

What can be done to increase acceptance of seaweed into the western diet?

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Abstract

By the year 2030 the world's population will sit around 9.8 billion. Of these 9.8 billion it is expected that 4.9 Billion will be part of the new emerging global middle class (1). This rise in a global middle class will contribute to a drastic change in lifestyle globally. These changes can be commonly seen in the rapid rise in demand for fresh meat. This increase in the demand for meat will be increasingly felt as more land is requisitioned to be used as grazing pasture. Requiring more land to be used for farming to feed these animals. This will again lead to an increase in the demand for farmland. The cyclical nature of this is worrying. This demand for protein rich food stuffs will become a more pronounced burden upon the global farming industry as a result. To counteract this protein substitutes need to be found that do not place elevated strain on limited land resources currently available.

Seaweed is chronically undervalued in the west and is still used sparingly outside of Asia. Its many attributes, alongside its protein content, will be explored in this article. To increase acceptance this article will not only look at seaweeds characteristics, it will also consider consumer psychology behind food purchasing, along with new food product branding. This article sets out to assess what can be done to accelerate the acceptance of seaweed within western culture. This article will give marketers as well as packaging designers a literature review based conclusion. This conclusion could be used in practice as a method for creating a brand and associated marketing strategy based around seaweeds attributes.

Keywords: Seaweed, Protein, Integration, Functional Food, Perceptions, Marketing Strategy, Branding

1. Introduction

The need to promote less environmentally impactful protein sources into the western diet is crucial with the currently expanding middle class and their demand for protein rich sources of food. Along with this, the shortage of protein in the developing world is currently an issue. Further on this, the fact that of the 79 countries with moderate to extremely alarming hunger

levels, 49 of them have workable coastlines (2).

To encourage the use of another source of protein, that unlike cattle farming does not further contribute to land usage or further greenhouse gas emissions (3), is a crucial necessity for future agriculture. The increasing demand for animal products within both China and India requires a reflection on how we in the west consume protein.

Increasing the consumption of any form of viable plant based protein source is a necessity that has to be met. Estimates currently state that of the world's grain supply somewhere in the region of 40-50% goes towards animal feed (3). Conversely if plant based protein sources were accepted more universally the strain on arable land could potentially be reduced.

The problem for many is that they see seaweed as something alien to their normal cooking and eating routine. To integrate a food that is also perceived by some demographics to be a 'poor man's meal' means we also have to breakdown pre-formed misconceptions about seaweed as a food (2). The many different types of seaweed make it difficult to approach as a foodstuff, about 12,000 to be precise, with about 500 species used for food (4). This large number and the remarkable nutritional differences between the different types of seaweed make the acceptance that much harder.

Recognizing the benefits of seaweed as a viable source of protein has been done previously. This article will instead focus in on what can be done to increase the acceptance of seaweed within the western diet.

2. Methods

This article's findings are based on a literature review. The literature reviewed will be a combination of seaweed articles along with food technology papers and psychological articles concerning acceptance. This literature review will ensure an outcome that could be used as a roadmap to allow for integration of seaweed into the western diet.

Rather than focusing singularly on the production and large-scale distribution, seaweed has to be seen as a desirable

commodity. To understand why their has not been larger scale acceptance, a review of the literature surrounding acceptance of foodstuffs. Along with this considering the reasoning and psychology behind what and why people choose to consume certain products over others.

This article, because of this, will also outline issues with acceptance and conversely highlight, where previously, issues and impasses may have been reached. Highlighting this is crucial so that these problems can be overcome. Examples may be given of existing or previously existing products that failed to correctly understand how important the acceptance process is.

