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Consumers' values, attitudes and behaviours towards consuming seaweed food products: The effects of perceived naturalness, uniqueness, and behavioural control

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ABSTRACT

Seaweed has great potential as a natural, healthy, and sustainable food. Seaweed as food is novel in Western countries; thus, few studies have focused on the factors influencing consumers' behavioural tendencies towards seaweed food products. This study aimed to fill the gap by investigating the antecedents for consumers' attitudes towards as well as their consumption of seaweed food products in a representative sample of Norwegian consumers (N = 426). An extended version of the value-attitude-behaviour (VAB) theory was employed as a conceptual framework to study seaweed consumption, assessing hedonistic values and perceived uniqueness versus biospheric values and perceived naturalness. Structural equation modelling was used to test the hypothesis. Our results showed that attitude significantly affected the consumption of seaweed food products and that perceived behavioural control positively moderated the attitude–consumption relationship. Perceived naturalness and uniqueness were associated with attitudes towards seaweed. Biospheric values directly influenced attitude, while perceived uniqueness positively moderated the hedonistic values–attitude relationship. In conclusion, this study indicates that Norwegian consumers form their positive attitudes towards seaweed food products based biospheric values and their beliefs that these products are healthy and natural.

1. Introduction

Seaweed is considered a pro-environmental food source since its cultivation does not need fertilisers, pesticides, or fresh water. Seaweed is a unique food source as it can extract the minerals found in seawater, allowing it to become a nutrient-dense food when harvested. Seaweed species contain protein and are low in lipids and calories. Seaweed is also known for being rich in iodine, antioxidants, vitamins, and minerals (Mabeau & Fleurence, 1993; Roohinejad et al., 2017). This study presents seaweed as a naturally grown, environmentally friendly, and healthy food category free from additives, artificial chemicals, or ingredients. The category shares its attributes with naturally grown (Román, Sánchez-Siles, & Siegrist, 2017) and organic food (Rana & Paul, 2017).

The consumption of seaweed eaten raw, dried, or as an ingredient in other food products is increasing. Vincent, Stanley, and Ring (2020) reported that the seaweed food market is projected to be worth €600–1,800 million in 2030 and will significantly benefit from the strong growth in plant-based diets in Europe. Seaweed is predicted to play an important role in a more sustainable diet in the future. Thus, there is a need for new studies to understand which factors influence consumers' attitudes towards as well as their consumption of seaweed. A few studies have looked at seaweed from a consumer behaviour perspective. For example, previous studies that profiled seaweed food consumers in Australia (Birch, Skallerud, & Paul, 2019) and Italy (Palmieri & Forleo, 2020) revealed that seaweed food consumers are educated, adventurous and health interested. Wendin and Undeland (2020) and Losada-López, Dopico, and Faíña-Medín (2021) analysed the influence of neophobia on consumer attitudes towards seaweed food. All these studies underlined the negative effect of food neophobia on consumer attitudes towards seaweed and are mostly based on convenience samples and sensory experiments. Finally, Govaerts and Olsen (2022) studied a representative sample of Norwegian consumers about their health awareness, perceived environmental responsibility, personal norms, and food innovativeness (which is similar to food neophobia), as well as those constructs' associations with seaweed's consumption.

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The present paper will examine how environmental values, attitudes, and product attributes affect seaweed consumption. Environmental values and attitudes are considered the most salient motives for consuming organic food (Aertsens, Verbeke, Mondelaers, & van Huylenbroeck, 2009; Kushwah, Dhir, & Sagar, 2019), an established food category similar to seaweed in that it involves environmental attributes. Values are assumed to be an essential motivational force for forming beliefs about sensory preferences, as well as health, nutrition, safety and quality, in addition to providing a stable basis for influencing attitudes and (sustainable) behaviours (De Groot & Steg, 2008; Milfont, Duckitt, & Wagner, 2010; Stern, 2000). Therefore, understanding if and how values are associated with consumers' expectations, attitudes, and behaviour towards seaweed products is vital.

In this context, this study is based on the value-attitude-behaviour (VAB) causal framework (Homer & Kahle, 1988). The VAB model has been successfully applied to explore a variety of pro-environmental behaviours and purchasing practices (Cheung & To, 2019; Jacobs, Petersen, Hörisch, & Battenfeld, 2018; Sharma & Jha, 2017), and its main components are considered to be of vital importance in exploring (sustainable) organic food consumption and willingness to pay (Katt & Meixner, 2020; Kushwah et al., 2019; Vermeir & Verbeke, 2006). The VAB model has so far not been used as a theoretical framework for exploring seaweed attitudes and consumption. The VAB theory proposes the causal hierarchical structure between more general and stable individual values and more context-specific attitudes and behaviours. Hence, this study explores if and how values and attitudes are related to consumers' consumption of seaweed.

The structures of universal core values (e.g., Schwartz, 1992) or the more domain-specific environmental attitudes and values (e.g., Milfont et al., 2010) are classified according to many different formats and constructs. Several studies confirm that biospheric and hedonistic values are the most robust conflicting types for explaining or predicting environmental attitudes, intentions, or behavioural tendencies (Balundė, Perlaviciute, & Steg, 2019; Steg, Perlaviciute, van der Werff, & Lurvink, 2014; Thelken & de Jong, 2020). This study contributes to the existing literature by investigating the conflict between immediate individualistic motives or values (hedonism) and longer-term collectivistic ones (biospherism) (Van Lange, Joireman, Parks, & Van Dijk, 2013) and its relationship to attitudes towards as well as the consumption of seaweed.

