their use. The European Food Safety Authority (EFSA) is responsible for evaluating the scientific evidence supporting health claims.

Nutrition claims are only permitted if they are listed in the Annex of Regulation EC 1924/2006.[59] The annex specifies, which requirements products need to fulfil so that a claim can be used. For example, "high in fibre" can only be used where the product contains at least 6g of fibre per 100 g or at least 3g of fibre per 100 kcal. Nutrient amounts will vary across oats products and, therefore, claims can only be used were applicable.

EXAMPLES OF NUTRITION CLAIMS APPLICABLE TO OATS.



Given the specific nutritional composition of oats, also other claims can be used (when applicable), for example "high in biotin", "high in thiamin, vitamin B1", "source of folate", "source of zinc", "source of iron".

Four health claims related to oats have been approved: two relating to the maintenance or reduction of blood cholesterol, one relating to oat dietary fibre and its effect on increase faecal mass, and one relating to post-prandial blood glucose.

FOUR KEY HEALTH CLAIMS BEEN APPROVED FOR OATS.

Claim	Explanation	Claim criteria / Conditions of use
ART.14(1) OAT BETA-GLUCANS (decreases the risk of disease)[60]	Oat beta-glucans have been shown to lower/reduce blood cholesterol. High cholesterol is a risk factor in the development of coronary heart disease	3g beta-glucans per day or min. 1g beta-glucans per portion
ART. 13(1) BETA-GLUCANS (general function)[61]	Beta-glucans contribute to the maintenance of normal blood cholesterol levels	3g beta-glucans per day
ART. 13(1) OAT GRAIN FIBRE (general function)[62]	Oat grain fibre contributes to an increase in faecal bulk	6g of oat grain fibre per 100g or at least 3g of oat grain fibre per 100kcal
ART.13(1) BETA-GLUCANS FROM OATS AND BARLEY (general function)[63]	Consumption of beta-glucans from oats or barley as part of a meal contributes to the reduction of the blood glucose rise after that meal	4g beta-glucans per 30g carbohydrates of a meal's portion

Often, however, consumers will not find the above-mentioned health claims on the package. This is mainly due to the following reasons:

- The product must achieve the conditions of use laid out in the EFSA opinion, i.e., reaching a certain amount of, e.g., beta-glucans per day or per portion, in order to bear the claim. However, the beta-glucan content varies among different types of oats and is impacted by growth, storage, and production.[64,65,66] This variance between crops can cause challenges ensuring these conditions are consistently met.

- In addition, authorising health claims in Europe is a complex and rigorous process. Much of the scientific research has shown beneficial effects of the consumption of oats products on health beyond the current permitted EFSA authorised health claims. However as these are not authorised benefits it is not possible to make these claims.

The limited possibility to use these health claims makes it difficult for manufacturers to promote the benefits of oats to consumers. Instead, there is a reliance upon existing consumer awareness and understanding of these benefits.

HEALTHY SOIL

Not only do oats have nutritious benefits, but they also have a multitude of agronomical and environmental benefits.

Oats are highly adaptable to poorer soil and climatic differences.[67] As an annual plant, they are planted in spring for the early autumn harvest in colder regions. However, they can also be planted in autumn for the summer harvest in warmer areas. When planted in spring, the oats go dormant during the summer; when planted in autumn, they remain unaffected by late frosts or snow. Red oats, which are more heat tolerant, are mainly grown in warmer climates, though most oats are grown in cool temperate regions.[68]

Oats are not only adaptable to different climates, but also to poorer soils. With good water supply, oat crops will grow on soils, that are sandy, low in fertility and highly acidic.[69,70]

Their higher performing root systems grow deeply and can break down and absorb nutrients from the soil. As well as contributing significant carbon back into the soil, these roots are important for the development of soil structure, particularly in zero and minimum-tillage farming.

Oats also play an important role in weed control. When grown as weed barriers or starter crop, they can act as a natural herbicide by choking out most weeds.[71,72]

Their root network and resistance to diseases and pests also results in minimum amounts of fertiliser and crop protectants required to achieve high yields.[73] Fungicides are usually not needed.

Oats can also contribute to healthy crop rotations and healthy soils when added as cover crop to the rotation (so-called “break crop”). Greater plant diversity can help suppress weeds, break pest cycles, reduce the need for fertilisers and pesticides also for other crops within the rotation, and increase crop productivity.[74]

Across all foodstuffs, cereals have lower greenhouse gas emissions footprints than other agricultural products, such as meat and dairy. Within cereal cultivation, the intensive cultivation of soil, the use of fertilisers, and liming serve to increase CO_2 emissions. Oats are a sustainable crop because they reduce these intensities.[75,76,77,78]

CONCLUSIONS

The benefits of oats products and their positive contribution to people’s diets and sustainable food systems cannot be highlighted enough.

Their unique nutritional density and composition gives them an important place in people’s diets and provides good reasons to shift towards a more plant-based diet. Providing a valuable source of essential nutrients, oats can play a role in addressing deficiencies in European population that currently do not meet recommended intake levels, for example, for vitamins, minerals, or fibre.

Unfortunately, to date, it is difficult to communicate these health benefits to consumers, as either the thresholds for using health or nutrition-related claims are too high or he claims that can be used are too complex to be easily understood.

Oats can make a significant contribution to sustainable food systems given their quality as “break crop”, weed suppressant and their reduced need for fertilisers and pesticides.

Given EU developments, such as the Farm to Fork Strategy[79] and the EU’s quest towards more sustainable food systems, more attention should be paid to oats and its multiple benefits.

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