3. What Is Seaweed?

Seaweed's are a type of Algae. "They are very simple plants that can range from microscopic (Micro-algae) all the way to large seaweed (Macro-algae). (5)" Another definition states that; "*Microalgae are single-celled organisms that can grow over a wide range of environmental conditions, whereas seaweeds are complex multicellular organisms growing in salt water or a marine environment.*" (3) They provide around 70% of all breathable air to the atmosphere (5). Duckweeds are not a type of Algae. They are commonly accepted as a form of Algae however they are instead actually; 'a small, free floating, light green, seed bearing plant...' (6). Duck weed is also known as Khai-Nam in south east Asia.

The main characterization or commonality between seaweed and duckweed is that they are both able to be consumed by humans. What sets them apart is that whereas Seaweed (Macro-Algae) grows in saltwater, duckweed grows in freshwater. However, the crucial factor is looking at the protein content.

For this article, I am going to classify Macro-Algae and Duckweed as one and the same. The primary aim of this article is to encourage the uptake of seaweeds as a viable food within the western market. The more types of water based plants that are safe for human consumption and are high in protein need to be looked into in more detail.

3.1 Acceptance So Far

Seaweed as a nutrient is currently consumed habitually in the following countries; Malaysia, China, Iceland, Canada, Japan, Korea, Singapore and some areas of Scandinavia. The current consumption in Tons per year is relatively small with a total in metric tons sitting somewhere around 7 million (4). This relatively small amount is valued at a staggering 6 Billion US Dollars (As of 2003) (7). This demonstrates just how valuable the industry could become if properly introduced in the west. China, Korea, Japan and the Philippines accounts for 90% of total world production at the moment (4). In conjunction with this duckweed is widely accepted within Thailand where it is called Khai-Nam. Figures for annual consumption do not seem to currently exist as it is commonly grown and harvested on a much more substance level than seaweed.

The problem with the acceptance so far is that it is in areas of the planet where there has been historic consumption of seaweed. There has been no need to try to introduce seaweed in these areas as it is already a well-established source of food. Both duckweed and seaweed have historically been seen as a 'poor mans' food (3). Trying to introduce seaweed has been tried for many years in the west. Prof Ole Mouritsen (University of Southern Denmark) believes that acceptance has been slow owing to the

fact that "People don't like the idea of eating something washed up" (8).

Countries with more arable land will obviously not have had, such a requirement, to eat as much seaweed as countries where farming was harder. My theory goes that seaweed is commonly eaten where it is commonly available. This is now only true for regions of the world where historical seaweed use has not been forgotten. The progression of farming in some areas of Europe has led to the eradication of the history of seaweed consumption. Commonly even in southeast Asia where duckweeds and Micro-algae's have been consumed It is still seen as a 'localized/ traditional dish' (3). Thus, trying to introduce seaweed into the western diet is something that will be incredibly tricky to attempt.

3.2 Health Benefits Of Seaweed

Seaweed is a highly nutrient rich foodstuff. One certainty that comes with eating seaweed that you will be receiving enough minerals and vitamins no matter what type of seaweed you are consuming.

Protein content varies from as low as 7% dry weight in some brown seaweed, but in species such as 'Nori' a green seaweed the protein content when dried is as much as 47% (8). Duckweed also contains a relatively high amount of protein. Content ranges from around 20-35% of dry weight (9). This high protein content is what I am interested in highlighting. It is obviously not the only benefit to consuming seaweed or duckweed.

Eating about a gram of seaweed (Macro-Algae) would take care of your daily iodine needs (10). A study from the United Kingdom focused on this singular beneficial aspect. The common diet in the UK lacks

iodine and introducing more iodine into the diet could benefit general health within the UK (11).

Along with this seaweed consists mainly of soluble fiber, this form of fiber slows down the digestive process and decreases the absorption of sugars and cholesterol. It is also very high in sodium and magnesium. Per 100g it contains about 43 calories and 0g of fat (12).

Further, research has been conducted concerning seaweeds effect on the absorption of fat into the body. Research has shown that seaweed has the ability to reduce the body's consumption of fats and thus reduce the risk of Cardio Vascular disease. (13)

Seaweed is a food that is vegetarian, vegan and gluten free, the health benefits listed above would have benefits on these three limited eating groups. Vegans and Vegetarians would gain a source of high quality low fat protein. People with Gluten intolerance would also gain another source of protein, as well as a highly beneficial source of dietary fiber.