When consumers look for novel and exciting food products, perceived uniqueness and naturalness have been suggested to be the most important factors in successfully marketing new food products (Stewart-Knox & Mitchell, 2015). First, the consumer perception of seaweed as a unique type of food (Jaeger et al., 2017) could be vital for its commercial success as a new food product in Europe. Second, perceived naturalness is an especially relevant factor, as it integrates the attributes of environmental friendliness and healthiness (Román et al., 2017). Hence, this study incorporates perceived uniqueness (associated with hedonism) and perceived naturalness (associated with biospherism) as a relevant extension of the VAB framework to study seaweed consumption.

Finally, other constructs or variables can affect the strength of the relationship between attitude and seaweed consumption (Padel & Foster, 2005). Previous studies showed that food neophobia (Birch et al., 2019) or food innovativeness (Govaerts & Olsen, 2022) could hinder or encourage seaweed consumption. Hence, the last contribution of this study is to extend the VAB framework by introducing perceived behavioural control as a moderator on the attitude–behaviour gap in the context of sustainable food consumption (ElHaffar, Durif, & Dubé, 2020; Vermeir & Verbeke, 2006). Using perceived behavioural control as a moderator for the VAB framework is novel but not unrealistic, based on the previous studies of specific barriers for seaweed and theoretical foundations in the context of environmental behaviour (La Barbera & Ajzen, 2020).

In summary, this study first aims to contribute to the current literature by assessing the relationship between values, attitudes, and behaviours in the context of seaweed food products. Second, it proposes a model emphasising the conflicts between individualistic/hedonistic and collectivistic motives to extend the VAB theoretical framework. Third, this study explores if and how two specific product attributes, namely perceived naturalness and perceived uniqueness, affect consumers' attitudes towards seaweed. Finally, this study also includes perceived behavioural control, as a moderator for the relationship between attitude and seaweed consumption, the attitude–behaviour gap.

2. Theoretical framework

2.1. The value-attitude-behaviour approach (VAB)

The VAB theory, developed by Homer and Kahle (1988), proposes a causal model integrating values, attitude, and behaviour. The VAB model posits the existence of a hierarchical influence from the more abstract cognitions (values) to mid-range cognition (beliefs and attitudes) to a specific behaviour (Homer & Kahle, 1988). The model assumes that values directly influence attitude and indirectly influence behaviour through attitude. The VAB model has subsequently been used extensively in the literature in various contexts of pro-environmental behaviour, such as recycling, nature preservation (Milfont et al., 2010), and organic food consumption (Grunert & Juhl, 1995; Sharma & Jha, 2017; Shin, Moon, Jung, & Severt, 2017; Vermeir & Verbeke, 2006). Based on these previous works, this study applies and extends the VAB model to understand the possible antecedents of attitudes towards seaweed consumption in Norway. Our extension of the VAB hierarchy involves two relevant and specific attributes associated with new and environmentally friendly food products (perceived uniqueness and naturalness).

The VAB model and the hypotheses are presented in Fig. 1. The figure highlights the conflict between general individualistic and collectivistic motivations. In the following sections, we will argue that perceived uniqueness is associated with hedonistic/individualistic values, and perceived naturalness is associated with biospheric/collectivistic values.

Values are defined as 'desirable trans-situational goals varying in importance, which serve as a guiding principle in the life of a person or other social entity' (Schwartz, 1992, p. 21). Values are stable beliefs and can be thought of as accumulated global attitudes influencing context-specific attitudes and behaviour (Homer & Kahle, 1988; Stern, 2000). Whereas, attributes (belief-evaluation) can be defined as the subjective probability that a particular object has a particular trait or characteristic (Fishbein & Ajzen, 2010). Hence, we define perceived uniqueness as the probability that consumers perceive seaweed food products as unique. Similarly, perceived naturalness refers to consumers' probability of perceiving seaweed food products as natural. Attitude is defined as an individual's overall positive and negative evaluation of an attitude object. Attitude is based on the sum of expectancy of relevant attributes (or beliefs) forming the individual's general evaluation of an attitude object (Eagly & Chaiken, 1993; Fishbein & Ajzen, 2010). Finally, behaviour results from consumers' attitude towards engaging in the specific behaviour. This study defines behaviour as the tendency to consume seaweed food products during the previous year.

In the following section, we will argue more deeply for the hypotheses we presented in Fig. 1.

