



Food Brain Predicts...

Trends

2023 & Beyond

About Spoonshot

- Food & beverage intelligence company
- Rich insights powered by our AI, #foodbrain
- Leveraging 28K+ external, diverse data sources
- Specialized research platform for consumer needs, trends, and opportunities



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Trends 2023...Let's Go!

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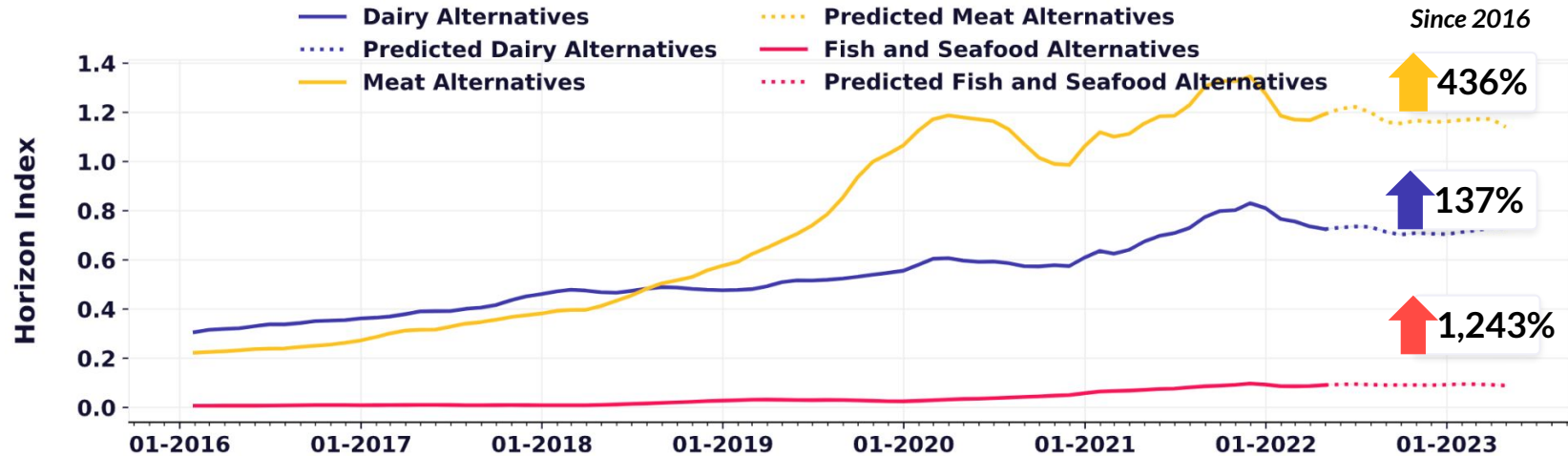
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Urgen-sea

The need for seafood alternatives has become imperative.

An alternative future for food emerges

Interest in dairy, meat, and fish alternatives



262% Growth in interest in alternative foods between Jan 2016 and April 2022

Interest in alternative foods is growing

What was once seen as a fringe offering for a very niche audience is now front-and-center strategy for brands across the industry, even for segments that would normally consider these products to be direct competition.

Interest in alternative foods has grown by over **3.5X** between Jan 2016 and April 2022. Spoonshot measures interest as the occurrence of a particular topic over time based on articles and blogs published in the media.

Further analysis of the alternatives space shows that the bulk of these alternatives is in the dairy and meat space.



Interest in these two broad categories is driven by perceived health benefits, concerns over animal welfare, and the breakout star driver, sustainability.

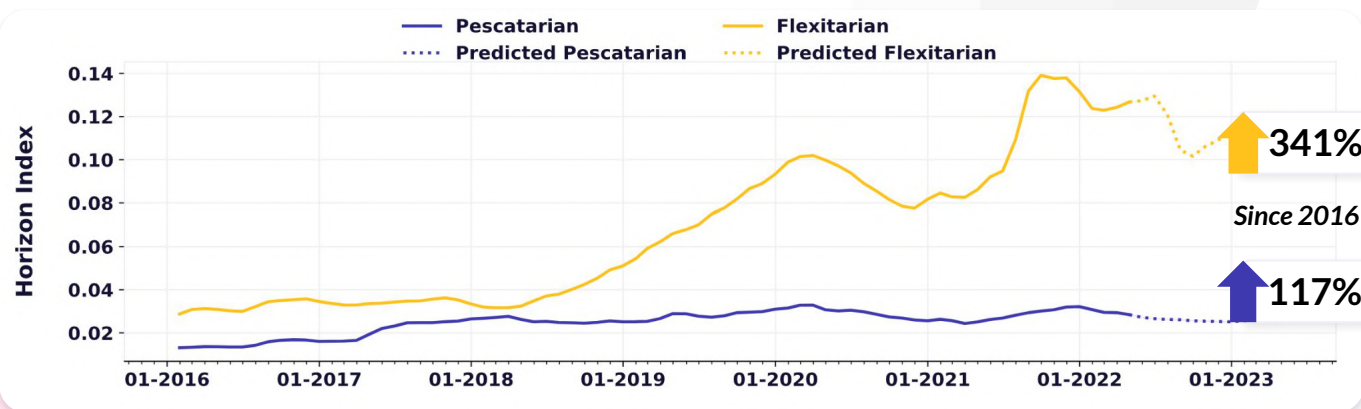
And alternative fish and seafood is where we expect to see the next big growth spurt in terms of innovation - not because it's sort of obvious, but more importantly, because there is greater urgency for fish alternatives than meat alternatives.

Consumers are reducing meat, but not fish

Flexitarian diets are gaining more popularity as consumers try to consume less meat and less frequently. Red meat consumption has been linked to various health and climate issues and factory farming has raised concerns about the overuse of antibiotics and the spread of new diseases.

Global fish consumption has doubled since 1998, and it is projected to go up by another 80% by 2050.

Interest in select diets



Only 2% of conversations on fish and seafood also mentioned vegan.

Fish consumption is growing

Global fish consumption has already doubled since 1998, but [new research](#) from Stanford projects this to go up by another 80% by 2050.

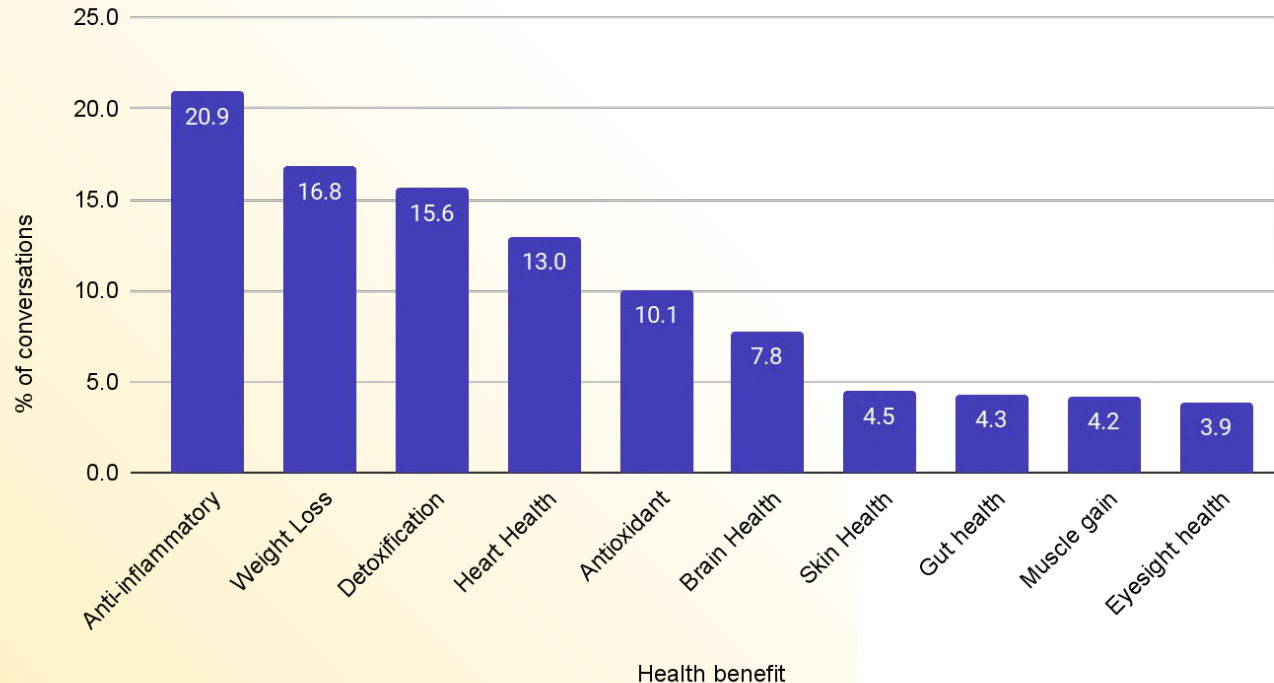
Spoonshot data shows that interest in pescetarian diets - not consuming meat, but consuming fish and seafood - is on the rise, more than doubling (117%) since 2016 and growing by 9% in the 12 months to April 2022.

Interest in flexitarian diets grew by 341% since 2016 and by 38% in the last 12 months. Flexitarian diets are gaining more popularity as consumers try to consume less meat and less frequently. Too much red meat consumption has been linked to various health issues and factory farming has raised concerns about the overuse of antibiotics and the spread of new diseases.

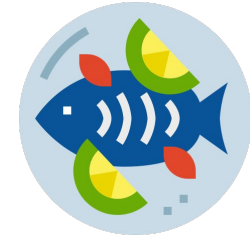


Fish is sought after for its health benefits

Top health benefits linked with fish in online consumer conversations



Top nutrients consumers associate with fish and health together



Protein - 20.7%

Low-carb - 8.8%

Low-calorie - 8.6%

Omega 3 - 4.0%

Global fish populations are dwindling

90%

of marine fish populations have been fully used, overused, or are under severe threat

One third

of global freshwater fish populations are in danger of extinction

Main reasons for declining fish and seafood populations:

- Growing global consumption
- Overfishing and unsustainable fishing practices
- Rising ocean temperatures
- Pollution

Fish populations are declining

Unlike livestock, whose populations are projected to double by 2050, freshwater and ocean fish populations are dwindling at alarming rates.

Some estimates say that 90% of marine fish populations have been fully used, overused, or are under severe threat as a result of overfishing. 90% of predatory fish such as cod, sharks, tuna, and swordfish have already disappeared from our oceans. If the world continues at its current rate of fishing, there will be no fish left by 2050.

Freshwater fish are facing similar issues. A study by a group of global conservation organizations assessed that as many as a third of global populations are in danger of extinction.

Populations of migratory freshwater fish have declined by 76% since 1970, and large fish – those weighing more than 30kg – have very nearly been wiped out in most rivers. The global population of megafish - those that weight more than 100 kg - is down by 94%. Sixteen freshwater fish species were declared extinct in 2020.



Reasons for and impact of declining fish resources

Main reasons for declining fish and seafood populations:

- Growing global consumption
- Overfishing and unsustainable fishing practices
- Overheating waters
- Pollution

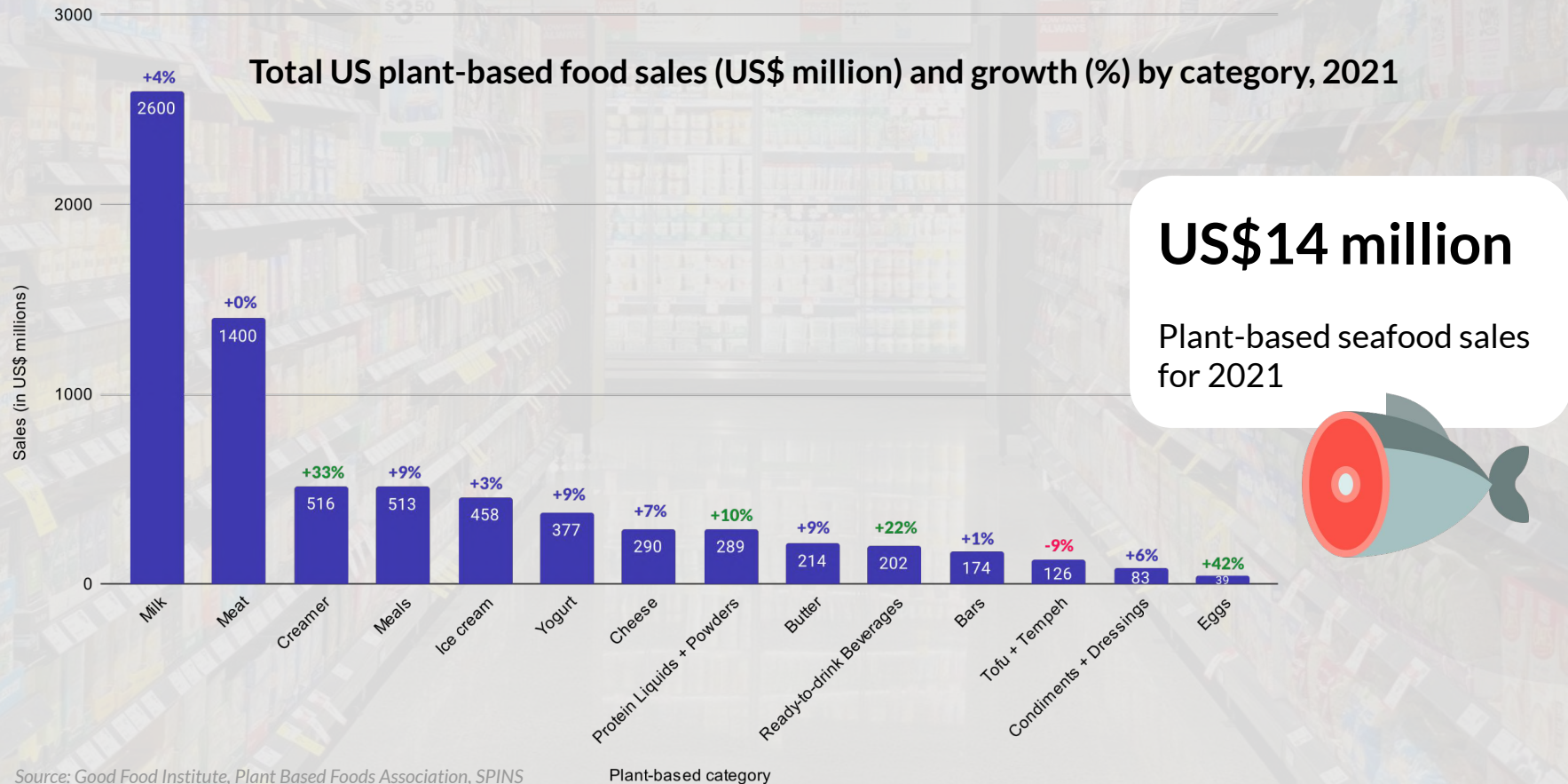


Given these issues, it is imperative that we focus on alternatives for fish and seafood.

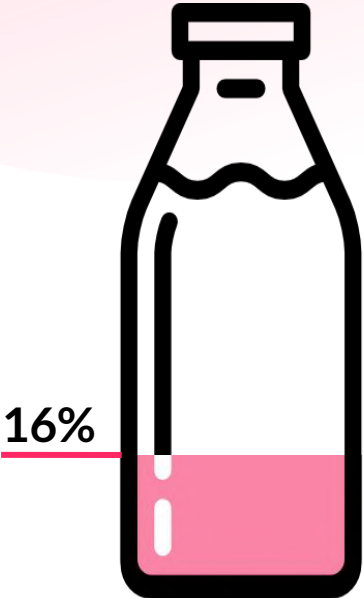
The impact of all of this is being felt right now.

- Fish prices have gone up, as with most other foods, thanks to a combination of supply chain issues and the Russia-Ukraine war. In the [UK](#), a recent report said that the average price of fish and chips has gone up by 21% and over 3,000 fish and chip shops may be forced to shut down as this inexpensive dish starts to go out of reach for many.
- Due to pollution, microplastics and toxins are finding their way into several species of ocean and freshwater fish, which then enter our food chain.