Even with people recognizing these health benefits this does and will not lead to acceptance. People's reasoning behind choosing foodstuffs is far more complex than recognition of health benefits.

3.3 Possible Health Risks

It has been highlighted that there have been previous risks associated with eating seaweed and duckweed. Before I elaborate on this further consumption of any food source has associated risks. Food production obviously has to be managed and regulated carefully. France is the only country in Europe to have created national regulations for the human consumption of seaweed as a

novel food. (14) EU directives were then built upon these regulations.

There have, historically, been perceived risks associated with consuming seaweed and duckweed. Some of these I would hope to dispel and some I would like to briefly highlight.

Firstly, there have been published links to thyroid cancer. This was thought to have been caused due to the raised iodine levels. However, a study conducted in Japan has found that this link was tenuous at best. They found no associated link between thyroid cancer and consumption of seaweed (11).

Secondly, seaweed and duckweed can be manipulated by changing the composition of the solution that they are suspended within. This obviously presents risks as naturally grown seaweed and duckweed will contain different levels of pesticides, allergens and pathogens. This obviously presents risks to human consumption (3). However, as with any food source the levels of substances contained within a food can obviously be monitored to ensure that they are safe when consumed. This potential weakness can be manipulated to the grower's advantage as I will mention later in this article.

These concerns are obviously well intentioned. These may have been inflated by extensive media coverage of incidents surrounding food scares. This belief is supported by other research which has hypothesized that there is an extensive media focus on food, scares concerning new food processing technology (15).

These fears will probably not simply be dispelled with further information and reassurances as to the safety of a new

product or process. All that can be done is ensuring that procedures and regulations ensure high levels of quality within new and emerging food technology. Misconceptions and fears of new foods and technologies may have slowed the acceptance of seaweed within the western market. Problems such as these are not the central issue of the article. Highlighting the fact that new food and food processing technology is often feared is a necessity.

4. Researching Reasoning Behind Consumer Preference and Acceptance

4.1 Consumer Psychology

The psychology as to why people will choose this (Seaweed) over another form of foodstuffs is what the issue revolves around. There are large amounts of research into why people choose to eat the things they eat; *“The process by which man accepts or rejects food is of a multi-dimensional nature”* (16). Costell, Tarrega and Bayarri explain this issue further later in the same article; *“one must bear in mind that when consumers eat food their responses are not only based on the sensory characteristics of the product and on their physiological status, but also related to other factors, such as previous information acquired about the product, their past experience’s, and their attitudes and beliefs.”* (16) This extensive description about the reasons behind choice of a food product has interesting links to points already highlighted in this article.

People often do not have experience with seaweed as a foodstuff in the west. This limits their ability to create a judgment on the product from a personal historic point of view. Along with this, the previous information many have about seaweed as an

entity is that it is found in the sea. There is little evidence to suggest that people have a clear understanding of seaweed as a foodstuff.

The sensory characteristics of seaweed also have probably gone some way to harm its acceptance into the western diet. For instance, a taste trial recorded that the most common dislike for seaweed from the participants was; *“fish-like smell and taste, uncommon taste and, in some cases, hard pieces”* (2). These reasons cannot be overcome easily when using seaweed in its raw state.

The success or failure of introducing a new product, especially new food technology, relies heavily upon: *“consumer’s behavioral responses to the innovation...despite an apparent increase in consumer interest in food related technology”* (17). Understanding peoples reasoning behind accepting an innovative food

4.2 Alternative Approaches to Consumer Acceptance

Alternatives may be to approach seaweed as a functional food. The description for which is as follows; *“a range of novel foods under development, which are designed to deliver some other benefit beyond nutrition to the person consuming them”* (18). Now this explanation accounts for foodstuffs that commonly are not beneficial to those consuming them but for instance would have a key component added to them.