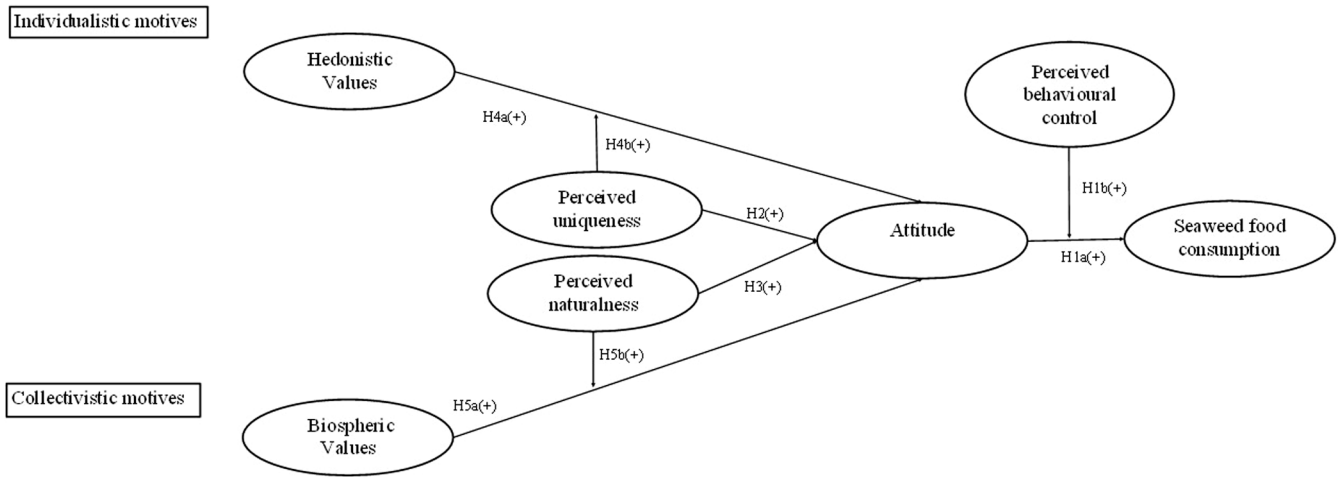

Fig. 1. The proposed structural model with hypotheses.

2.2. The gap between attitude and seaweed consumption

The positive causal relationship between a pro-environmental attitude and pro-environmental behaviour is in accordance with established general attitude models, such as the TPB (Fishbein & Ajzen, 2010) and VAB (Homer & Kahle, 1988), as well as with other models focusing on environmental attitudes, concerns, and engagement (e.g., Bamberg, Hunecke, & Blöbaum, 2007; Rodríguez-Casallas, Luo, & Geng, 2020; Zerbini, Vergura, & Latusi, 2019). Wendin and Undeland (2020) demonstrated an overall positive attitude of Swedish consumers towards seaweed food products. This study expects that positive attitudes towards seaweed food products positively influence individuals' seaweed consumption. Accordingly, this study proposes the following hypothesis:

H1a: Attitude is positively related to the consumption of seaweed.

However, despite having positive attitudes towards the given behaviour, people do not always perform the intended behaviour (the attitude–behaviour gap) (Aschemann-Witzel & Niebuhr Aagaard, 2014; Yamoah & Acquaye, 2019). To reduce the gap between attitude and behaviour, various individual, social, and contextual factors have been used in the literature as antecedents and moderators between attitude and pro-environmental behaviour, such as social factors/norms, environmental involvement and concern, trust, habit, price, and contextual factors (ElHaffar et al., 2020; Vermeir & Verbeke, 2006). With inspiration from the most-used theoretical framework for exploring health, food, and pro-environmental behaviour (Fishbein & Ajzen, 2010), this study uses perceived behavioural control to moderate the attitude–behaviour gap.

2.2.1. The moderating role of perceived behavioural control

Perceived behavioural control refers to a person's beliefs about how easy or difficult it is or likely or unlikely they are to perform a specific behaviour (Ajzen, 1991). Past studies have often used perceived behavioural control as an antecedent to various food and environmental behaviours (Fishbein & Ajzen, 2010; Yuriev, Dahmen, Paillé, Boiral, & Guillaumie, 2020). Although perceived behavioural control was initially used as a moderator in the theory of planned behaviour (TPB) framework (Ajzen, 1985), there has only recently been a renewed interest in using perceived behavioural control as a moderator of the different relationships of the TPB (e.g., La Barbera & Ajzen, 2021; Redondo & Puelles, 2017). However, the literature shows contrasting findings, as some studies show positive moderating effects, while others show negative ones, and in some cases, there are no significant moderating effects (Kothe & Mullan, 2015; La Barbera & Ajzen, 2021). This study differs from previous studies on seaweed consumption by using perceived behaviour control as a possible facilitator to consuming seaweed (e.g., Birch et al., 2019; Govaerts & Olsen, 2022).

Theoretically, there is still a lack of evidence that perceived behavioural control moderates the relationship between attitude towards pro-environmental food and (novel/unfamiliar) pro-environmental food consumption. Hence, this study explores the moderating effect of general perceived behavioural control on the attitude–seaweed consumption relationship. We believe that the higher the perceived behavioural control, the stronger the association between attitude and consumption. In other words, people with a positive attitude towards seaweed food products will be more likely to consume them if they believe they can easily buy them.

In line with the theoretical considerations and the results of previous research outlined above, it is hypothesised that:

H1b: Perceived behavioural control positively moderates the relationship between attitude and seaweed consumption.

2.3. Perceived uniqueness and naturalness as salient product attributes

Attitude theory refers to belief as an association of some characteristic or attribute, usually evaluative, with an attitude object (Eagly & Chaiken, 1993). According to Ajzen (2011), beliefs about attributes reflect the information people have about the performance of a given behaviour. Salient associations, beliefs or attributes provide the cognitive foundation for attitudes. When activated, they generate different attitudes, subjective norms, and/or perceptions of control, which then impact a given behaviour (Ajzen, 2011; Armitage & Conner, 2001). Which product attributes are most salient differs between food categories and individuals (Aikman, Crites, & Fabrigar, 2006).

In this study, we argue that perceived uniqueness and naturalness are two salient product attributes influencing attitude towards seaweed food products. Choosing perceived uniqueness and naturalness is based on the salient characteristics of seaweed as a naturally grown, environmentally friendly, healthy, new, and unique food category. Moreover, perceiving a product as natural or unique is not so dependent on sensory experience (e.g., taste). Thus, assessing naturalness and uniqueness as salient product attributes is probably more valid across subjects with low or no sensory experiences with seaweed (Olsen, 1999).

Thus this study uses the construct of naturalness (Román et al., 2017) and uniqueness (Stewart-Knox & Mitchell, 2015) to function as salient attributes associated with seaweed values and attitude.