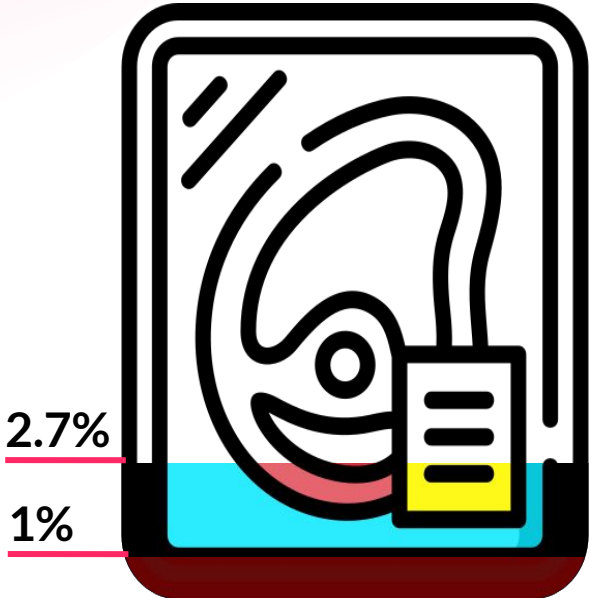
Plant-based seafood is still a very small space



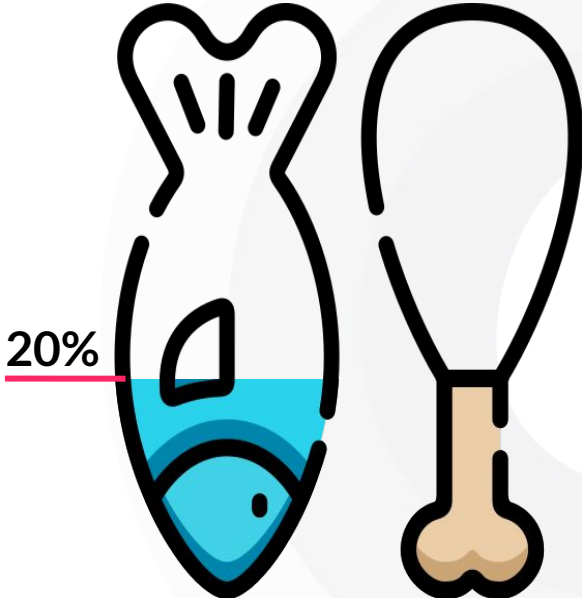
Share of different plant-based foods in the US, 2021



Plant-based milk: **16%** of retail milk sales



Plant-based meat: **2.7%** of retail packaged meat sales
Plant-based seafood: **1%** of plant-based meat



Conventional seafood: **20%** of total meat and seafood sales

Source: Good Food Institute, Plant Based Foods Association, SPINS

Sophie's Kitchen finds growing interest in alt seafood

“Plant-based seafood can be nutritionally equivalent or superior to conventional seafood. A study by Kelton Global commissioned by non-profit organization and alternative-protein advocate *The Good Food Institute* found nearly three in four consumers are interested in alternative seafood.

Along with growing consumer interest in plant-based foods, factors like the high incidence of seafood allergies and the high price points of many seafood products—especially products that are consumed raw and thus pose special consumer risks—generate a sizable number of highly motivated early adopters and market entry points for alternative seafood products. Additionally, after learning about plant-based and cultivated seafood, 42 % of respondents said they found plant-based seafood appealing, and 43% would consider purchasing it in the future.”

- **Miles Woodruff, PhD, CEO & Co-Founder, Sophie's Kitchen**

Health benefits of plant-based, cultivated seafood ranked

Question:

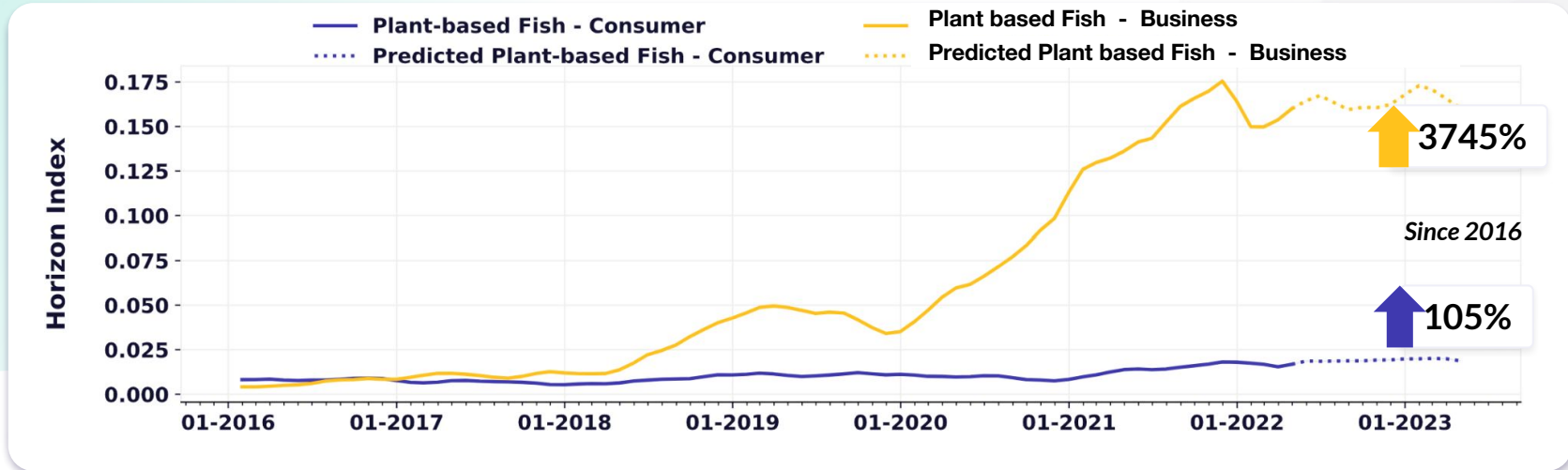
“How important would each of the following health factors be in your decision to eat plant-based or cultivated seafood over wild-caught or farm-raised seafood?”

These numbers are those who selected somewhat important or extremely important

Health benefit	Plant-based (%)	Cultivated (%)
No mercury	45	46
Low risk of foodborne illness	37	42
High in protein	36	39
No microplastics	36	39
Rich in Omega-3s	34	36
Contains few and easily recognizable ingredients	33	35
Eliminates allergy concerns	28	N/A
High in fiber	26	28
Micronutrient content	25	28
Low fat content	24	26
Low sodium	24	26
Low calorie	24	23

Business interest takes off, while consumer is slower

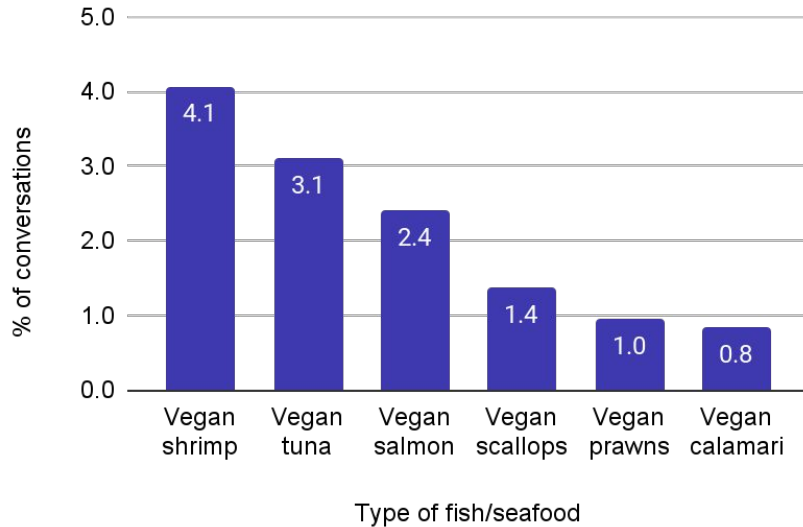
Consumer and business interest in plant-based fish



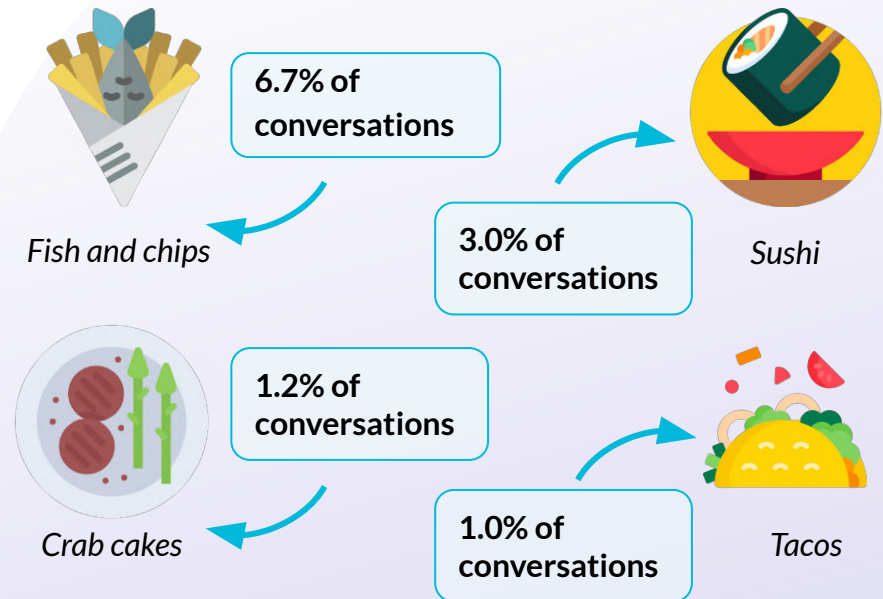
The high association that fish has with health in consumers' minds versus meat has proven to be a major roadblock in the growth of alternatives.

Consumer associations with vegan seafood

Most popular fish/seafood alternatives



Most talked about dishes

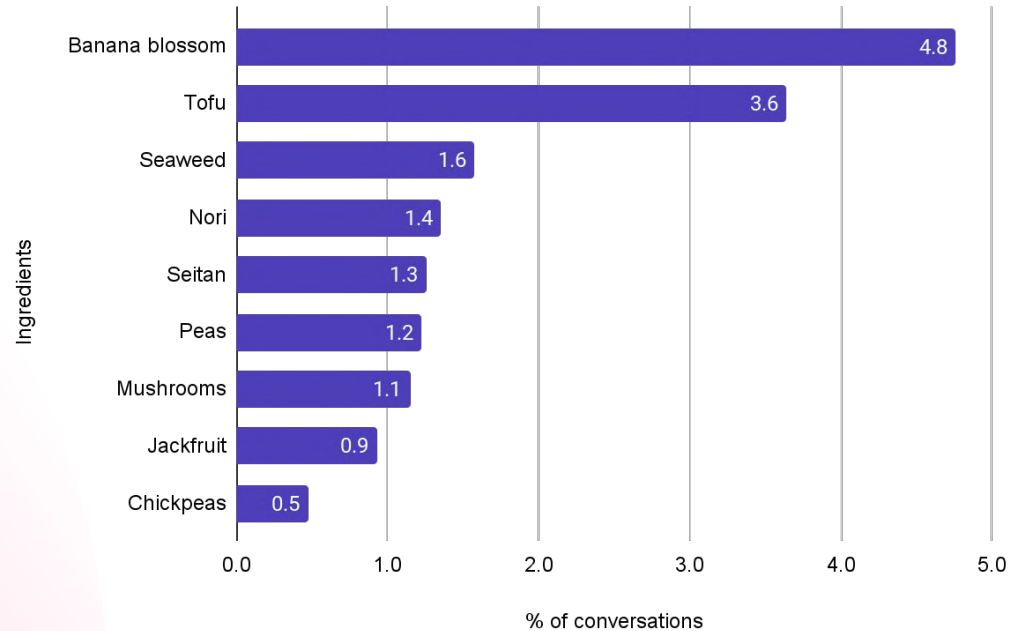


Note: These are based on consumer conversations on vegan fish/seafood

Ingredients to consider to improve consumption experience



Top ingredients associated with vegan fish/seafood in consumer conversations



World's first unbreaded jackfruit fish fillet is launched



Jackfruit + Kelp Seaweed

8.58

Consumer

Very High

Novelty

Medium

Flavor

Product concepts for vegan seafood

Mushroom + Kelp Seaweed + Cocoa Bean

8.56

Consumer

High

Novelty

High

Flavor

Banana Blossom + Seaweed Powder + Salt

9.0

Consumer

Medium

Novelty

High

Flavor

Jackfruit and seaweed make for a strong plant-based fish

The Cornish Seaweed Company and Jack & Bry, a gourmet plant based meat company that uses jackfruit as its base ingredient, announced the launch of what they're calling the world's first unbreaded jackfruit and seaweed fish fillet.

The fish fillet is vegan and made with cooked white flakes of jackfruit, which are marinated in a blend of seaweed to accurately replicate the white, flaky texture of fish and re-create an authentic seafood taste.



Our data had no other products using this combination, but there were home recipes and menu dishes that did. The seaweed and jackfruit combination had very high novelty and a high consumer acceptance score.

We also looked at possible concepts based on ingredients consumers spoke about.

Mushroom + Kelp Seaweed + Cocoa Bean has a high consumer score and flavor score.

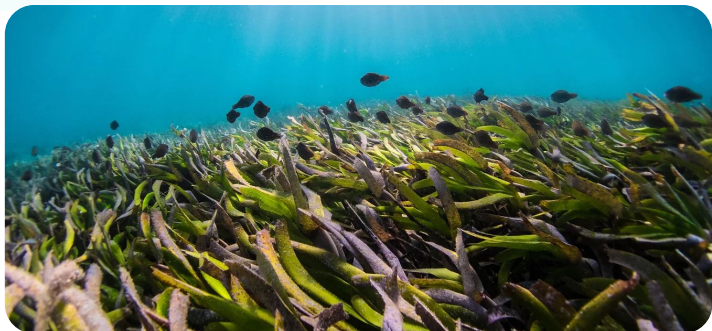
Banana blossom + seaweed is also a potential option, since banana blossom does actually offer the flaky texture of fish.

Algae emerge as viable ingredients for faux fish

The bulk of retail products so far have used legumes and vegetables as the base ingredient to mimic seafood/fish. However, new companies have started to consider more novel ingredients - like algae - that could help get the flavor and nutrition right, while also being more sustainable.

Seafood Reboot

This Paris-based startup is said to be working on seafood alternatives that will be vegan, non-GMO, and algae-based.



ALGAE

High

Novelty

0.01%
penetration in
products

Revo Foods

This Austrian startup has developed a texturized salmon fillet made from pea protein and algae extracts, and is 3D printed.



Spirulina shows significant potential for fish analogs

Israeli food tech company SimpliiGood has developed the first smoked salmon analog made from a single ingredient - spirulina. This product is expected to hit the market by 2023.



95% pure, fresh spirulina + minimal flavour and oil



At SimpliiGood's spirulina farm,

- 98% of water used is recycled
- 50 tons of spirulina is produced/year
- Harvested every 24 hours

0.16%

Products containing Spirulina in 'All' categories

Medium

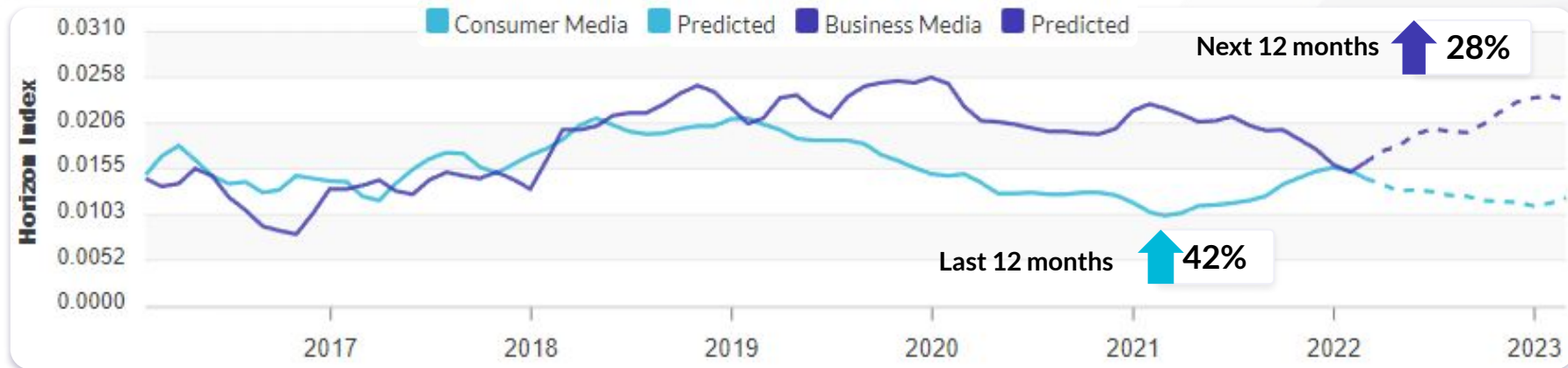
Novelty

6.40

Consumer

What does our data say?