Examples in modern society include high protein breads or vitamin infused butters. Pasteurization is also a form of technological process that creates a functional foodstuff. It was originally viewed with suspicion, however now the process is widely

accepted as the norm. The benefits of pasteurization beyond nutrition is that dangerous microbes are removed (15). This process is commonly referred to as fortification and has in general been used to provide large ranging health benefits to societies. These changes to food have previously been seen as beneficial by individuals and more importantly within society as a whole. (18)

4.2.1 Highlighting Benefits

The components that exist within seaweed are beneficial when added together with other foodstuffs. This is highlighted in a study that found that by adding specific types of seaweed to meat products you could offset the uptake of detrimental substances found in certain meat products these included; *“sodium and fat and improving fatty acid profiles”* (19). The article details how seaweed when added to meat and comprising up to 5.5% of the product has a hugely beneficial effect on both the end product as well as the nutritional qualities of the product overall.

The study did not look to try to increase the protein uptake by introducing the seaweed into the meat, but instead looked to increase the quality of the existing product. The article points out that seaweed on its own has beneficial nutritional characteristics. The article goes as far as to state that; *“seaweeds contain several bioactive substances, which is why they are gaining a reputation as the new ‘super food’”* (19).

This nutritional characteristic can be highly advantageous as it could aid with the integration. Studies have shown that perceived benefits are crucial to aid in the acceptance of a new food technology (20)

(18). These benefits are most commonly nutritional which is true for seaweed.

4.3 Incremental Integration

Recognizing that seaweed has the potential to be used as a component within other foodstuffs allows for a directional shift. Novel food is widely accepted for its health and nutritional benefits. It is increasingly clear that these changes need to occur within ‘natural’ food rather than processed food. This is converse to populist opinion with current interest lying within food supplements (18). Surveys suggest that older respondents are more interested in changes to their choice of unprocessed food rather than novel products (18).

This rise in the acceptance of supplements to benefit one’s diet is detrimental to the line of thought that I am progressing along. Trying to encourage people to consume seaweed is made harder by the fact that many may believe they already have a healthy diet owing to their use of supplements. Crucially what has to be remembered, as is becoming increasingly difficult with the focus that is placed upon the issue by the media, is that single food is either healthy or unhealthy (18). The attitudes perceived health benefits surrounding certain foodstuffs has led to some food’s being rewarded with ‘cult’ status. What should conversely be focused on is getting a healthy breadth of diet with balanced component parts.

4.3.1 Benefits from Incremental Integration

Novel food technology could facilitate this balance. Integrating seaweed into meat has been shown to be advantageous. Along

with this, there is evidence that the antioxidants contained within the seaweed, would improve oxidative stability (21). This improvement with the use of seaweed would dramatically increase shelf life whilst reducing the need for the use of synthetic preservatives within foods.

This has further benefits for the acceptability of a food that contains seaweed. A study suggests that the mere suggestion that a food has been modified synthetically, or contains synthetic components, can have knock on effects for the consumer valuation of said product (22). This would of course have a knock-on effect on the usage of seaweed. Demonstrating how adding seaweed could potentially be beneficial to an even wider variety of products for a multitude of characteristics.

These possible integrations, if accepted, would not be owed to a singular characteristic of seaweed, such as protein content, but would instead be owing to its many other valuable nutritional and natural characteristics.

Integration within existing products in my opinion would dramatically increase the desire to integrate seaweed into the western diet in its raw form as well. The integration would have to be conducted incrementally as; *“consumers are increasingly weary of new technologies because of the perceived risks”* (15).

It is fundamental to point out at this point that this new approach would still increase the usage of seaweed within the western diet. Along with this, it would facilitate the further de-mystification of seaweed as a viable component within the

western diet. The crucial component of this article once again was ‘acceptance’.