2.3.1. Perceived uniqueness

According to the *Oxford Dictionary*, uniqueness is defined as 'the quality of being very special or unusual' or 'by the fact of being the only one of its type'. In the food consumption literature, Cardello et al. (2016, p. 24) define unique food as 'food that is highly differentiated from other products of the category based on sensory, image, functional, emotional characteristics that are positively valued by consumers'. However, product characteristics not only define the concept of uniqueness, but can also be defined in terms of consumer responses. From a consumer perspective, a unique product is unusual, novel, or unfamiliar (Jaeger et al., 2017). Unique products also evoke positive emotions (Favalli, Skov, & Byrne, 2013) and are associated with high quality (Jaeger et al., 2017).

Following Jaeger et al. (2017) conception of food product uniqueness, consumers might consider seaweed food products unique. This is the case because, first, seaweed remains new to Western consumers. Second, seaweed presents unusual and unique flavours and textures (Figueroa, Farfán, & Aguilera, 2021). Finally, it remains challenging in Norway to obtain seaweed food products, as they are available only in high-end or international stores.

Regarding seafood consumption, Olsen and Tuu (2021) indicated that perceived uniqueness influences the intention to eat luxury seafood products. Moreover, in the context of ethnic food and restaurants, the perceived uniqueness of ethnic food/menus is particularly appealing to consumers as it has a positive relationship with consumer attitudes and intentions towards such restaurants (Liu & Mattila, 2015).

For the emerging seaweed industry in Europe, it is crucial and relevant to evaluate whether consumers' perceived uniqueness impacts their food attitudes. Few studies have measured the influence of perceived uniqueness on consumers' food attitudes and choices (Jaeger et al., 2017). Thus, the following hypothesis was formulated:

H2: The perceived uniqueness of seaweed food products is positively related to attitudes towards seaweed.

2.3.2. Perceived naturalness

The concept of naturalness is highly abstract (Román et al., 2017) and lacks a clear definition (Hemmerling, Canavari, & Spiller, 2016). Naturalness is frequently associated with healthiness and minimally processed and organic food (Román et al., 2017; Rozin, 2005). Moreover, consumers perceived natural food as healthier than conventional food (Michel & Siegrist, 2019; Román et al., 2017). This study defines perceived naturalness following Román et al. (2017) as the 'belief that seaweed food products are safe, healthy, organically grown, and natural/no additives' (Table 2).

In general, a consumer's positive attitude towards natural food is an important factor in food choice (Román et al., 2017). Moreover, beliefs regarding naturalness can have important managerial implications since consumers are less willing to buy food perceived as less natural (Etale & Siegrist, 2021). Previous studies have also demonstrated the positive effect of naturalness on consumers' attitudes and intentions. For instance, Aschemann-Witzel and Grunert (2017) showed that Danish people have a more positive attitude towards food perceived as natural than towards processed food. Hence, the following hypothesis is proposed:

H3: The perceived naturalness of seaweed food products is positively related to attitudes towards seaweed.

2.4. Hedonistic versus biospheric values

Values are cognitive representations of basic motivations. They are abstract, desirable goals, which are relatively stable over time and across situations (Schwartz, 1992). Values vary in importance; the higher the importance a person attributes to a value, the more likely the person is to act in ways that promote attaining that value.

Based on Schwartz (1992) 56 universal values, recent studies have identified and reduced the number to four key values which are particularly relevant in relation to pro-environmental behaviours: two egoistic, hedonistic, altruistic and biospheric values (Steg et al., 2014). However, this study will limit its focus to the effect of hedonistic and biospheric values because previous studies have suggested that those two are the most salient values in understanding pro-environmental (food) consumption (Balundė et al., 2019; Steg et al., 2014; Thelken & de Jong, 2020).

Consumers with hedonistic values define pleasure or sensuous gratification for oneself as their defining goal (Schwartz, 1992). Moreover, typically, they tend to make pro-environmental decisions based on a concern to improve their feelings and reduce effort.

Theoretically, hedonic values should also be negatively related to pro-environmental attitudes and behaviour, as acting pro-environmentally requires effort or reduces comfort (Steg et al., 2014). However, pro-environmental food can also be associated with pleasure (e.g., Bryła, 2016) and positively related to beliefs, attitudes, and behaviours. In their study, Vermeir et al. (2020) emphasise the positive influence of hedonism on attitudes towards food consumption.

Moreover, according to Barrena and Sánchez (2013), consumers adopt new food for hedonic reasons, regardless of the level of fear towards novel foods. In this case, seaweed's novel and unique organoleptic and nutritional characteristics might be positively associated with hedonism.

Accordingly, the following hypothesis was formulated:

H4a: Hedonic values are positively related to attitude towards seaweed.

In opposition to individualistic motives, collectivistic ones, like biospheric values, play an important role in pro-environmental food consumption as people with such values tend to make pro-environmental decisions based on a concern for preserving the ecosystem and the biosphere as a whole (De Groot & Steg, 2008).

Biospheric values are positively related to pro-environmental beliefs, attitudes, and behaviours (De Groot & Steg, 2008; Nilsson, von Borgstede, & Biel, 2004; Schultz, 2001). Biospheric and sustainability values also directly influence how people shape their beliefs and attitudes towards environmentally friendly food products (Ateş, 2020; Hayley, Zinkiewicz, & Hardiman, 2015; Shin et al., 2017; Zhang, Grunert, & Zhou, 2020).