Consumer and business interest in spirulina, US



13%

Nutrition related social media conversations on spirulina linked to protein

11%

Claims related social media conversations on spirulina linked to protein

Spirulina + Sesame oil

Medium
Novelty

High
Flavor

Spirulina + Safflower oil

Medium
Novelty

High
Flavor

Spoonshot's take

Indiscriminate fishing, warming waters, and rapid consumption together have resulted in the very real possibility of a future with limited access to fish and seafood.

There is now an urgent need to increase the focus on seafood alternatives, be it plant-based or lab-grown, compared to dairy and meat alternatives.

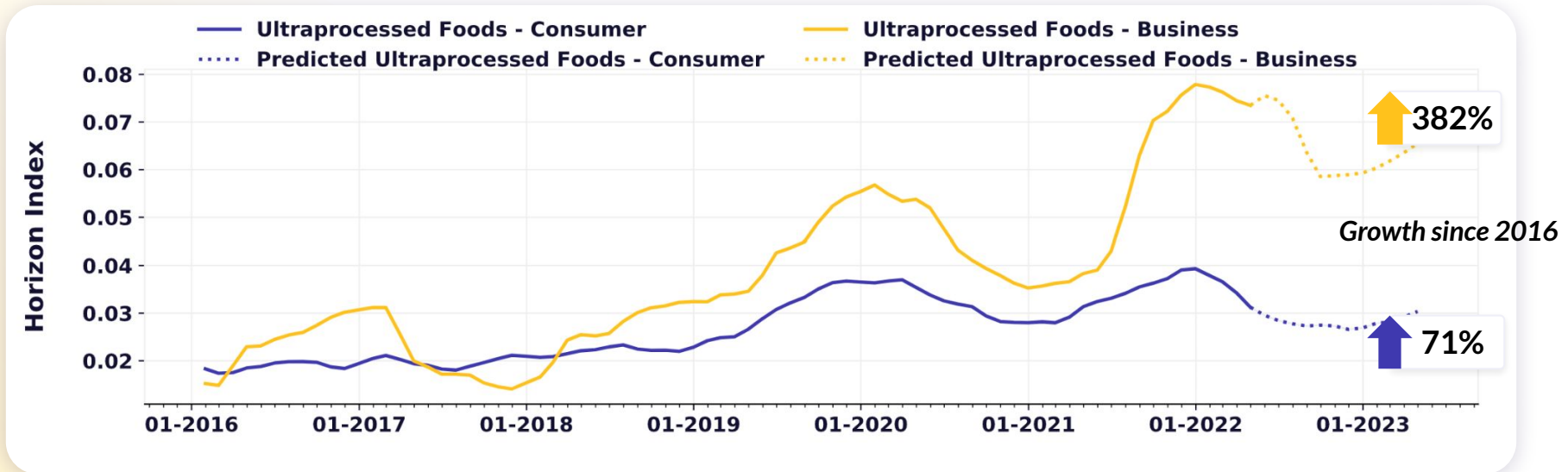


A Clean Plate

Calls for clean label claims in plant-based foods are becoming louder.

Concerns over ultra processed foods is growing

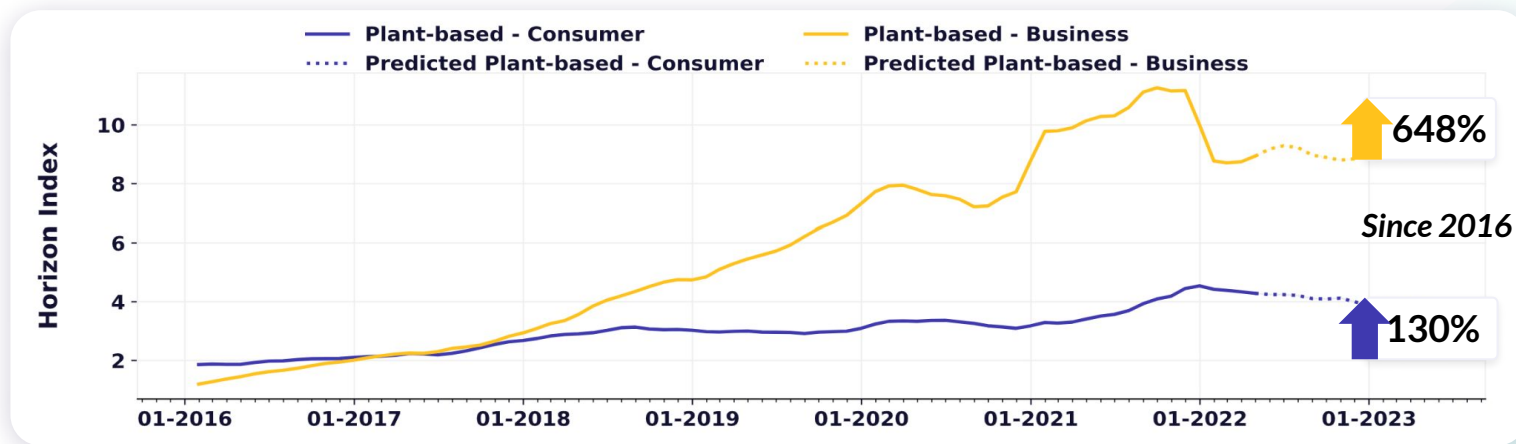
References to ultra processed foods are low but growing rapidly



Plant-based food continues to gain popularity

The plant-based space continues to make its presence felt by expanding into more categories. Alternatives to milk, meat, dairy, eggs, are all seeing significant innovation as companies race to launch products that appeal to consumers and other businesses alike.

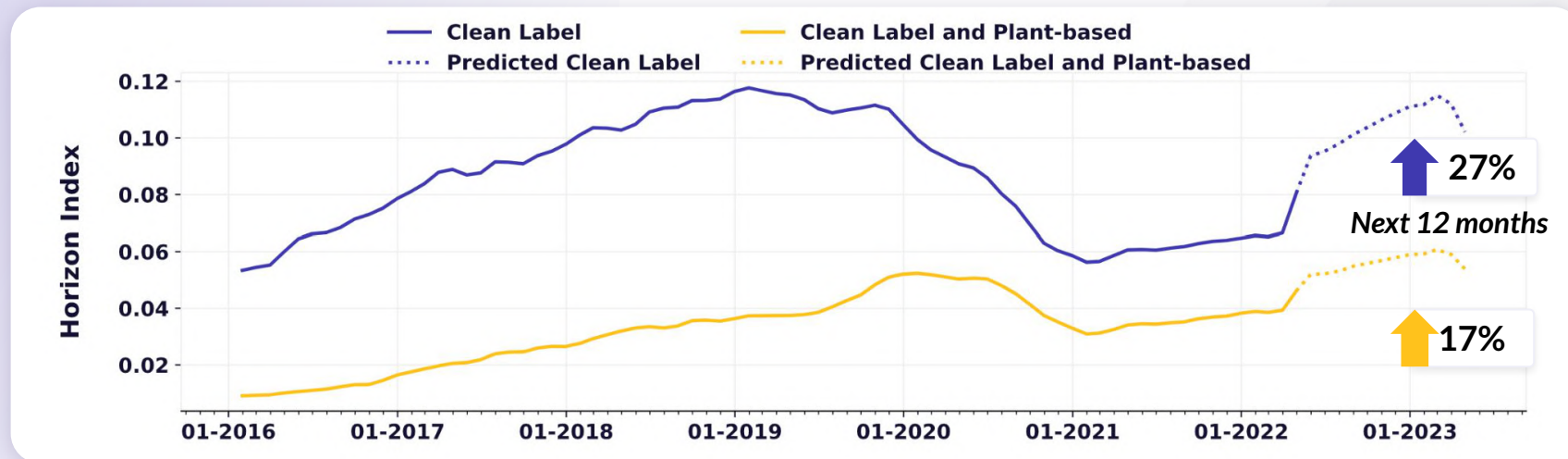
Interest in plant-based food and drink



The reasons for the expansion of plant-based alternatives to animal products have been well documented: perceived health benefits, concerns over animal welfare, and greater sustainability.

Clean label will be the next area of focus for plant-based food

Interest in clean label, all categories vs plant-based



0.86

Relation score between plant-based and clean label

NOTE: The relation score is a measure of the association between two topics - plant-based and clean label - and within the F&B space quantified using Pointwise Mutual Information. The higher the PMI score, the higher the probability of the two topics occurring together when compared with chance. A score over 0.4 is considered as a high association.

Growth in the 12 months to April 2022

↑ 32%

↑ 34%

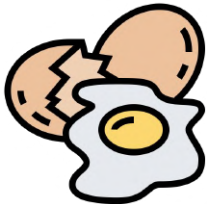
Calls to clean up ingredient lists in plant-based will get louder

10% of consumer conversations on vegan/plant-based food were about clean eating.

Ingredients for plant-based liquid egg

11 ings

Ingredients: Water, Mung Bean Protein Isolate, Expeller-Pressed Canola Oil, Corn Starch, Contains less than 2% of Baking Powder (sodium acid pyrophosphate, sodium bicarbonate, corn starch, monocalcium phosphate), Dehydrated Garlic, Dehydrated Onion, Carrot Extractives (color), Turmeric Extractives (color), Salt, Transglutaminase.



Standard egg

INGREDIENTS: 100% LIQUID EGG WHITES
CONTAINS EGGS.

1 ing

Dried Whole Egg Powder

INGREDIENTS: Whole eggs, less than 2% sodium silicoaluminate as an anticaking agent
CONTAINS: Egg

2 ing

As the demand for clean label grows, so will the market for clean label additives.

Long lists of ingredients can put off consumers

As the plant-based sector grows, so will the scrutiny towards it, especially in terms of the claims of being healthier and better for the environment.

Products are increasingly being called out for the use of too many highly processed ingredients, including preservatives, stabilizers, and various other additives. Concerns over ultra processed foods are also on the rise.

So much so that newer plant-based launches have started to address this issue and are calling out their clean label credentials.

And this clean label aspect of plant-based food is a feature we expect to see grow significantly over the coming year. In fact, clean label is going to be a major requirement for alternatives as the sector expands. Sales of plant based meat have started to slow down (for a number of reasons) and this may be the key to winning back consumer engagement.

Our analysis of published articles and blogs by industry experts and consumers and influencers showed that over the last year, references to clean label within the meat alternatives space grew at par with references to clean label.

What consumers want from clean label plant-based foods

Most talked about features about clean label plant-based foods from consumer conversations



Vegan
48%



Gluten-free
32%



Natural
25%



Ingredients
19%



Organic
18%



Healthy
17%



Plant protein
12%



Fresh
10%



Sustainable
10%



Non-GMO
8%

New plant-based meat launches call out clean label credentials

Plant-based meat brands are starting to highlight minimal ingredients and no nasties in their launches.



Fable Food Co highlights its clean label credentials with products that are made with only recognizable ingredients and are said to be free from preservatives, artificial ingredients, and GMOs.

Main ingredient:
Shiitake



Plantcraft positions itself as the world's first clean-label, plant-based deli meat company. It is said to be free from all top 8 allergens and artificial ingredients.

Main ingredients: Green banana, pea protein, golden linseed, sunflower seed, grapeseed oil, nutritional yeast, herbs & spices

New plant-based meat alternatives with clean label claims

Australia-based **Fable Food Co** makes a range of meat alternative products and ready meals that feature shiitake mushroom as the main ingredient used in place of meat. The range is intended for consumers who don't eat meat or want to cut down on their meat consumption for a variety of reasons.

The range also tries to recreate the experience of slow-cooked meat.

Fable highlights its clean label credentials with products that are made with only recognizable ingredients and are free from preservatives, artificial ingredients, and GMOs.

The company uses shiitake mushrooms for a number of reasons:

- They have natural umami flavors
- They are a slow-growing mushroom so they naturally have the fleshy fibers that give the meaty bite typically associated with animal proteins
- They have the right chemical composition that when cooked imparts flavors that are found in animal products
- They are nutritious, high in fiber and antioxidants as well as an animal-free source of Vitamin B12

Plantcraft is a Hungarian-US startup that positions itself as the world's first clean-label, plant-based deli meat company. Its products include pâtés and pepperoni, made with green banana, pea protein, golden linseed, sunflower seed, grapeseed oil, nutritional yeast, and herbs and spices. These plant-based alternatives are clean-label and free from all top 8 allergens and artificial ingredients. They also contain 8g of protein and 5g of fiber per serving.

The leading primary ingredients within vegan deli meats is wheat or soy, and Plantcraft's departure from them is very telling of how plant-based meats may evolve in the coming years.

Ancillaries also increase their focus on clean ingredients

While some companies focus on using a combination of whole foods to achieve the desired results for their plant-based foods, others will need additives. With clean label versions of these building blocks of plant-based alternatives, companies can achieve the coveted “clean” label.

Sales Growth of Plant-Based Clean Label Products

DOLLAR % CHANGE FOR YEAR ENDED 1.21.2021



Organic
↑ **28%**



Non-GMO
↑ **27%**



Fair Trade
↑ **15%**



Certified B Corps
↑ **14%**

The need for such ingredients is only going to grow in the coming year and it is an area ripe for innovation. As such, this need will also see ancillary companies - those that make the building blocks - gain more importance.


Mimicking the cooking experience with plant-based colors

Achieving the color shift from the 'bloody' raw state to the desired cooked appearance can be done by blending a selection of different fruits and vegetables in different ratios.




PLANT-BASED BURGER PATTY, RAW TO COOKED


Raw, fresh






4 min. Cooking time



8 min. Cooking time



pH	5.9
Plant-Based Color Source	Carrot, Beetroot, Pepper
Plant Protein Source	Soy
Processing Step	Cold process for making fresh burger patties. Cooked to 165°F internal temp with oil for 8 minutes.

GNT Group's color shift solution uses a flowable red powder of encapsulated carrot concentrate, which melts as the temperature increases during cooking and releases the carrot concentrate, facilitating a change in color similar to red meat.

Clean label stabilizers for plant-based milks

IFF has launched a nutrient-dense hydrocolloid sourced from non-GMO red seaweed.

Called SEAFLOUR, this ingredient contains protein, fiber, and minerals, and offers stability, high-suspension ability, and a smooth, creamy mouthfeel.

- **Suitable for:** Plant-based milks
- **Results:** Shortens ingredient list; allows for clean label messaging



Scope to replace methylcellulose with natural ingredients

Methylcellulose

- Is capable of gelling at higher temperatures which helps texture of plant-based burgers to match that of animal protein
- Responsible for creating a good “bite”
- Allows for adhesion and binding of the uncooked ingredients

Plant-based alternatives

- Citrus fiber – a byproduct of making juice from citrus fruits – is a natural ingredient that can be used as a binder in plant-based meats
- Makes for a good replacement for methylcellulose in combination with other natural ingredients like agar, psyllium, and native starch



Spoonshot's take

Clean label is now a requirement for food and drink, so it isn't surprising that consumers are demanding the same from plant-based alternatives.

As the plant-based space grows, food manufacturers will need to rethink their ingredients to comply with the consumer demand for clean label options.

This development also means opportunities for ingredient suppliers to create clean label building blocks for plant-based foods to improve texture, flavor, and appearance.



Earthy Endeavor

Soil health emerges as an important part of sustainable food production.

Soil degradation has become a pressing global concern

Soil erosion is a natural phenomenon that happens under all climatic conditions and all around the world. However, increased unsustainable human activity has accelerated erosion and degradation, which in turn can negatively impact agricultural productivity.

50%

of the world's most fertile topsoil has been lost in the past 150 years. This is 10X faster than it's being replenished.

-World Wide Fund for Nature

33%

of the world's soils are already degraded and 90% could become degraded by 2050 at the rate

-United Nations' Food and Agriculture Organization

Soil health is being depleted

We often hear older people complain that food just doesn't taste the same as when they were younger. Many of us may roll our eyes at this, but it may actually be true. Farming and production has changed drastically over the last century to feed our exploding population and this has had its impact on the taste and the nutritional profile of the food we eat - and the soil we grow it on.

The depletion of soil health is becoming a source of concern. [95%](#) of our food comes from the soil and soil degradation affects agricultural productivity and could lead to a significant loss in crop yields.

In fact, in just the last 150 years, half of the world's most fertile topsoil has been lost. This is 10 times faster than it's being replenished, according to the WWF.