4.4 Raising Awareness

The next hurdle to acceptance is to identify the correct method for raising consumer’s awareness of seaweed. There are many possible approaches to conveying dietary or food information. In this article I will focus on the two methods that could be applied to the marketing and integration of seaweed.

4.4.1 General Message Campaigns

Simply telling people how beneficial a food is has been shown to have negligible lasting impact on dietary change. This has clearly been shown with the emphasis that was placed upon the Five a day campaign (18). The campaign in North America was widely seen as ineffectual and may have had detrimental effects owing to the fact that people believed that eating five a day would ensure an entirely healthy diet (18).

The five a day campaign was a good demonstration of a *“general message”*. This is a message that is designed to reach across a wide variety of people. Another example of this is the dietary food pyramid. The problem with such messages is that the individual must *“translate this general information into specific alternatives”* (23).

Extensive general information campaigns often have little impact. The five a day campaign did not stop the still rising obesity rate within North America. This draws attention to how fruitless even *“general message”* campaigns can be.

General message campaigns do however work. This seems counter to what I

just stated however, the reasoning is present. General information campaigns do work. Introducing seatbelts, stopping substance abuse and cancer screenings are all entities that have been the subject of campaigns. The rate of acceptance can be slow. An example of this is as follows; *“if 60% of people were doing the target behavior before the campaign about 65% can be predicted to do the behavior after the campaign”* (24).

The key issue that is supported by data (24) is that once a campaign ends, the probability is that the acceptance of the behavior change will decline. This is the main hurdle with promoting acceptance of seaweed. Ensuring that users are aware of the product, during the campaign, and use of such a produce does not decline after the end of such a campaign.

4.4.2 Tailored Awareness Campaigns

When trying to convey important health and dietary information research states that; tailored messages are more beneficial as they focus more on a consumer’s perceptions, attitudes, and practices (23).

Tailoring messages, so that a consumer is not overwhelmed with information, will be more beneficial for integrating seaweed into the western diet. General information has a place within promoting food and dietary information, but could be ineffectual for the further integration of seaweed, comparatively to tailored messages. Risks associated with both forms of campaigns should be looked into in greater detail.

4.5 Branding Consumer Food Products

The branding of a product can dramatically effect acceptance into the

market. New Product Development (NPD) is vital for the introduction of new products. Having a clear understanding of the process around creating a brand is crucial to the success of any new product.

This will be a consumer product and as such having clear product tactics outlined prior to the launch of such a product is crucial to its eventual success. Studies have shown that when introducing a product to market: *“offering broader product assortments performed better in terms of market share within the first 2 years after market entry”* (25). This illustrates how gaining a large initial market share may insure a new brand greater success in the market and increase said brand’s longevity within the consumer goods market.

The failure of product launches often cannot be put down to the initial market entry. Instead failure hinged around the *‘Innovative improvements that will improve a brands image’* (25). This indicates that lack of innovation often leads to failure within the market. The product in this instance would be highly innovative within the consumer food market.

Crucially it is about getting the tone of the product branding correct. Packaging design can make or break a product. This was exhibited within a study that showed how people responded to different styles of tartan that would be associated with a new Scottish whisky. The survey found that traditional tartan styling was required as alternative, contemporary tartans would cause confusion with the consumer perception of the brand (26).

This demonstrates how much attention is required when designing the

branding of a new product. The smallest of changes can influence basic perceptions and therefore change the entire way that the product is viewed.

4.5.1 Sustainability and Associated Branding

With seaweed being a sustainable and ethical choice of foodstuff it' is imperative that this is conveyed through the branding of any potential product. This is owing to the fact that consumers have been shown to have been influenced during purchase by the choice between Environmentally Friendly Products (EFP) and other alternatives (27).

This trend of preferring brands that are more committed to social responsibility should be utilized when bringing new innovative products such as seaweed to market. The same article highlights the demographic which is the most influenced by this change; *"Millennials appear more responsive to sustainability"* (27).