Moreover, increasing consumer environmental awareness is followed by a trend towards naturalness and healthy and environmental food, from which seaweed food products may benefit (Figueroa et al., 2021; Wendin & Undeland, 2020). Two recent studies have shown a positive relationship between consumers' environmental awareness and seaweed consumption. Palmieri and Forleo (2020) found that consumers who are aware of their environmental impact are more willing to consume seaweed than other consumers. Similarly, Lucas, Gouin, and Lesueur (2019) indicated that French seaweed consumers are conscious of the environmental impact of their food choices.

After integrating the theoretical and empirical background, the proposed hypothesis is as follows:

H5a: Biospheric values are positively related to attitudes towards seaweed.

Finally, studies have shown that salient attributes also moderate the relationships between values, attitudes, intentions, and behaviours. Depending on constructs, relationships and context, salient attributes had a positive or negative effect on the relationships (Asif, Xuhui, Nasiri, & Ayyub, 2018; Cooke & Sheeran, 2004; ElHaffar et al., 2020; Vermeir & Verbeke, 2006).

This study argues that consumers' specific product attributes will strengthen the relationship between values and attitudes. In other words, we assume that if people believe that seaweed is sustainable and natural, consumers with biospheric values are more likely to have a favourable attitude towards seaweed food products. Similarly, we argue that as people believe that seaweed food products are unique, consumers with hedonistic values are more likely to have a favourable attitude towards seaweed food products.

Therefore, our model will estimate the moderating effects, for which the following hypotheses are proposed:

H4b: Perceived uniqueness positively moderates the relationship between hedonistic values and attitudes.

H5b: Perceived naturalness positively moderates the relationship between biospheric values and attitudes.

3. Materials and methods

3.1. Data collection and sample

An online survey was conducted in June 2020 in Norway to measure the different concepts. The sample, which was collected through the YouGov consumer online panel, consisted of 426 adult participants and was representative of gender, age, and region. Six hundred YouGov consumer panel members were contacted to participate in the survey. The respondents were required to answer all the questions to complete the survey. The respondents were aged 18–74 (see Table 1), the majority (60%) were well educated (university or university college), and most lived in households without children present (73%). The survey consisted of biospheric values, hedonistic values, attitudes, seaweed consumption, perceived naturalness and uniqueness, and other constructs not reported in this study.

Seaweed as a source of food is little used in Norwegian culture. Therefore, at the beginning of the survey, we introduced pictures of seaweed food products available in the Norwegian market (Appendix 1: e.g., dried seaweed, sushi, chocolate, chips, and drinks with seaweed) with a description of seaweed: 'Seaweed is a form of algae that grows in the sea. There are various species of edible seaweed, the colour range of which varies from red to green to brown. Seaweed helps to capture CO_2. Seaweed is a good source of nutrients, such as proteins, vitamins, minerals, and dietary fibre'.

Table 1
Sociodemographic characteristics (N = 426).

Variables	Per cent
Gender	
Female	52
Male	48
Age	
18–29 y/o	17
30–39 y/o	17
40–49 y/o	16
50–59 y/o	18
≥ 60 y/o	32
Children living at home	
Yes	27
No	73
Level of education	
Primary and lower secondary school	7
Upper secondary school	33
University or university college (1–3 years)	32
University or university college (4 years or more)	28

Table 2
Standardised factor loadings, reliability, and validity.

Constructs and items	Mean	Standard deviation	Indicator loading	Composite reliability	Average variance extracted
Attitude				0.93	0.82
'Bad /Good'	3.98	1.91	0.95		
'Negative/ Positive'	4.36	2.00	0.89		
'Unpleasant/ Pleasant'	3.72	1.83	0.87		
Perceived behavioural control				0.74	0.63
'How easy or difficult is it for you to choose seaweed food products?'	3.83	1.81	0.63		
'If I wanted to, I could easily choose seaweed food products'.	3.80	2.06	0.92		
Perceived uniqueness				0.66	0.52
'Ordinary/ Unique'	4.65	1.77	0.93		
'Traditional/ New'	5.02	1.91	0.53		
Perceived naturalness				0.84	0.60
'Non-organic/ Organic'	5.42	1.60	0.81		
'Synthetic/ Natural'	5.44	1.69	0.82		
'Unhealthy/ Healthy'	5.22	1.61	0.78		
Hedonistic values				0.81	0.60
'Pleasure'	7.38	1.38	0.78		
'Enjoying life'	7.10	1.60	0.82		
'Self-indulgent'	6.49	1.75	0.71		
Biospheric values				0.90	0.70
'Preventing pollution: protecting natural resources'	6.62	1.82	0.87		
'Unity with nature: fitting into nature'	6.27	1.88	0.75		
'Protecting the environment: preserving nature'	6.73	1.79	0.87		
'Respecting the earth: harmony with other species'	6.74	1.81	0.83		

3.2. Measures

Biospheric values and *hedonistic values* were measured using a scale developed by Steg et al. (2014); three items measured the hedonistic values. Following Schwartz (1992), the respondents were asked to rate the importance of each item on a scale from 1 ('opposed to my principles') to 9 ('extremely important'). Table 2 shows the measurement items used to measure biospheric and hedonistic values.

Perceived behavioural control was measured with the following two items (Table 2): 'How easy or difficult is it for you to choose seaweed food products?', on a scale from 1 ('very difficult') to 7 ('very easy'), and 'If I wanted to, I could easily choose seaweed food products', ranging from 1 ('very unlikely') to 7 ('very likely'). These items are regularly

used in the literature to assess perceived behavioural control within social psychology (Armitage & Conner, 2001), and pro-environmental behaviour (Park & Ha, 2014).