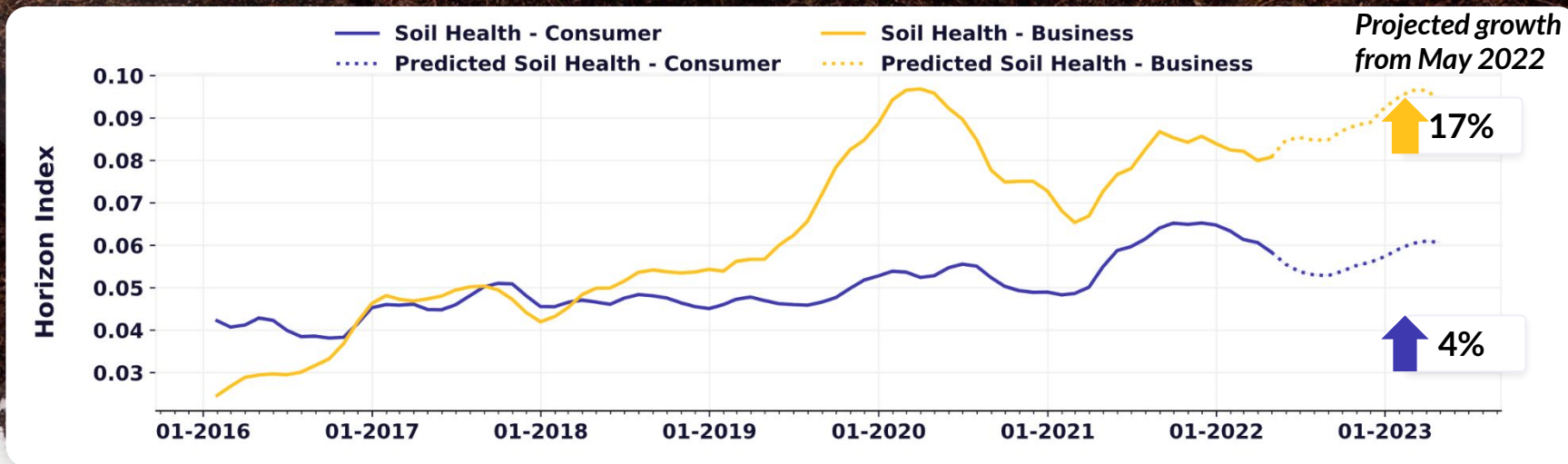
For context, it takes 1,000 years to produce just 2-3 cm of topsoil, which itself is only about 2-8 cm in depth, but contains most of the ground's nutrients and fertility.

A major contributor to soil degradation is soil erosion, which occurs naturally everywhere around the globe as a result of the elements - rain, snow, wind, plants, and animals. But its rate is significantly accelerated by unsustainable human activities, which include things like intensive agriculture and the use of chemical fertilizers and pesticides, deforestation, overgrazing, and improper land use.

The FAO estimates that a third of the world's soil is already degraded and if we don't address this issue, by 2050, this will reach 90%.

Interest in soil health is on the rise in business media

Interest in soil health in media channels



The growing interest in soil health is linked to growing interest in how food is produced and its impact on the planet.



0.55

Relation score between soil health and sustainable agriculture

Interest in soil health is on the rise in the media

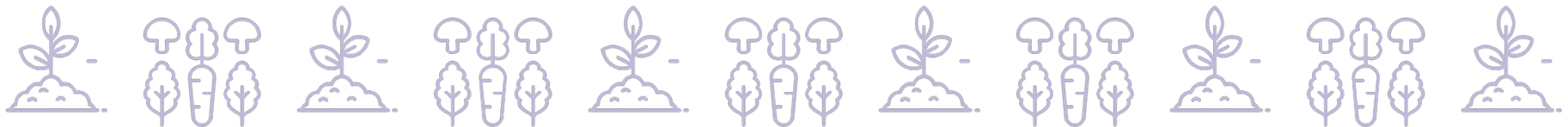
This depletion and its impact on food production why interest in soil health has been seeing some growth in media channels, even if it's just in fits and starts.

Our data indicates that over the next 12 months, we will be hearing more on this space. Business interest in topics related to soil health, for example, is projected to grow by over 17% during the next 12 months. Consumer interest is a bit more muted, but that too is expected to see a 4% growth in this period.

Increasing concerns over soil health can be linked to growing interest in sustainable food production.

We specifically looked at quantifying the association between soil health and sustainable agriculture within the F&B space using Pointwise Mutual Information.

The higher the PMI score, the higher the probability of the two topics occurring together when compared with chance. A score over 0.4 is considered as a high association.



Soil health is linked to sustainable agriculture

Sustainability as a whole is gaining ground with consumers, though sustainable farming is still a relatively new topic for them.

Only a fraction of sustainability-related consumer conversations talked about sustainable farming.

We further analysed conversations where consumers talked about sustainable farming and soil health together.

Here, it became clear that this is not just a more aware audience, but their main topics of discussion revolved around farming techniques widely associated with improving soil fertility.

Interestingly, some brands have started to call out some of these production methods on pack to highlight their commitment to sustainability and soil conservation. In time, this is likely to expand awareness among consumers as well.



Consumers associate soil health with production methods

Sustainable farming is still a relatively new topic within sustainability conversations, and soil health even more so. However, top-of-mind issues for this cohort are production methods that improve soil health.

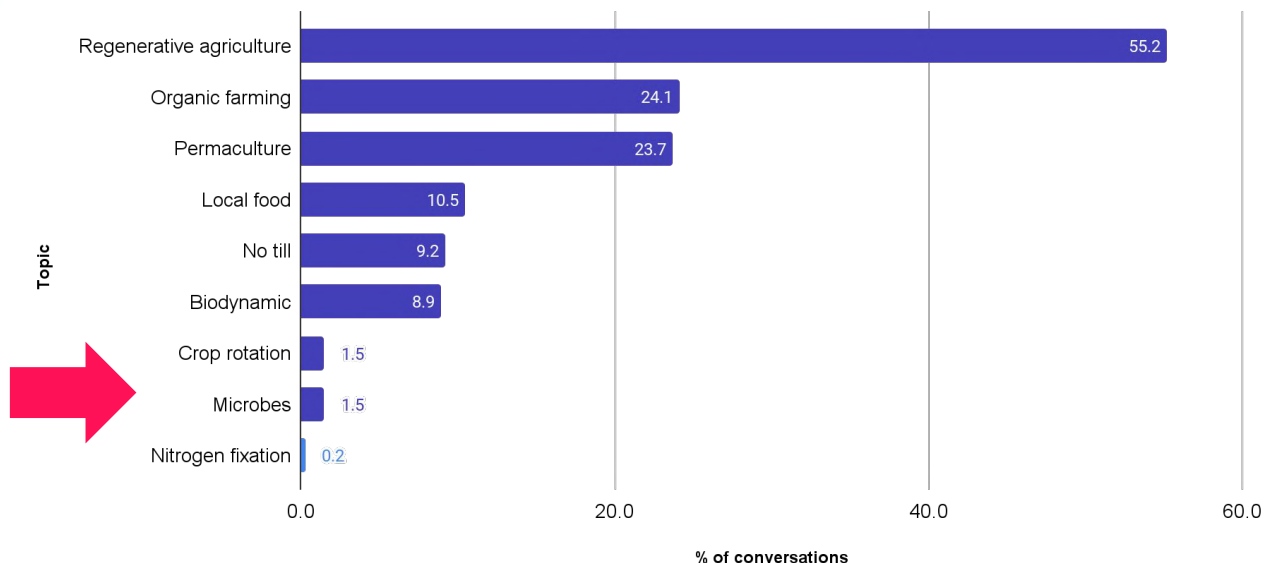
6.0%

Of conversations on sustainability mention sustainable farming

2.5%

Of conversations on sustainable farming mention soil health

Select topics associated with soil health and sustainable farming



Brands are seeing opportunities to promote ag production

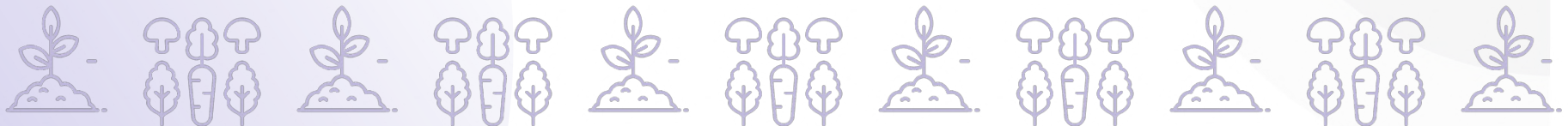
Currently, the most popular call-out we're seeing on pack is food grown using regenerative agriculture, which includes farming and grazing practices that help rebuild organic soil matter to improve soil biodiversity and fertility. This in turn improves the nutritional value of food.

The regen ag model incorporates a number of other techniques such as no-to-low tilling, crop rotation, cover crops, using perennial crops, planned grazing, and so on.

Regen ag also has the potential to improve carbon capture thereby lowering emissions.

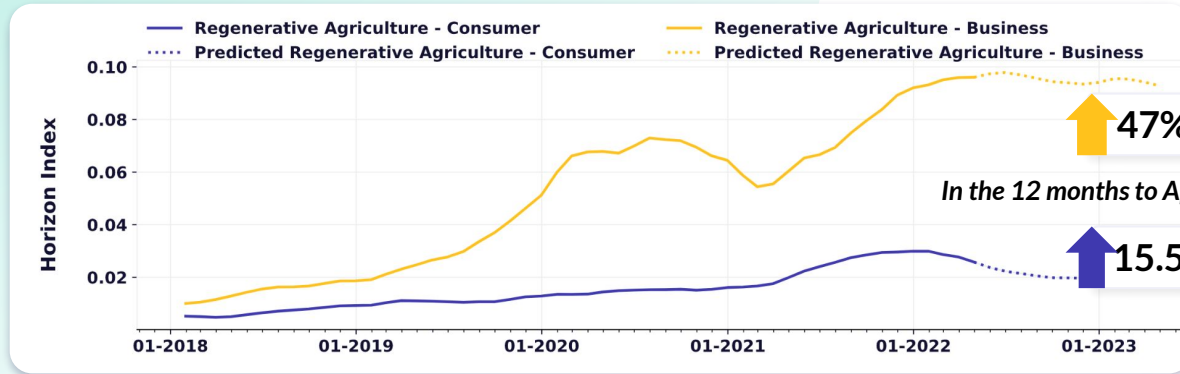
This is why many large food and drink manufacturers are starting to invest in regenerative agriculture in their supply chains. For most companies, the bulk of their emissions comes from how and where they source their raw materials.

- In 2019, General Mills said it would convert 1 million acres of land to regen ag practices by 2030. As of May 2021, 115,000 acres of US farm land had been enrolled into the program.
- In 2021, Nestlé said that it was investing over €1 billion over the next five years to advance regen ag across its network of farmers and suppliers.



Brands have started to invest in regenerative farming

The bulk of carbon emissions for F&B manufacturers is from raw materials. So, some have started to invest in regenerative farming to address various issues across the supply chain, including the decline in soil health and land management. Recent studies have even shown that regen ag not just improves soil fertility but also crop nutrition and human health.



9.2%

Of consumer conversations on sustainable farming also talk about regenerative farming



Converting 1 million acres of land to regen ag practices by 2030



Investing over €1 billion over the next five years to advance regen ag across its network

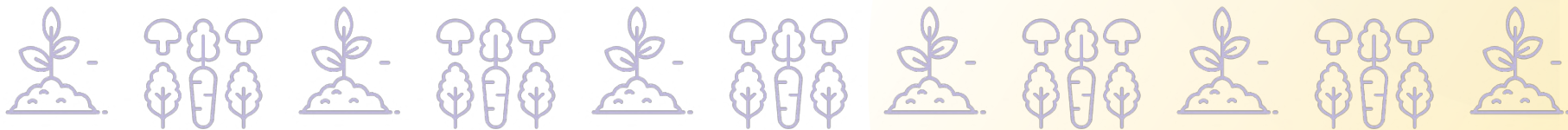
Companies start to highlight crop rotation

While the regenerative agriculture model has captured the attention of many larger companies, some smaller companies are promoting more specific methods, like crop rotation.

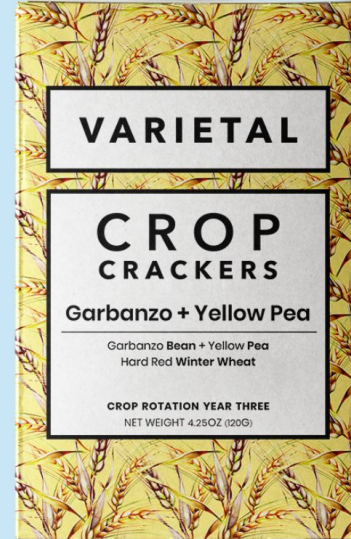
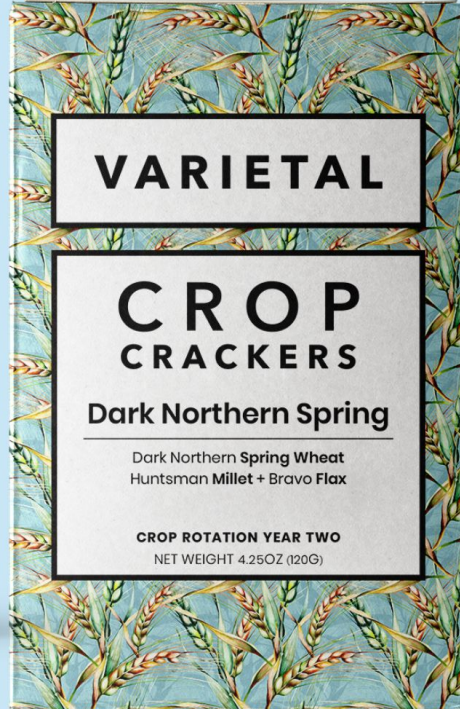
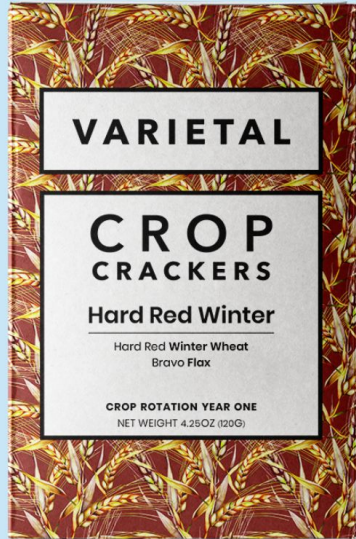
Rotating crops helps return nutrients to the soil essentially by increasing biomass from different crops' root structures without over-dependence on synthetic fertilisers. This not only increases farm biodiversity but also works to interrupt pest and disease cycles.

One brand that is highlighting this is the soon-to-be launched **Varietal Crop Crackers**, developed by Alpha Food Labs. These crackers are made from a number of different wheats, legumes, and seeds planted within a crop rotation.

The pack highlights the rotation cycle and the crops harvested in that cycle. This not just supports soil and water health, but also is used to incentivize farmers to take up crop rotation.



Crop rotation comes to the front of the pack



Varietal Crop Crackers are made from a diverse assortment of wheats, legumes, and seeds planted within a crop rotation.



1.5%

Of conversations on sustainable farming and soil health talk about crop rotation

Focus on nitrogen emerges

Another emerging topic from consumers conversations was on nitrogen fixation. Granted it is very small, at just 0.2% of conversations on soil health and sustainable farming together, it is an important aspect for farmers and food producers.

Nitrogen is an important element linked to soil health and a key part of fertilisers. Synthetic nitrogen is estimated to have doubled food production since its introduction about a century ago, and farmers rely heavily on it.

But the synthetic stuff is very harmful to soil, crops, and consumer health in the long run. It's also pretty inefficient and expensive for farmers, since about half of applied synthetic nitrogen never reaches the crop it was intended to fertilize.

It even contributes to 5% of greenhouse gas emissions and adversely impacts water quality.



Pivot Bio launches microbial nitrogen

To tackle these issues, Pivot Bio has created the first microbial nitrogen to replace the traditional synthetic nitrogen based fertilizers.

Pivot Bio maps trillions of interactions between living organisms in the soil to identify rare microbes with the right internal DNA to produce nitrogen. It then reverse engineers the way that nitrogen is created and reprograms the genetic code of other microbes to improve their nitrogen production capabilities.

The reprogrammed microbes are able to produce the right level of nitrogen based on the needs of the crop. Because of the customisable nature of this technology, it can be used across different soil types, farming practices, weather conditions, thus reducing the dependence on the synthetic stuff and improving soil health.

Creating synthetic nitrogen is also quite energy intensive, but Pivot Bio uses precision fermentation to get the right concentration of microbes for the job. And this, it says, reduces potential greenhouse gas emissions by up to 98%, which can help improve air quality.

To showcase the utility of this product, Pivot Bio has launched a snack brand called Connect that uses crops grown using this microbial nitrogen. Connect Snacks' first product is a gourmet butterfly yellow popcorn grown in Nebraska, with the on-pack claim.

This innovation may pave the way for cleaner fertilisers and could even redefine the way we think about organic food and make it less expensive in the long run.