This trends visibility has been studied with the following findings; food brands that emphasize sustainability within their marketing comprise of; *"Coffee (78%), Tea (61%), Snacks (60%)"* (28).

The emphasis on sustainability will need to be utilized to the full within any product that is produced. Seaweed's sustainability can be used beneficially in a potential new products marketing approach.

5. Discussion

From the findings of the article it seems to me that a cohesive, and combined, drive towards raising the integration of seaweed into existing foodstuffs could both alleviate existing demand for animal protein,

as well as increasing demand for seaweed. This would be done whilst simultaneously reducing the mystery surrounding seaweed. This is crucial as a; *"fragmented approach to introducing new products, may help to explain 'the' limited success of innovative food products"* (22).

Problems surrounding the sensory properties of seaweed in its raw state would be overcome using this proposed method of integration. This is crucial, as this detrimental factor was consistent across the research I conducted. The desirability of seaweed in its raw form is heavily reduced owing to its sensory characteristics. This could be overcome by integration into existing products.

The limited commercial products that already exist on the market that make use of seaweed; do so with limited stress placed upon its highly valuable characteristic's (29). New product's need to be designed to ensure that the consumer is made aware that they are consuming a product containing seaweed. The consumer would also need to be made aware of exactly how a product that contains seaweed benefits them over a product that does not contain seaweed.

Within the article, it is made clear that there are many different beneficial attributes of seaweed. To implement conclusions from this article a viable understanding of branding and marketing would be needed. This article does not pretend to have the certified solution to any potential process for complete integration of seaweed as a consumer food product. It also only looks at one possible method for further intergration. Other methods were not researched such as changes to infrastructure or organizations. Further research would be required into

branding, marketing and the complexities surrounding both. This article does however concisely propose a basic roadmap to integrating seaweed into the western diet.

5.1 Proposed Integration Process for Seaweed into the Western Diet.

Packaging for seaweed products need to be designed to not speak to the consumer with a general message. Rather, tailoring information, so that the user actively engages with the purchasing decision that they are making. Emphasis on the sustainable characteristics alongside the health benefits will increase the chances of success of this food product during introduction into the market. Potentially ensuring successful initial integration of seaweed into the western diet.

The branding would immediately have to make the consumer aware of the benefits of the product that they are purchasing. This would be another point where the tailored approach would benefit the user. Inducing further interaction with the product after the initial purchase would also be crucial. Final consumption of the product would have to be enjoyable and leave the user feeling that their purchase and the process they undertook was a worthwhile endeavor.

A product would need to be affordable and place emphasis upon desirability for the end consumer. This desirability could not be based exclusively upon the nutritional value of the product but should also take into account the sustainability and environmental responsibility of the product.

The ecosystem surrounding the product and the marketing would need to be cohesive and concrete. Every part of the

purchasing process would need to ensure similarities with all other aspects. This would ensure a de-fragmented approach to the integration of this product. This would ensure the crucial emphasis on integration within western society. Focusing on a single beneficial characteristic within foodstuff leads to over simplifications and therefore inaccurate and unhealthy consumption patterns.

6. Conclusion

The sensory issues surrounding seaweeds in their raw state have created resistance to the acceptance of seaweed. Focusing on one characteristic alone e.g. protien content will also not help people in their understanding of the benefits of seaweed as a product.

The proposed solution is to integrate seaweed in its raw powdered form into other foodstuffs stimulating further acceptance. This would need to be done whilst focusing on all the beneficial qualities that seaweed could offer the consumer (Nutrition, Sustainability, and Social Responsibility).

I suggest that further research be conducted into a user trial schemes, choosing between tailored or general advertising campaign's as well as bespoke packaging design for the product. With the aim of providing evidence for this suggested approach to integration of seaweed into the western diet.

Directing focus away from acceptance of seaweed in its raw form and instead recognizing that it can be beneficial when combined with other foodstuffs, should succeed in improving the acceptance within western society.

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