Attitude was assessed using three items preceded by the stem 'To eat products that contain seaweed is …'. The respondents were asked to range each item along a 7-point semantic differential scale (bad/good, negative/positive, and unpleasant/pleasant). These items are commonly used in food-related studies (e.g., Hayley et al., 2015; Honkanen, Olsen, & Verplanken, 2005), and cover general, cognitive, and affective evaluations of attitude (Crites, Fabrigar, & Petty, 1994; Fishbein & Ajzen, 2010).

In the same manner, to measure *perceived uniqueness,* respondents were asked to range two bipolar items along a 7-point semantic differential scale (1 = ordinary/7 = unique or 1 = traditional/7 = new). The items were adapted from Jaeger et al. (2017).

Perceived naturalness is a latent construct which is measured by three theoretically based items (healthy, natural, and organic). Based on Michel and Siegrist (2019), we measured *perceived naturalness* by asking participants to evaluate the following characteristics of food with seaweed on a 7-point semantic differential scale (unhealthy/healthy, non-organic/organic, synthetic/natural).

Seaweed food product consumption was measured by a single item asking the frequency at which respondents bought seaweed food products over the past year. The latter scale was originally scored from 1 (never) to 11 (more than three times a week). However, as the data were not normally distributed, the scale was changed into a dichotomous variable: 0 = has not consumed seaweed in the past year vs 1 = has consumed seaweed in the past year.

3.3. Analytical procedures

The statistical analyses were performed using Stata 16. A principal component analysis with Varimax rotation was first conducted to verify the validity of the concepts used for this study. Then, a maximum likelihood confirmatory factor analysis (CFA) with maximum likelihood estimation and multivariable structural equation (SEM) was conducted. The convergent and discriminant validity of the constructs were assessed using Fornell and Larcker (1981) methodology. The convergent validity of the constructs was established when the estimation of average variance extracted (AVE) was > 0.5, and there was discriminant validity when the AVE value of a latent construct was larger than the squared correlation (SC) of any other latent construct in the model. Composite reliability (CR) was used to evaluate the reliability of the scales (Hair, Anderson, Babin, & Black, 2010).

Multiple indicators are reported to evaluate the goodness of fit: χ^2 (chi-square), CFI (comparative fit index), TLI (Tucker–Lewis index), RMSEA (root mean square error of approximation), and SRMR (standardised root mean residual). According to Brown (2015), model fit is good when CFI and TLI indices are > 0.90, and RMSEA and SRMR are < 0.08.

Finally, Cortina, Chen, and Dunlap (2001) single-step estimation approach was adopted and applied with Stata, as this method is considered conceptually and operationally straightforward. The interaction term was first calculated by multiplying the mean-deviated values of the independent variable with the moderator variable to avoid multicollinearity. The interaction was then included in the structural model, and all the variables were analysed simultaneously.

4. Results

4.1. Reliability and validity of measures

A CFA with a maximum likelihood estimation method was conducted to estimate the measurement model. The results of the measurement model, including five latent variables with a total of 15 indicators and one observable variable (see Table 2), indicated a good fit to the data (χ^2 (120) = 303.34, $p < 0.001$, RMSEA = 0.06, CFI = 0.96, TLI = 0.94, SRMR = 0.05).

The convergent and discriminant validity assessment results showed no convergent and discriminant validity problems between the latent variables attitude, perceived behavioural control, perceived uniqueness, perceived naturalness, hedonistic values, and biospheric values with AVE > 0.5 and AVE > SC, respectively. The CR were all>0.5 (0.93, 0.74, 0.66, 0.84, 0.81, and 0.90, respectively), indicating good construct reliability.

The results (see Table 3) showed that less than half (seaweed consumption = 0.44) of the participants had consumed seaweed food products over the past year. The participants showed a positive attitude regarding seaweed food products (attitude = 4.02). Regarding participants' beliefs, seaweed was perceived as being natural (perceived naturalness = 5.36) and, to a lesser extent, unique (perceived uniqueness = 4.83). Regarding the values profile of the respondents, biospheric and hedonistic values were leading principles in their lives (biospheric values = 6.54; hedonistic values = 6.99). Moreover, the results showed that the variables biospheric values, hedonistic values, and perceived uniqueness did not correlate with seaweed consumption. Table 3 displays the intercorrelations and descriptive statistics.

4.2. Structural model analysis and indirect effects

SEM with a maximum likelihood estimation methodology was used to test the two models (see Table 4). The basic VAB model showed a good data fit ($\chi2 = 107.24$ with df = 51, RMSEA = 0.05, CFI = 0.98, TLI = 0.98, SRMR = 0.03). The extended VAB model had an acceptable data fit ($\chi2 = 259.66$ with df = 109, RMSEA = 0.05, CFI = 0.96, TLI = 0.95, SRMR = 0.04). Attitude ($\beta = 0.46$, $p < 0.001$) significantly explained seaweed consumption, thereby supporting H1a. Attitude explained 22% of seaweed consumption. Biospheric values ($\beta = 0.17$, $p < 0.001$) were

Table 3
Mean, standard deviation, and correlations.

	Mean	Standard deviation	1	2	3	4	5	6	7
1. Seaweed consumption	0.44	0.49	1.00						
2. Attitude	4.02	1.79	0.45***	1.00					
3. Perceived behavioural control	3.82	1.72	0.36***	0.54***	1.00				
4. Perceived uniqueness	4.83	1.59	0.02	0.30***	0.17***	1.00			
5. Perceived naturalness	5.36	1.43	0.14**	0.51***	0.27***	0.41***	1.00		
6. Hedonistic values	6.99	1.35	−0.02	0.05	0.04	0.11*	0.11*	1.00	
7. Biospheric values	6.54	1.63	0.06	0.25***	0.26***	0.13**	0.20***	0.31***	1.00

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table 4
Results of testing the proposed model.