Microbial nitrogen could improve air, water, soil health



17%

consumer conversations on sustainable farming also associate it with organic food

Snack brand Connect uses a first-of-its-kind **microbial nitrogen** instead of synthetic nitrogen fertilizers as part of a move towards cleaner air and water.

Pivot Bio's microbial nitrogen is generated by microbes using fermentation. This can remove various harmful impacts of using synthetic nitrogen as a fertiliser.

- No harm to the soil
- No nitrous oxide emissions
- No nitrates into waterways

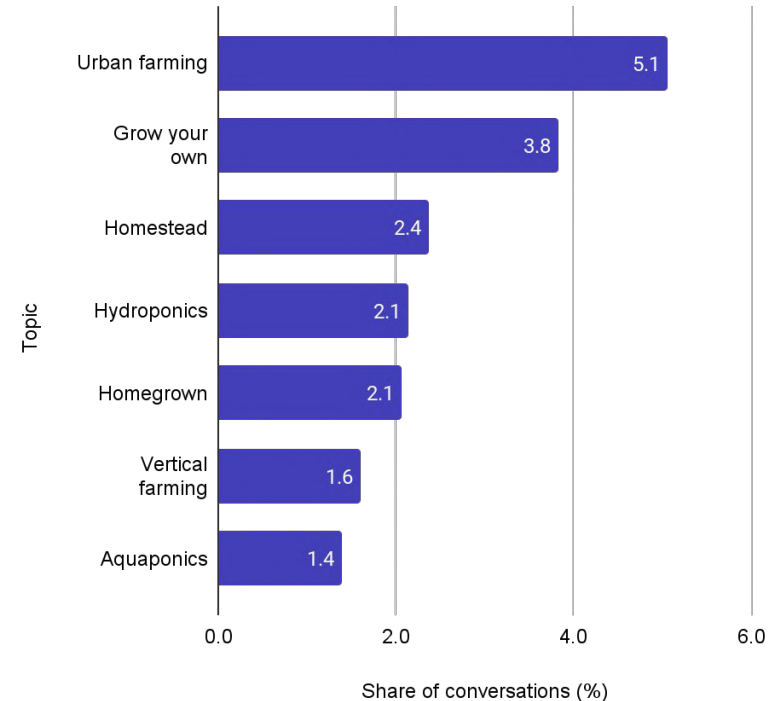


Vertical farming lowers pressure on soil, promotes at-home ag



Canadian-based startup **Just Vertical** is encouraging home gardeners to join the indoor growing movement. Its products are marketed as elegant pieces of furniture that can grow 8-10 pounds of food a month using hydroponic technology.

Emerging farming techniques within sustainable agriculture conversations



Spoonshot's take

Soil health is starting to emerge as an important area of focus within the space of sustainable food since it is linked to food production and security.

While this is still at an early stage, brands are starting to showcase their commitment to improving soil health even though it may take a while to gain consumer buy-in.

In the long term, we expect more food producers to look at investing in farming practices that improve soil health, which in turn can increase the taste and nutrition of food, while also helping tackle climate change.

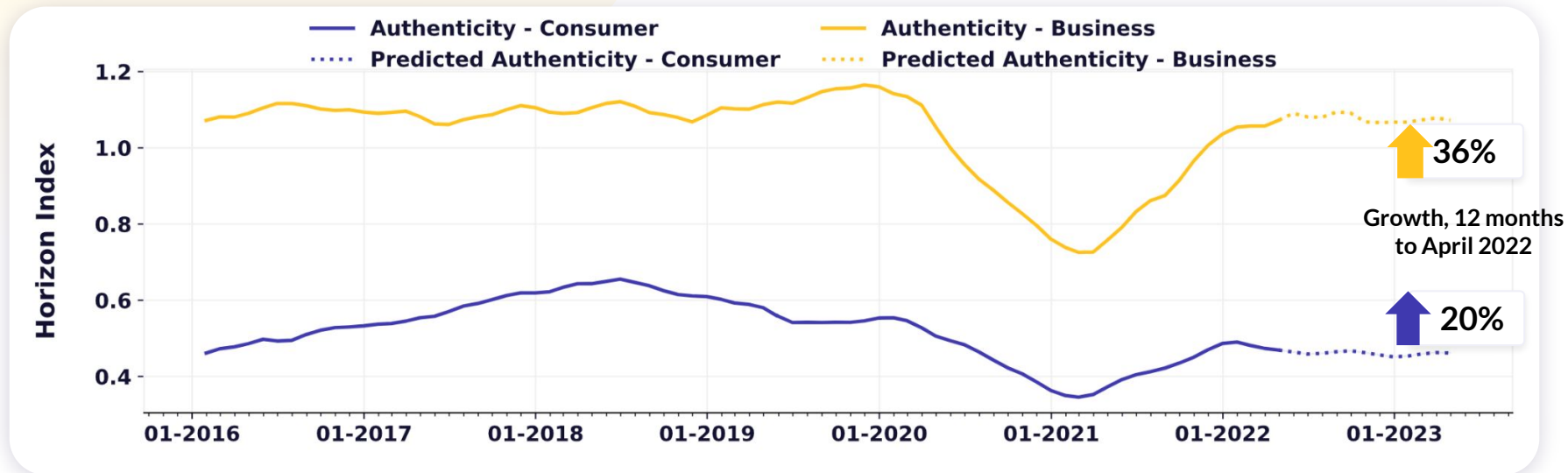
The Spice is Right

Emerging flavors to watch out for

Authenticity is vital for the growth of new flavors

Authenticity in flavors and cuisines has become a vital component for consumers and businesses. It was a pretty steady mainstay in food and drink till the pandemic hit, but has now started to bounce back.

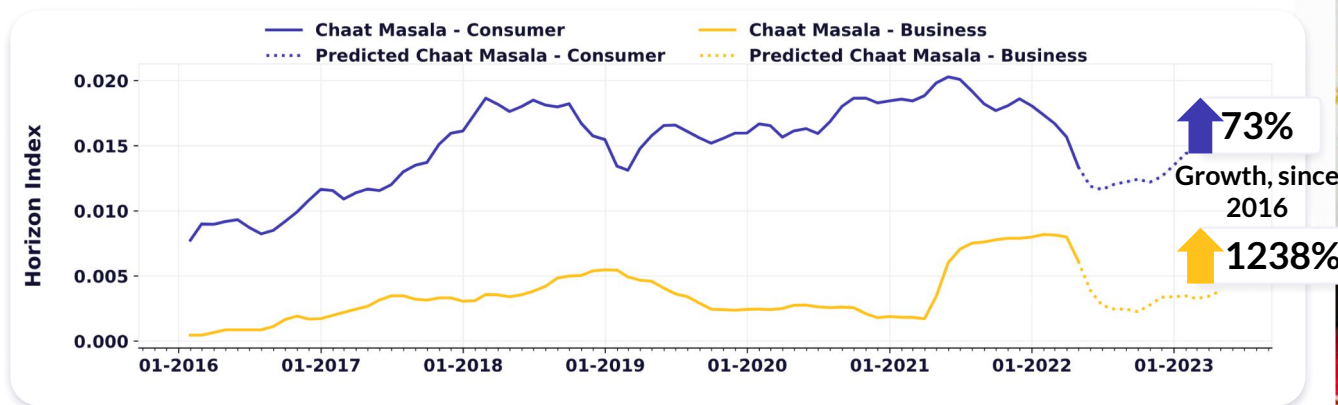
Interest in authenticity in food and drink



Chaat masala is popular among consumers, not yet businesses

Chaat masala is a spice blend from North India made with dried mango powder, cumin, coriander, dried ginger, salt (often black salt), black pepper, asafetida, and chili powder. It is a staple flavor enhancer for many street food dishes in North India but can also be used in other foods and beverages for a multi-flavor combination.

Consumer interest in chaat masala is 5X greater than business interest, indicating that there is a gap waiting to be filled

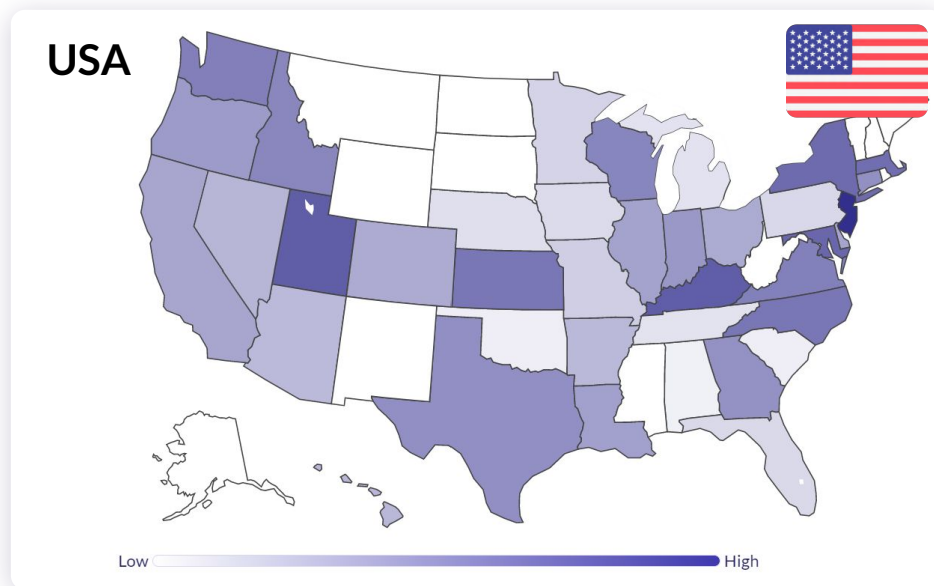


High
Novelty

4.30
Consumer

Comparison of chaat masala use in the US and UK in menus

Ingredient distribution by state and region

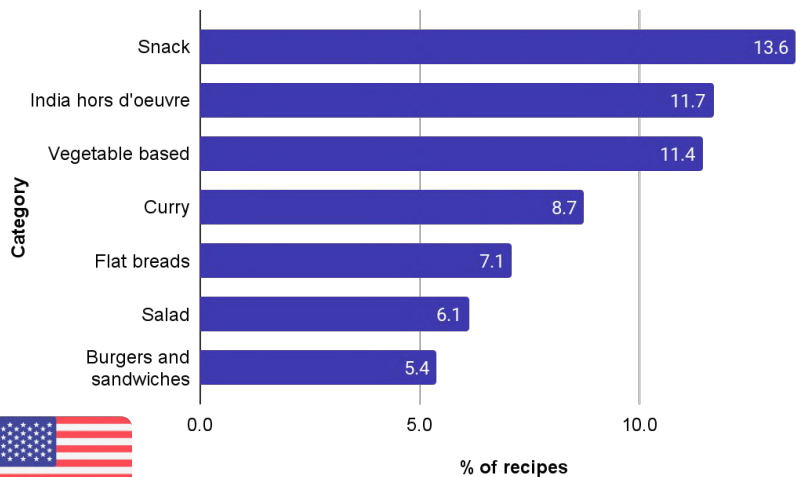


	Total Menus	Total menus containing 'Chaat Masala'	Penetration % in menus	Penetration vs 'Oregano'
US	434,542	641	0.15%	5.13%
UK	122,004	1,471	1.21%	5.95%

Chaat masala has a wide distribution in home recipes

USA

Category distribution of recipes containing chaat masala, US



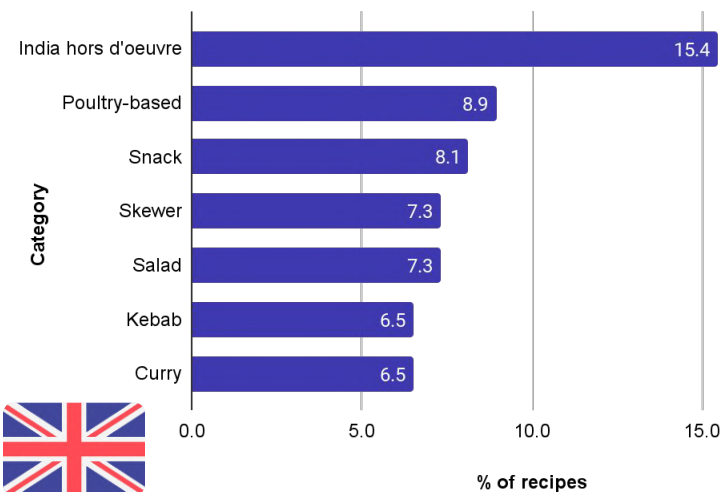
0.04%

penetration % in recipes containing 'Chaat Masala'

Only **6** product launches featured chaat masala in the US

UK

Category distribution of recipes containing chaat masala, UK



0.1%

penetration % in recipes containing 'Chaat Masala'

Only **12** product launches featured chaat masala in the UK

Potential for sweet-sour-savory combos with chaat masala

Masala Nimbu Soda Cocktail



This is a savory-sweet lemonade cocktail made with mint leaves, cumin powder, chaat masala, black salt, sparkling lemonade, white rum.

Source: Yummly, Malai, Spoonshot

Chips



Chaat masala is a popular flavor in snacks in India.

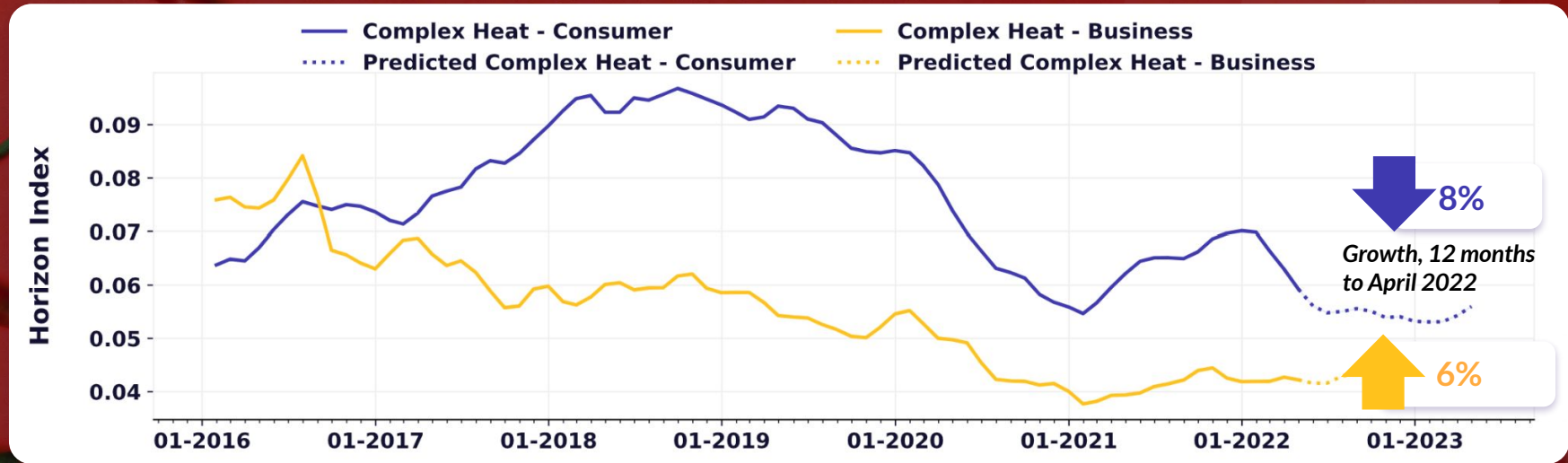
Chaat Masala Sorbet



Ingredients for this ice cream include dried hibiscus, chaat masala (*dry mango, black salt, cumin, salt, coriander, chili, musk melon, black pepper, ginger, citric acid*), salt, lemon juice. The chaat masala is said to add a **savory umami** to this sorbet.

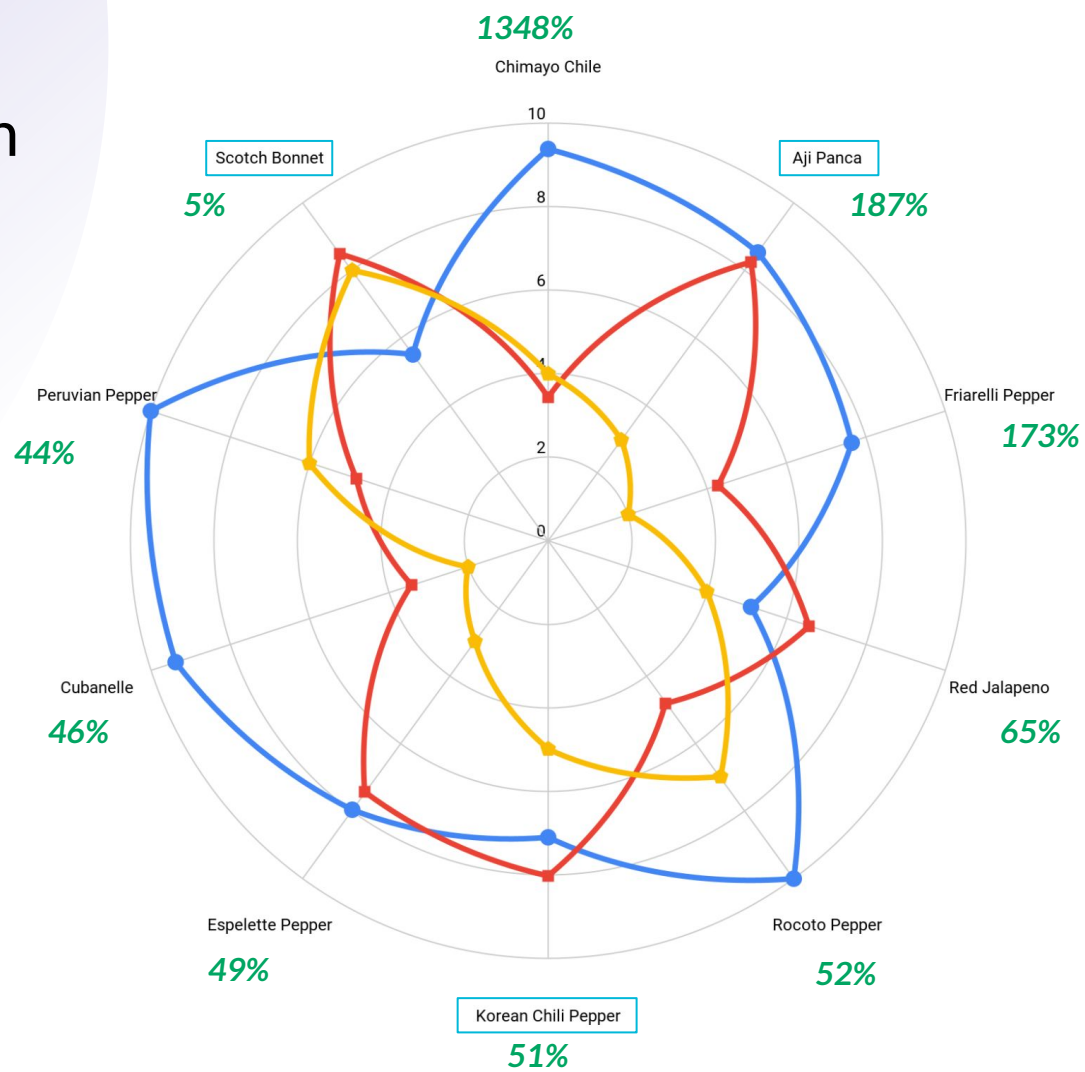
Consumers show a distinct fondness for heat

Heat is another flavor where consumer interest is greater than business interest, indicating significant scope for innovation incorporating heat. In particular, consumers are showing interest in complex heat, which goes beyond level of heat to specific varieties of pepper from around the world, underlying flavor notes, and even pairing with other flavors.



Global heat is on

- Novelty score
- Consumer score
- ◆ Scoville scale



Numbers in green are the growth rates for the 24 months to April 2022 for each variety of chili

Note: Please see next page for definitions

Source: Spoonshot

Definitions and criteria for choice of chili

Novelty score is an indicator of how unique or unfamiliar an ingredient is. It ranges from 1 (very low) to 10 (very high).

Consumer score captures the sentiment of consumers towards the ingredient, i.e., how popular it is among consumers. It ranges from 1 to 10.

The **Scoville scale** is a measurement of the spiciness or heat of chili peppers, as recorded in Scoville Heat Units (SHU). We have converted the index to range from 1 (no heat) to 10 (very high heat).

These chilis were chosen because:

1. They had greater consumer interest than business interest
2. They had positive growth in interest over the last 24 months



Interest in chilies from around the world is growing

As consumers increasingly demand authentic food experiences, the different flavor notes of the chilies can help bring this



Chimayo Chile
New Mexico (US)
Smoky, Earthy



Aji Panca
Peru
Sweet, Fruity, Smoky



Friarelli Pepper
Italy
Sweet, Crisp



Red jalapeno
Mexico
Earthy, Vegetal, Sweet



Rocoto Pepper
Central and South America
Peppery, Grassy, Fresh, Crisp, Fruity



Korean Chili Pepper
Korea
Sweet, slightly smoky



Espelette Pepper
France
Sweet, Fruity, Smoky



Cubanelle
Cuba
Mellow
honey-mixed-with-pepper
flavor



Peruvian Pepper
Peru
Fruity



Scotch Bonnet
Caribbean, West Africa
Sweet, Fruity, Tropical, Earthy

Global chili variants are being called out front of pack



This salsa product from the US uses whole beans, corn bean, and a combination of Chimayó chile and Pequin chile.



This hot sauce from Jamaica is made from Jamaican yellow Scotch Bonnet peppers.

Spoonshot's take

Chaat masala and global heat are two major flavor trends that will gain significant ground in the coming years, driven by significant consumer appeal.

These are both versatile and allow for a whole host of flavor combinations.

Ms.'d Opportunities

Expanding research into women's health opens up opportunities for food and drink brands.

Women's health: A sorely neglected area

2022 has been a rather interesting year for women's health, to say the least. And as such, we predict that the coming year is going to see a flurry of activity in this area, and a ton of opportunities for food manufacturers to address specific concerns and requirements for women.

And it's about time. Historically, women's health is an area that has been sorely neglected. Much of what we know about the human body and health is from men studying male bodies.

And the impact of this oversight is pretty devastating. Diseases presenting differently in women are often missed or misdiagnosed, and those affecting mainly women remain largely a mystery: understudied, undertreated and frequently misdiagnosed or undiagnosed.

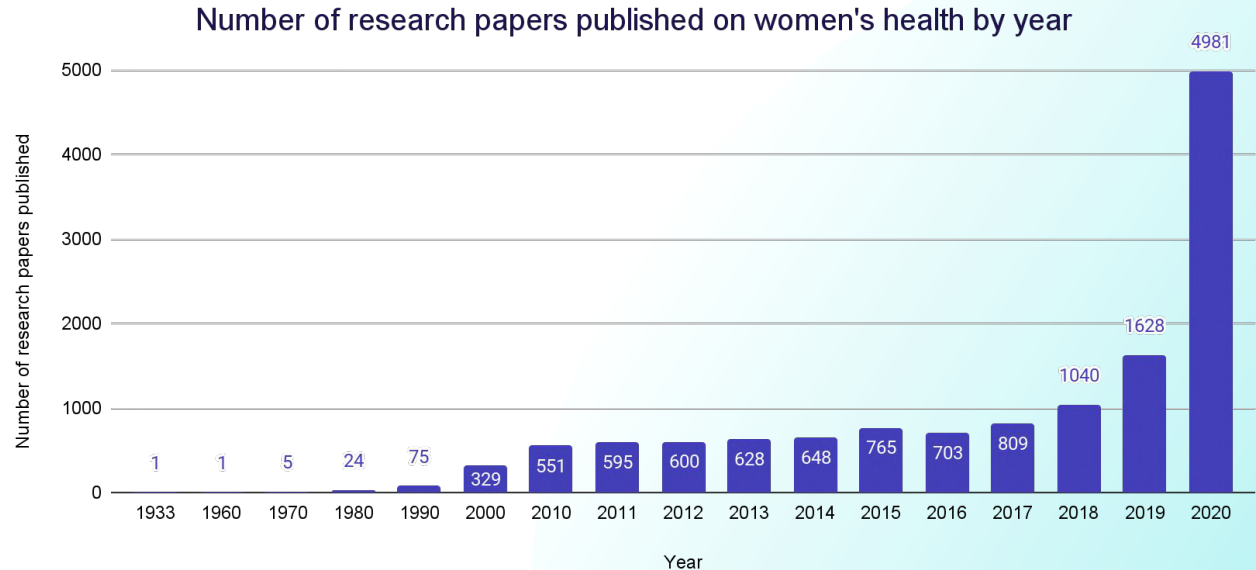


Research into women's health is starting to take off

Men and women are simply not built the same way, mentally, physically, and emotionally. This sounds obvious, but we have only really begun to understand why. We now see increasing attempts to catch up, with research into women's health seeing significant growth - and growth in research activity usually indicates future potential.

9X

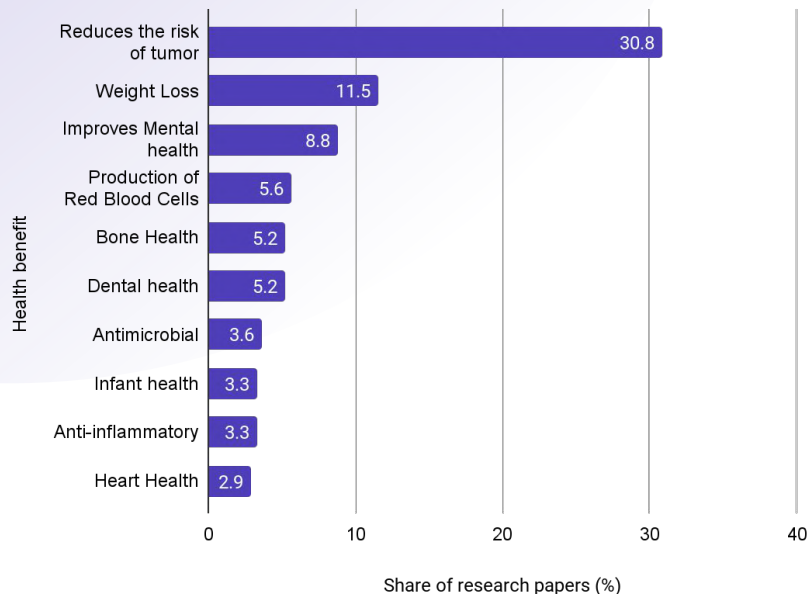
The increase in research papers published on women's health between 2010 and 2020



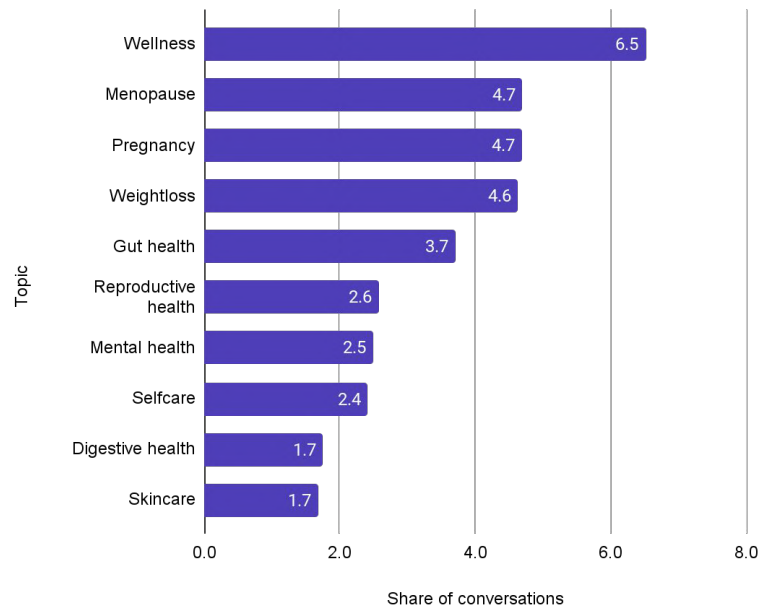
Consumers and research focus on different areas of health

Research primarily looks at more medical conditions and their impact on women, while consumers focus on issues that impact them regularly.

Leading women's health issues from research papers

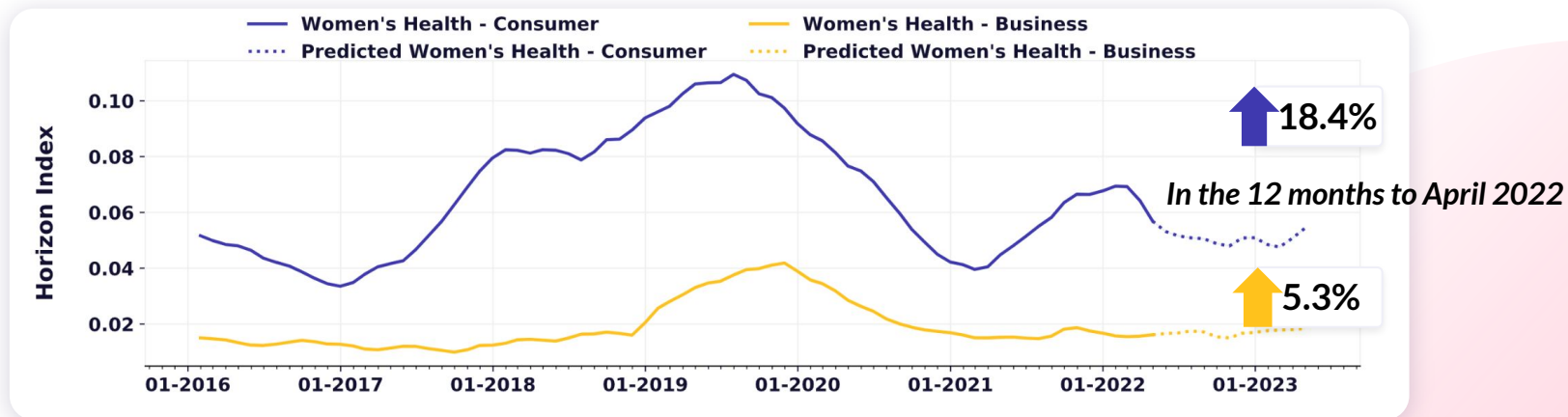


Leading women's health topics in online consumer conversations



There is a significant gap in addressing women's concerns

Consumer interest in women's health is greater than business interest



Only 0.01%
of product launches carry
women's health claims

We narrowed down three potential opportunity areas for food and drink manufacturers, linked to specific needs based on certain life stages of women - infancy, adult, aging.

Research looks into impact of soy formula on infants

INFANCY

One set of studies we found was linked to the impact of soy-based infant formula on the development of babies.

Many infants are fed with soy infant formula for a number of reasons, including lactose intolerance. Soy contains chemicals that present hormone-like activity, such as estrogenic isoflavones. In moderate quantities, this is not a problem for adults, but the impact on infants has not really been looked into in great detail. There are indications that soy formula does have an impact, but it is different for girls and boys



Soy infant formula could have long-term effects on girls



Possible change in developmental trajectories

Infants fed cow milk formula, soy formula and breast milk exclusively were compared to see how these different foods impacted their estrogen-responsive development.

Infant girls fed soy formula showed tissue- and organ-level developmental trajectories similar to exogenous estrogen exposure.

Vaginal-cell maturation was higher and uterine volume decreased more slowly in soy-fed girls compared with cow-milk-fed girls.



Potential link to painful periods

Another study suggested that soy formula feeding during infancy is associated with several indicators of severe menstrual pain in reproductive-age women.

Potential emerges for soy-free, dairy-free infant formula

While most infant formula products are milk-based or soy-based, there are very few other options. A new product addressing this issue is Hembal, which has just launched a hypoallergenic infant formula made from organic hemp seeds.



This is said to be the first US-based product that is

- Vegan
- Soy-free
- Dairy-free
- Gluten-free
- GMO-free
- Organic hemp-based

Hemp Seed Milk



High
Novelty

5.00
Consumer

Projected growth for the next 12 months, US

573%

Consumer media

31%

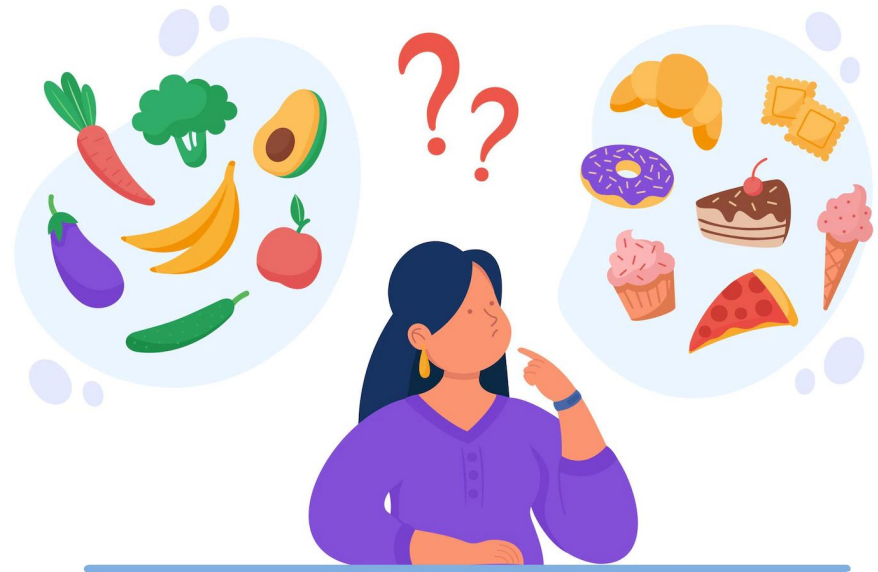
Business media

Addressing PMS food cravings

ADULT

The next opportunity area is linked to food cravings, one of the many symptoms of PMS or premenstrual syndrome. Over 90% of women say they get some form of PMS symptoms.