Relationships	Hypothesis testing	Original VAB		Extended VAB	
		β	z	β	z
Attitude → Seaweed consumption	H1a supported	0.45	11.34***	0.46	11.85***
Hedonistic values → Attitude	H4a not supported	−0.04	−0.74 (n.s.)	−0.08	−1.56 (n.s)
Biospheric values → Attitude	H5a supported	0.29	5.47***	0.17	3.43***
Perceived naturalness → Attitude	H3 supported	–	–	0.45	7.78***
Perceived uniqueness → Attitude	H2 supported	–	–	0.13	2.08*
Hedonistic values × Perceived uniqueness → Attitude	H4b supported	–	–	0.10	2.24*
Biospheric values × Perceived naturalness → Attitude	H5b supported	–	–	0.07	2.45*
Attitude × Perceived behaviour control → Seaweed consumption	H1b supported	–	–	0.07	2.41*
R^2*(%) Seaweed consumption*		20%		22%	
R^2*(%) Attitude*		8%		35%	
Model fit indices					
χ2(df)		107.24(51)		259.66(109)	
RMSEA		0.05		0.05	
CFI		0.98		0.96	
TLI		0.98		0.95	
SRMR		0.03		0.04	

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

significantly related to attitude, thus confirming H5a. However, we have to reject H4a, as hedonistic values (β = -0.08, p = n.s.) had no significant relationship with attitude. Biospheric values explained 8% of the variance in attitude. H1b proposed that the positive effect of attitude on seaweed consumption would be stronger when perceived behavioural control increases. As expected, this hypothesis was supported by a significantly positive effect of the interaction between perceived behavioural control and attitude towards seaweed consumption (β = 0.07, $p < 0.05$).

Perceived uniqueness (β = 0.13, $p < 0.05$) was significantly related to attitude, thus confirming H2. Perceived naturalness (β = 0.45, $p < 0.001$) was also significantly related to attitude, confirming H3. Together, hedonistic and biospheric values and perceived uniqueness and naturalness explained 35% of attitude. H4b proposed that the positive effect of hedonistic values on attitudes towards seaweed would be stronger when perceived uniqueness increased. This hypothesis was supported by the significantly positive effect of the interaction between perceived uniqueness and hedonistic values (β = 0.10, $p < 0.05$). Finally, the moderation analysis results showed that perceived naturalness moderated the relationship between biospheric values and attitude, confirming H5b. There was a statistically significant positive effect of the interaction between perceived naturalness and biospheric values (β = 0.07, $p < 0.05$).

5. Discussion

The first aim of this study was to examine the ability of the extended VAB model to explain the consumption of seaweed food products among Norwegian consumers. The results indicated a good data fit. The first hypothesis was confirmed, as attitude is highly associated with seaweed consumption. This finding corresponds to previous consumer studies on seaweed food products (Palmieri & Forleo, 2020; Wendin & Undeland, 2020). Perceived behavioural control leads to a higher predictive power of attitude with regard to seaweed consumption. This result is in line with previous studies (La Barbera & Ajzen, 2021; Redondo & Puelles, 2017) and confirms the contribution of perceived behavioural control to reducing the gap between attitude and pro-environmental behaviour.

The results highlight the importance of biospheric values in the formation of attitude. This is consistent with previous findings, which showed a positive relationship between biospheric values and pro-environmental food consumption (Shin et al., 2017) or other pro-environmental food behaviours (Ateş, 2020; Nguyen, Lobo, & Greenland, 2016). However, the results also showed no significant direct relationship between hedonistic values and attitude. This result contrasts with Steg et al. (2014) findings, which suggested a significant effect of hedonistic values on pro-environmental attitude. This might be explained by consumers' lack of familiarity with seaweed, which, like other unfamiliar foods, might hold little sensory appeal for consumers (Tan, Tibboel, & Stieger, 2017). Moreover, consumers' reluctance towards unknown products may dissociate seaweed as a sensory-appealing type of food, as supported by previous studies confirming consumers' neophobia regarding seaweed food products (Birch et al., 2019; Chapman, Stévant, & Larssen, 2015; Losada-López et al., 2021).

The second aim of this study was to investigate the relationship between two specific product attributes (perceived uniqueness and perceived naturalness) and attitude. The model explained 35% of the variation in attitude. Together, perceived uniqueness and perceived naturalness increased the explained variation in attitudes by 27%; thus, the addition of perceived uniqueness and attitude improved the model's explanatory power. The explanatory capability of assessing specific attributes associated with the general evaluation (attitude) of food products is in accordance with previous studies (Ham, Pap, & Stanic, 2018).

Seaweed food products were perceived as unique and natural; they thus generated a favourable attitude from the respondents. This finding is interesting because consumers' perception of a food product as healthy, not artificial, and more environmentally friendly significantly positively affects the general acceptance of a given food (Román et al., 2017). Moreover, in this study, consumers' perception of seaweed food products as unique, natural, healthy, and sustainable is positively associated with their general attitudes. With the high production costs and limited availability of seaweed food products, marketers should present and promote (through packaging and stories) seaweed food products as unique quality products and should emphasise their naturalness.