More than 150 different symptoms have been documented in studies, ranging from physical and emotional to behavioral and cognitive. Food cravings are up there with the most commonly reported behavioral PMS symptoms, along with mood swings, irritability, anxiety, and tension.



Link between food cravings, PMS are not understood

However, there are several theories:



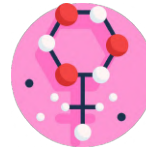
Eating carbs increases serotonin levels, which increases a general sense of wellbeing.

Studies have found that when serotonin neurotransmission in the brain is increased, either through diet or drugs, people's food intake and mood goes back to normal.



Women may be turning to food for physical and psychological comfort, especially when feeling low.

Research indicates that cravings are not just hunger driven, and "thinking" of a really tasty food is the most common reason for wanting to eat it.



Food cravings are regulated by hormones.

Researchers have observed that women tend to eat more when estrogen levels are low and progesterone levels are high, which occurs during the luteal phase or the first half of the menstrual cycle



PMS may be linked to hypoglycemia (low blood sugar) in the second half of the menstrual cycle.

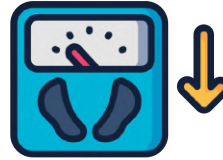
Women were found to experience a significant drop in blood sugar after eating, accompanied by irritability, and followed again by hunger and cravings.

Topics women associate with cravings

Leading topics that are associated with women's health and cravings together



Holistic nutrition
66%



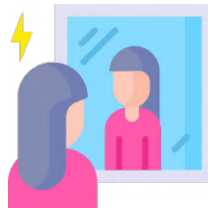
Weight loss
42%



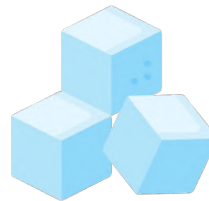
Emotional eating
36%



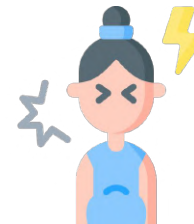
Weight gain
33%



Body image
33%



Sugar
21%



Stress
20%



Hormone balancing
19%

2%

of consumer conversations on women's health also talk about cravings

Chocolate launches address PMS

There is research that shows that women tend to eat more during the luteal phase (the first half) of the menstrual cycle, and regardless of the diagnosis of PMS. This increased food intake can be as high as 500 extra calories per day. The most popular foods at this time are carbs, fats, and sweets, with chocolate being particularly popular due to its combination of these three features.

6%

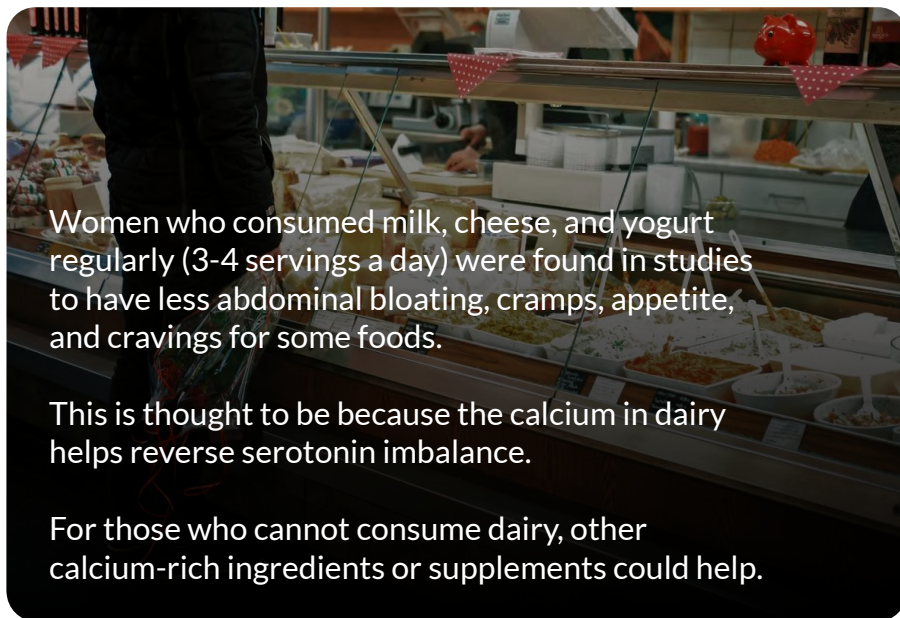
of consumer conversations on women's health and cravings together also talk about chocolate

Rhythm Chocolate includes a selected blend of botanicals and vitamins as well as the patented ingredient, **SaffSerene®** (featuring saffron flowers grown in Turkey and Morocco) clinically shown to provide a **50% reduction in the severity of PMS symptoms, help support healthy mood, balance, and stress levels.**



Scope for other foods that help temper PMS cravings

There are opportunities here for brands to offer ready-to-eat foods that can address the cravings but are also healthier and more balanced than the simple carbs and empty calories of traditional comfort foods.



Women who consumed milk, cheese, and yogurt regularly (3-4 servings a day) were found in studies to have less abdominal bloating, cramps, appetite, and cravings for some foods.

This is thought to be because the calcium in dairy helps reverse serotonin imbalance.

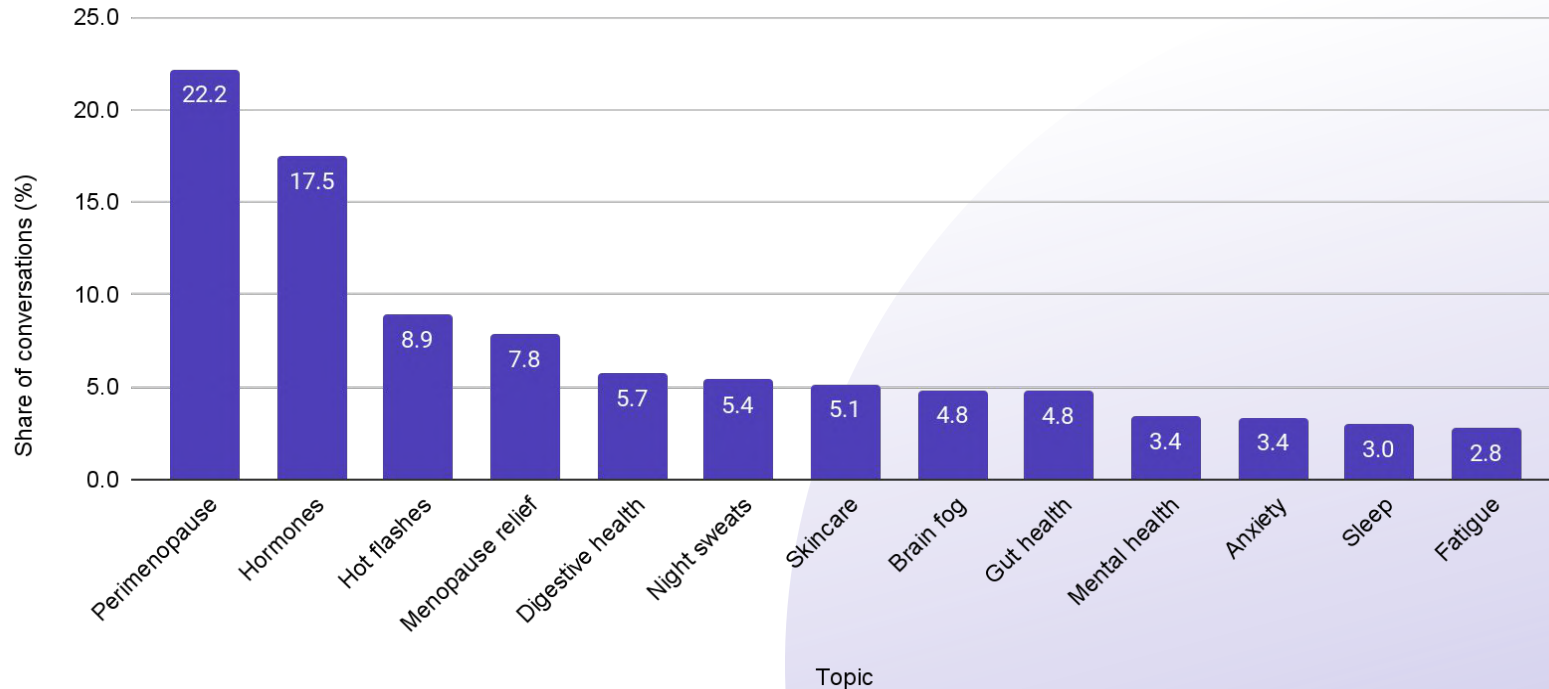
For those who cannot consume dairy, other calcium-rich ingredients or supplements could help.



Foods rich in magnesium can help reduce bloating, water retention, and mood symptoms.
Vits B6 and E may also be helpful for cravings.

Topics associated with menopause in online conversations

Main topics linked to women's health and menopause in consumer conversations



MPowder aims to remove the taboo linked to menopause

MPowder is a range of food supplements for women experiencing or starting to experience menopause. It is the world's first plant-based protein supplement powder that has been formulated to address the three distinct biochemical stages of menopause. These powders can be added to smoothies, porridges, or protein balls.



The company is looking to not just support women transitioning into menopause but also remove the taboo attached to it and thus the negative impact it has on the quality of life for many women.

MPowder addresses peri- and post-menopause

Peri-Boost Biostage N°1 is nutritional support for women over 40 years and it targets the most frequent effects of perimenopause, including fatigue, sleep issues, bloating, loss of skin elasticity, hormone imbalance, and joint aches.

This product's ingredients include:

- DracoBelle™ Nu, which is a water-soluble powder extract from organically grown Moldavian Dragonhead shown to improve skin moisture, elasticity, and density
- Organic cacao, for sleep and blood pressure
- Ginger, for digestion and joint pain
- Moringa leaf powder, for bone health
- Golden flaxseeds, for hormone balance and hot flashes
- Soy protein and isoflavones, for hot flashes and mood
- A range of whole food, vitamins, and botanicals specifically for perimenopause

Meno-Boost Biostage N°2 is for both menopause and post-menopause and it offers nutritional support for women who have had menopause. It addresses some of the common symptoms of this stage, including hot flashes, blood pressure regulation, heart health, bone health, energy, sleep issues, anxiety, and brain fog.

The main ingredients used include:

- Maca, for hormone fluctuations
- Organic ashwagandha KSM-66, for libido and mood
- Red clover, for hot flashes
- Slippery elm, for gut health
- Rosehip, for bone health
- Pomegranate seed extract, for blood sugar regulation

Gut health may be the key to alleviating menopause symptoms

5%

of consumer conversations on women's health and menopause together also talk about gut health

Early studies indicate that the interplay between the microbiome and menopause holds promise for new interventions to alleviate menopausal symptoms and improve quality of life for women.



A clinical trial assessing the effects of the **paraprobiotic *Lactobacillus gasseri* CP2305** on menopausal women suggested that **daily administration** of CP2305 could significantly **improve psychological** (*irritability, depression, insomnia, and dizziness*) and **vasomotor menopausal symptoms** (*hot flashes, chills, excessive sweating, and palpitations*), with no effect on the follicular phase levels of reproductive hormones.

Spoonshot's take

Research into women's health is an area that has only fairly recently started to get the attention it deserves.

As the research expands and presents us with new insights into women's health, we will also see a lot more scope for innovation within food and drink addressing issues uniquely for women across different life stages.

In fact, there is scope for cradle-to-grave innovation to support women's needs.

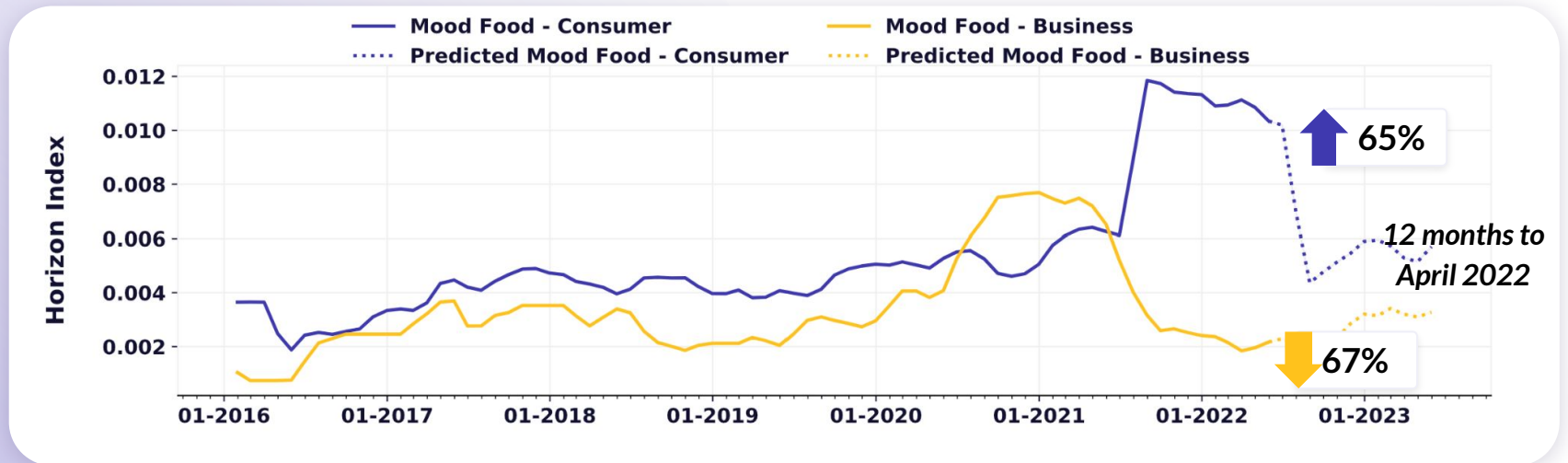
The High Life

THC and psilocybin have potential as the next major “adult” functional foods.

The need for wellness drives interest in mood foods

Health now encompasses not just physical aspects, but also mental and emotional aspects - which fall under the umbrella of “wellness”. In particular, ingredients that offer assistance in dealing with everyday pressures are finding favour with consumers, especially for stress, relaxation, sleep and so on. Such foods, which have earned the sobriquet of “mood foods”, have caught the attention of consumers.

Consumer interest in mood foods is on the rise



Easing attitudes towards cannabis boost CBD market

Over the last decade, our attitudes towards marijuana have started to ease up and along with that so have government regulations. A number of countries have made medical and/or recreational marijuana legal, based on overwhelming consumer support.

These changes led to the boom in CBD, often positioned as a therapy for dealing with issues like stress, anxiety, pain management and so on.

In fact, CBD has become a major part of the wellness industrial complex, and companies across regions where it is legal have been launching CBD-infused foods in various formats, from beverages to snacks.

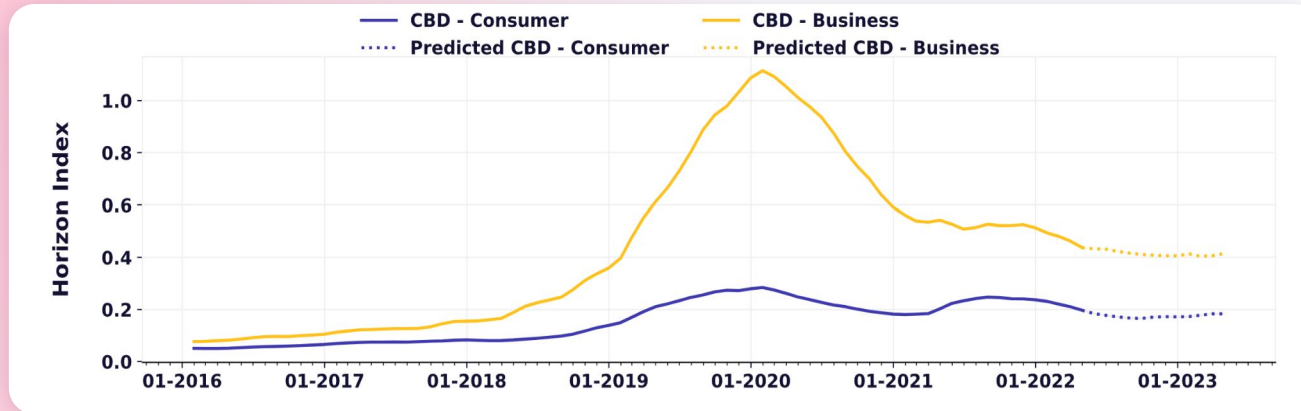
Despite this, the CBD market has not grown as rapidly as initially hoped. One reason for this is the pandemic, when people's priorities shifted to other functional aspects like immunity. The other reason is the confusing regulatory landscape and some safety and efficacy issues.