The third objective of this study was to investigate the effect of specific attributes on the relationship between values and attitude. The results confirmed that consumers with hedonic values are more likely to have a positive attitude towards seaweed if they perceive seaweed food products as unique. This result is in line with that of Cardello et al. (2016), who showed that types of beer which are perceived as highly unique are strongly associated with hedonism. The outcome also confirmed the expected moderating effect of perceived naturalness on the relationship between biospheric values and attitude, which to our knowledge has not been demonstrated before in the literature. Theoretically, this result shows that salient product attributes affect the relationship between values and attitudes, as shown by Aertsens et al. (2009) and Dreezens, Martijn, Tenbült, Kok, and De Vries (2005), and indicates that specific product attributes can be used to activate the values–attitude relationship.

These results are also of practical relevance for the seaweed stakeholders. Marketing campaigns should emphasise the positive consequences of seaweed on the climate and its naturalness. These

consequences are regarded as important for consumers who endorse biospheric values. Regarding hedonistic values, the results indicate that consumers with hedonistic values may have an ambivalent attitude (Olsen, 1999) towards seaweed. However, the moderation of the hedonistic values–attitude relationship implies that when consumers perceive seaweed food products as unique, they are more likely to have positive attitudes towards them.

Finally, overall, the results show that the model's biospheric part is more related to attitude than the hedonistic element of the model, which means that consumers with biospheric values are more likely than people with hedonistic ones to consume seaweed food products. This result is congruent with the results of Steg et al. (2014), as it confirms the relevance of biospheric values in pro-environmental consumption and strengthens Katz-Gerro, Greenspan, Handy, and Lee (2017) view that biospheric values are an essential value type for explaining environmental behaviour.

5.1. Limitations and future research

Although this study contributes to increasing the understanding of which factors explain attitudes and seaweed consumption, limitations remain, and further studies are necessary. First, like other studies based on self-reported questionnaires, this study is prone to biases. For example, as there is an increasing focus on the environment, respondents could be susceptible to overestimating biospheric values and perceived naturalness, as doing so may be more socially desirable.

Second, compared to other more complex models, the VAB model is a straightforward one that presents the advantage of preventing overfitting, and is easier to interpret. However, there remains a large per cent of the variance that the model does not explain. The addition of perceived behavioural control as a moderator of the relationship between attitude and consumption slightly decreased that gap. This underlines that explaining novel food behaviour is complex. Besides perceived behavioural control, there are still many factors influencing the attitude–seaweed consumption relationship that have yet to be explored. Among these, we would recommend extending the model by including, for example, price (Padel & Foster, 2005) as a potential barrier.

Third, we believe that this study provides a good indication regarding consumers' attitudes, perceived naturalness, and perceived uniqueness of seaweed food products. However, as only 55% of the respondents had consumed seaweed food products, the attitude and beliefs of 45% of the respondents were not based on actual experience, but on expectations and beliefs. We believe consumers' attitudes and beliefs may differ after trying seaweed. Therefore, it would be interesting to study eventual variations in attitudes and beliefs before and after trying seaweed food products.

Fourth, this study focuses on seaweed food products as a general category. This study is a first step towards increasing our knowledge regarding variables affecting the consumption of seaweed food products. However, there might be differences between specific seaweed food products. Moreover, as there is no direct relationship between hedonistic values and seaweed consumption, future studies should test different seaweed food products to evaluate what type of products consumers associate the most with pleasure. For example, hedonistic values might be strongly related to attitudes towards snacks with seaweed rather than seaweed salads. Therefore, further research studying and comparing the key factors influencing attitudes towards specific food products would be interesting.

Finally, since seaweed is perceived as a unique product, future studies should examine the relationship between perceived uniqueness and consumers' need for uniqueness (Ham et al., 2018), in addition to other dimensions of personal values (Steg et al., 2014).

6. Conclusion

The current research used an extension of the VAB framework to explain seaweed consumption in a Norwegian context. The findings expanded our understanding of the factors affecting seaweed food consumption directly and indirectly. Despite not being familiar to all consumers, the respondents had positive attitudes and expectations towards seaweed food consumption. Moreover, the positive relationship between attitude and consumption is stronger when consumers perceive it is easy to consume seaweed food products.

Norwegian consumers perceived seaweed as unique and natural. Both perceived uniqueness and naturalness trigger a positive response towards seaweed foods from the public. Moreover, consumers with hedonistic values are more likely to have positive attitudes towards seaweed food products when they perceive them as unique. Similarly, consumers with biospheric values are more likely to have positive attitudes towards seaweed when seaweed products are perceived as natural. Consumers with biospheric values are more likely to consume seaweed than those with hedonistic ones; however, customers possess different combinations of values. Thus, a product that activates different values is advantageous because values are positively related to attitudes. This indicates that most Norwegian consumers form their attitudes towards seaweed according to biospheric values and health considerations.

Beyond the theoretical contributions, these findings will help the seaweed industry develop its marketing strategy by promoting seaweed's naturalness and healthiness. Marketers should also make an effort to encourage consumers to associate seaweed with pleasure. Finally, since seaweed food products are perceived as unique, seaweed food products can be positioned as high-quality or luxury products. By extension, the conclusions can be used to promote seaweed to policymakers and investors. The European seaweed sector remains new and requires more private investment and public support to develop. Therefore, promoting seaweed uniqueness and naturalness and emphasising positive biospheric consequences are ways in which policymakers and investors can be positively influenced.

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CRediT authorship contribution statement

Florent Govaerts: Conceptualization, Methodology, Software, Formal analysis, Formal analysis, Data curation, Writing – original draft, Writing – review & editing. **Svein Ottar Olsen:** Conceptualization, Methodology, Supervision, Writing – original draft, Writing – review & editing.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

Appendix A:

Pictures of seaweed food products:

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