We expect to see a lot more growth in CBD in the coming years, with the UK becoming the first country in the world (in April 2022) to regulate the market for safe, orally consumed legal CBD extracts. This is three years after the country gave CBD novel food status.

There are now around 3,500 CBD foods that have received approval for sale to consumers in England and Wales. This could spur some unified regulation in other parts of the world as well.

Easing attitudes towards cannabis boost CBD market

The pandemic and the confusing regulatory landscape have held the sector back in terms of growth.




Growth, 24 months to April 2022

 **60.7%**

 **30.7%**

Projected growth, next 12 months

 **6.9%**

 **5.1%**

The UK is the first country to regulate the market for safe, orally consumed legal CBD extracts. 3,500 products have approval for sale in the country.

Mental health issues drive the need for wellness solutions

Topics associated with mental health in consumer conversations

Anxiety



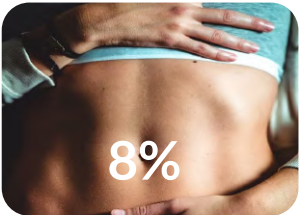
Depression



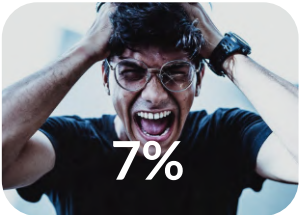
Nutrition



Gut Health



Stress



Sleep



Mental health issues continue to become more prevalent with consumers becoming more willing to open up about them.

They are also more open to trying out complementary remedies and therapies for overall well being as opposed to prescription drugs.

Interest in THC as a functional ingredient is growing

The easing of attitudes towards CBD has also helped ease attitudes towards its psychoactive sibling THC, the compound in cannabis that gives the high. While recreational use of THC products is not as widespread - legally speaking - as CBD, where it is, we can see it taking a similar trajectory to CBD and then some.

The most popular food-related vehicles for THC have been brownies and baked goods, usually homemade or freshly made. But now THC has made its way into a number of different formats thanks to relaxed restrictions - and some regulatory loopholes.

For example, chefs in many parts of the US are experimenting with cannabis infused foods, from pastries and chocolate to pasta sauces, pizza, fries and so on, like Canna Cafe in Chicago.

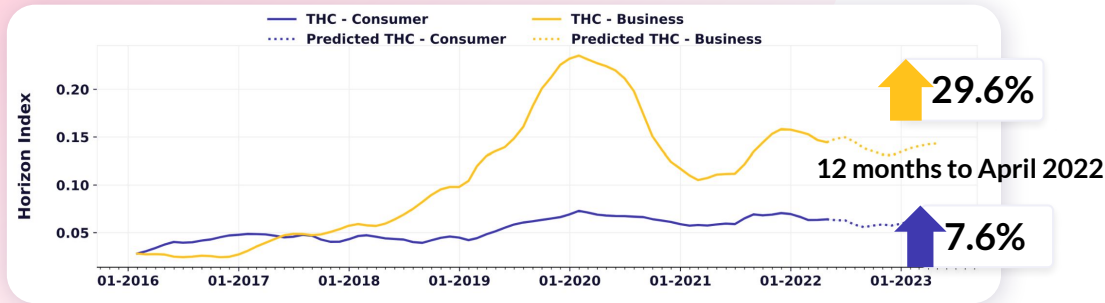
Some even offer multiple-course tasting menus with a range of dishes infused with microdoses of THC and CBD, such as the pop-up restaurant Herbal Notes.

Experiments with cannabis infused foods in a food service setting is not to get people high (though that's an option too), but instead to give them an introduction to the versatility of THC as an ingredient, while also offering them a relaxed feel.

Different strains can promote different effects - certain strains can enhance focus, while others can calm. Chefs experimenting with cannabis are looking at all of these aspects of dosage and strains to really give their customers unique culinary experiences, and in fine dining no less.

Interest in THC-based foods is on the rise

Consumer and business interest in THC

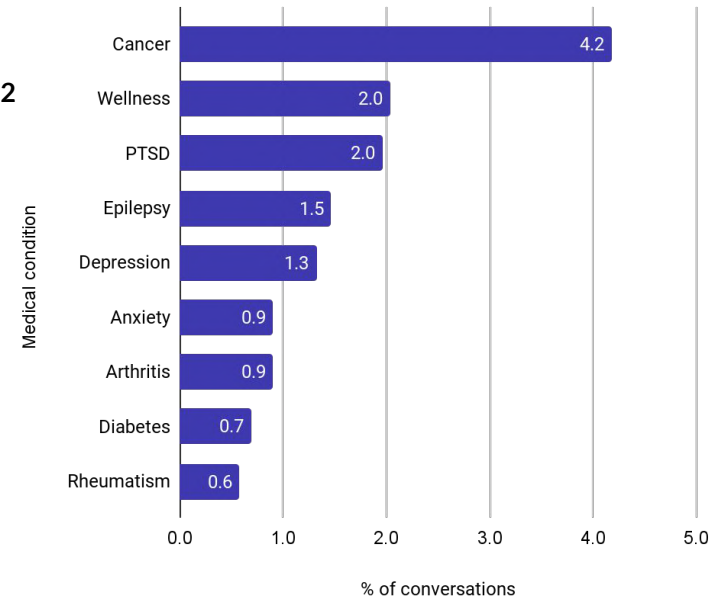


21%

of consumer conversations on THC were about medical marijuana

Like alcohol, ingredients like THC will need to be age-gated to keep it away from underage consumers.

Medical conditions talked about in consumer conversations on THC



US restaurants start serving up THC-infused dishes

Canna Cafe in Chicago uses delta-8 in its food, another psychoactive compound from cannabis which is said to provide a gentler high.



Herbal Notes is a popular pop-up restaurant that offers 6-7-course tasting menus for US\$150. Every dish is infused with a microdose of THC and CBD.



THC expands into packaged food and drink

There is also a whole range of packaged food and drink that are infused with THC. The marketplace includes chips, crackers, chocolates, and even cocktail kits that consumers can indulge in without smoking.

And some of these products are quite premium. **Rose Delights** makes cannabis-concentrate edibles from fine ingredients, like d'Anjou pears, Sangiovese and Viognier grapes. The company also collaborates with chefs to create these products.

Artet, which is Tetra backwards, is looking to recreate the aperitif occasion with cannabis-infused, non-alcoholic aperitifs.

Tempo's cannabis infused crackers and Potli Cannabis Infused Shrimp Chips come in a range of flavors and THC strengths.



The THC experience gets a luxury retail makeover



Cannabis-curious consumers today have a much wider range of packaged formats to choose from to experience THC.

Green D'anjou pears from Mt. Hood Organics are poached in Koch mezcal and finished with a smokey/sweet Ancho chili powder



Artet is a non-alcoholic and cannabis infused aperitif. This product blends cannabis and eight botanicals. (2.5mg/serving)

Snacks start to incorporate THC



Tempo's cannabis infused crackers come in 4 flavors and each cracker is infused with 5mg of THC



Potli Cannabis Infused Shrimp Chips come in 2 variants, with different spice levels and THC levels

THC in food & drink is only set to grow

This is a fascinating expansion since incorporating THC into foods that consumers are familiar with can make it easier for the inexperienced who want to try it out but not at the risk of negative impacts.

This could even change the stoner perceptions of cannabis, putting it more firmly into the space of “grown-up” functional ingredient.

So it isn't surprising that interest in THC foods has been growing over the last year (after the pandemic blip). Another reason for growth can be attributed to some loopholes in the regulations.

There's going to be some pushback in this regard eventually while regulations get sorted out, but meanwhile, food and drink innovations featuring THC is only going to grow.



THC primes the market for more psychotropic ingredients

The acceptance of THC has opened the gates for other psychotropic drugs to maybe enter the fray as functional ingredients. There is now research indicating that certain psychotropic or psychedelic drugs may have strong therapeutic benefits and thus there are calls to ease up regulations surrounding them.

One of these is **psilocybin**, a hallucinogenic chemical found in certain types of mushroom (magic mushrooms). It's actually a prodrug, a secondary metabolite that is converted into its psychoactive form after ingestion.

Psilocybin is still a banned substance in most parts of the world, but over the last few years, several cities in the US have decriminalised it and some states have even cleared the way to research the medicinal effects of psilocybin and various other illicit substances like LSD or MDMA. This can be linked to significant consumer support for this.

Our data shows that there is greater interest in psilocybin in consumer media compared to business media. In 2020, a ballot initiative made Oregon the first state to legalize psilocybin use, and the policy is being worked on. The Oregon Health Authority (OHA) started accepting applications from psilocybin manufacturers and "service centers" starting January 2 this year.

Psilocybin may be the next big “adult” functional ingredient

Projected interest in both consumer and business media is expected to go up significantly in the coming year.

Our analysis of research papers has also shown a bump up in the studies into psilocybin. Initial research has shown promise for psilocybin in the treatment of depression, anxiety and mood disorders, as well as pain and PTSD.

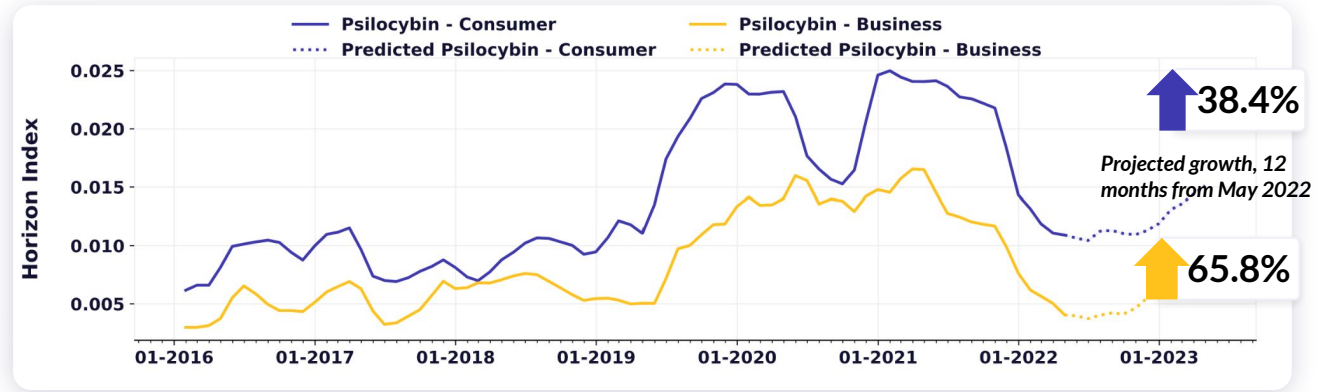
Psychedelics could very well emerge as alternatives to antidepressants and opioids, which can have severe side effects.

There is also anecdotal evidence of users finding benefits of microdosing with psilocybin, though there is not yet much research into this area. The Food and Drug Administration has approved and fast-tracked several clinical research trials.

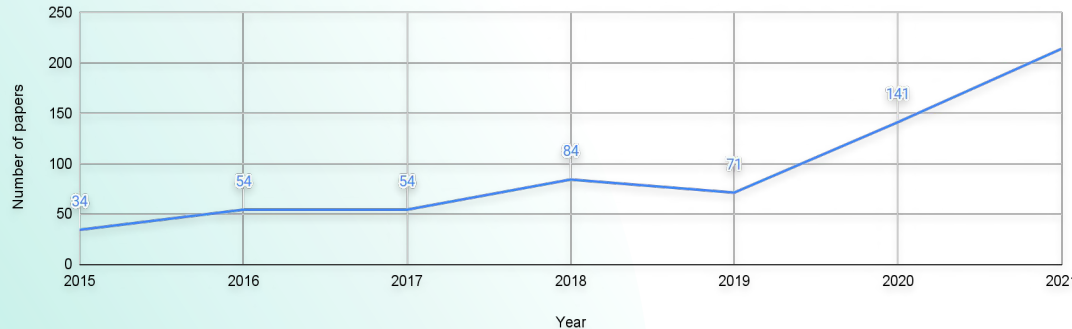


THC's expansion opens the doors for psilocybin

The next big “grown-up” functional ingredient to watch out for is psilocybin - a prodrug molecule found in certain mushrooms.



Number of research papers published on psilocybin by year



6.3X

Growth in research papers published on psilocybin, 2015-21

Psilocybin's popularity expands in popular culture

Psilocybin's growth ties in nicely with the overall acceptance of mushrooms as functional ingredients - a number of them are seen as adaptogenic or nootropic. Magic mushrooms are also becoming part of our culture, what with books like Michael Pollan's "***How to Change Your Mind***" or the rather polarizing Netflix show "***The Goop Lab***" bringing its effects to the forefront.

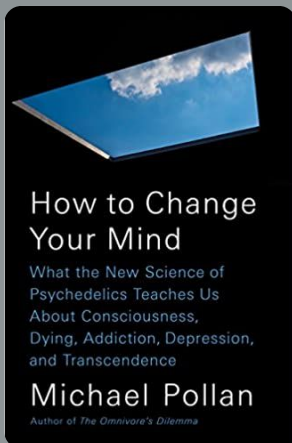
We're even seeing recipes and cookbooks detailing the use of psilocybin as an ingredient in a variety of dishes, from omelets to beverages.

A more promising indicator of psilocybin's potential as a functional ingredient is the fact that the American Herbal Products Association has formed a new Psychedelic Plants and Fungi Committee.

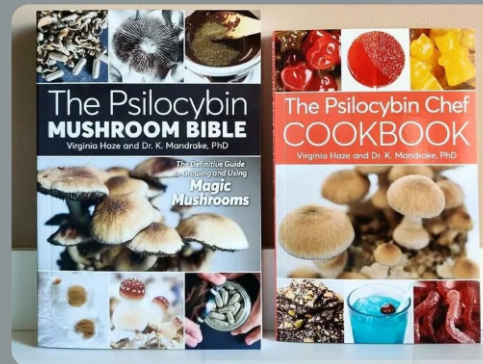
The association had similarly formed a cannabis committee quite some time before state regulations on cannabis started easing up.



Psilocybin starts to emerge in wellness culture



Magic mushrooms are also becoming part of our culture, what with books like Michael Pollan's *How to Change Your Mind* or the Netflix show *The Goop Lab* bringing its effects to the forefront.



Grilled cheese sandwich with psilocybin

Magic mushrooms are also becoming part of the culinary scene. These books provide recipes and instructions on dosage when it comes to cooking with psilocybin.

84%

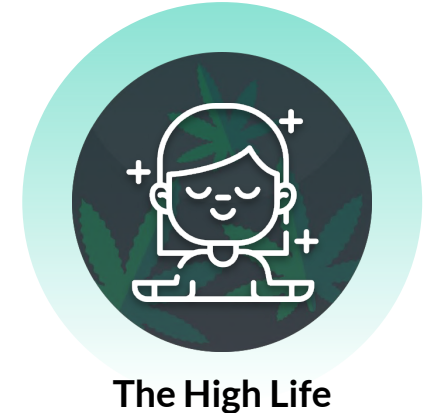
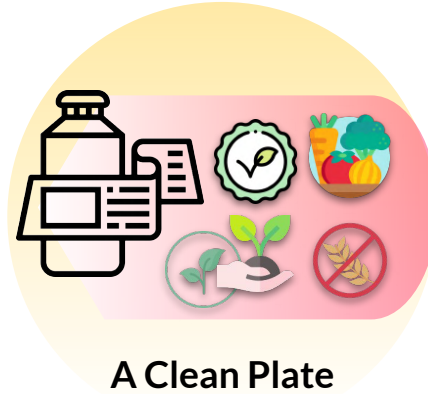
Growth in references to wellness during 2016-21

Spoonshot's take

Our relationship with drugs has changed dramatically over the last decade with the legalization of cannabis and the penetration of CBD in multiple food categories in some parts of the world. There is a lot more openness towards and acceptance of controlled substances, particularly within wellness culture.

And while it's too early to talk about legalization, there's growing evidence that these ingredients may hold the key to dealing with the stresses of modern life. And we could all use a dose of calm.

Trends for 2023 & Beyond



THANK YOU



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