

MASTER DISSERTATION

**UNVEILING THE SEAWEED CONSUMER:
EXPLORING CONSUMER INTENTIONS AND PROFILE
TOWARDS SEAWEED PRODUCTS**

AUTHOR: Mariana Pereira Rodrigues

SUPERVISOR: PhD. Mafalda Nogueira

CO-ADVISOR: PhD. Sandra Gomes

**UNVEILING THE SEAWEED CONSUMER:
EXPLORING CONSUMER INTENTIONS AND PROFILE
TOWARDS SEAWEED PRODUCTS**

AUTHOR: Mariana Pereira Rodrigues

Dissertation presented to IPAM, to fulfil the requirements needed to obtain the Master's Degree in *Marketing Management*, developed under scientific supervision of *Mafalda Nogueira, PhD.* and co-supervision of *Sandra Gomes, PhD.*

INSTITUTO PORTUGUÊS DE ADMINISTRAÇÃO DE MARKETING, JUNE 2025

ACKNOWLEDGEMENTS

Two years ago, I had no idea what write a thesis really meant. The word alone felt heavy – because every story I heard was wrapped in pressure and fear. And yes – all of it *can* be true. But what about the *quiet beauty of discovery* that comes with it? Along this journey, I have not only discovered the power of resilience, but also the power of support, and, above all, the wonderfulness of sharing it with people who made it lighter, and more deeply meaningful.

To my advisor, ***Mafalda Nogueira PhD.***, the light that encouraged me to be bold and dare without fear. To my co-advisor, ***Sandra Gomes PhD.***, for power of the discipline and knowledge instilled in me. Thank you for cheering me to discover and experience the unknown. And, to all the other teachers who believed in this research and made me feel proud of it.

To my family, especially to my ***Mom, Dad, GrandM, Auntie Mila, Ção, Bié, GodF, GodM***, ..., for always believing and making me believe in me. Every milestone I achieve carries a piece of *will to win*, resilience, and courage that you taught me.

To ***Ana Carolina*** and ***Liliana***, for inspiring me to be my best version, pushing me to dream without limits. All your words reached my heart, and made me feel appreciated. You are truly remarkable – much more than any *francesinha*. To all my friends, for the words of encouragement – specially to *outra Mariana* who never got tired of all my *thesis alga-dramas*.

Last but not least, to ***David***. For the patience that never fades, and the warmth that calms my storms. You made your strength become mine, and you were always there for me, even when your own journey asked so much of you. Both our minds were stretched and tested, yet I thank you for being each other's wingman on this journey that is the thesis – of our master's, and of our lives. Thank you, endlessly.

To you all, a thank you as big as my dreams! MPR.

As a nod to my GrandF,

who taught me that every dedicated and consistent step could metaphorically lead us to *New York*, the city that boldly dares and embraces the obstinate ones.

Where ambition comes to life, and dreams find their true size.

Catch you there, always <3

DECLARATION OF COMMITMENT TO ETHICAL WRITING

I, Mariana Pereira Rodrigues, declare on my honour that the work presented here to obtain the title of Master in 2025 from the Instituto Português de Administração e Marketing of Porto is original, the result of the research I have carried out, and that the use of contributions or texts by other authors are duly referenced, in accordance with the principles and rules of Copyright and Related Rights.

Furthermore, I declare on my honour that if this work includes content developed in whole or in part from artificial intelligence tools, it is clearly identified and duly referenced.

Porto, 29 June of 2025.

The author:

Mariana Pereira Rodrigues

RESUMO

Objetivo – Esta investigação explora a intenção de consumo de produtos à base de algas em Portugal, delimitando o perfil do consumidor destes produtos.

Metodologia – Adotou-se a abordagem quantitativa com técnica de recolha de dados o inquérito por questionário, para testar a aplicabilidade da Teoria do Comportamento Planeado (TCP) para previsão da intenção de consumo de algas. A amostragem caracteriza-se como não probabilística por conveniência, e a população é composta por indivíduos portugueses com mais de 18 anos. Foi obtida uma amostra de 391 respostas válidas.

Principais Resultados e Conclusões – A intenção de consumo de algas é explicada em 68,7% pela atitude, normas subjetivas, controlo percebido, nojo e responsabilidade alimentar. Atitudes positivas são cruciais para a propensão do indivíduo consumir algas. Esta, por sua vez, é afetada negativamente pela neofobia e nojo de algas e positivamente pela responsabilidade alimentar. A responsabilidade alimentar é a dimensão do estilo de vida com mais impacto nas variáveis analisadas. A idade, rendimento e proximidade geográfica dos indivíduos ao mar impactam diretamente a sua intenção de consumo. Por último, verificou-se uma neutralidade de intenção de consumo e baixa vontade de pagar o preço real dos produtos à base de algas mencionados, apesar da maioria dos indivíduos já ter consumido algas antes.

Limitações – Os dados autorrelatados, oriundos do questionário, podem criar enviesamento nas respostas. Ainda, a baixa diversidade sociodemográfica da amostra pode impactar os resultados deste estudo. Poderia ter sido realizado o modelo de equações estruturais, ao invés de modelos de regressão linear múltipla. Foram apenas analisadas algumas das motivações e barreiras ao consumo de algas, sendo que outras não foram exploradas. Por fim, devido ao tipo de revisão adotado (revisão sistemática da literatura (RSL)), não foram analisados alguns artigos que estudam a aplicação da TCP em contexto de *novel food*.

Valor/Originalidade – A originalidade deste estudo reside na sua fundação rigorosa, contruída através de uma RSL, crucial para sintetizar o estado atual do conhecimento na aceitabilidade de produtos à base de algas. Desta forma, tanto quanto é do conhecimento do autor, não há estudos deste tema em Portugal, nem tão pouco com a aplicação estendida da TCP. Este estudo contribui, tanto para a literatura, como para as empresas que comercializem algas como alimento ou para as que contêm produtos com possibilidade de inclusão de algas.

Palavras-Chave – Teoria do Comportamento Planeado; Intenção de Consumo; Algas; Novel Food; Revisão Sistemática da Literatura

ABSTRACT

Objective – This research aims to explore the intention to consume seaweed products in Portugal, while developing the profile of these consumers.

Methodology – A quantitative approach was adopted, with a questionnaire as the data collection technique, to test the applicability of Theory of Planned Behaviour (TPB) to predict the seaweed' consumption intention. The sample was non-probabilistic by convenience, and the population was composed of Portuguese individuals over the age of 18. The sample contains 391 valid responses.

Main Results and Conclusions – The intention to consume seaweed products is explained by 68,7% for individual' attitude, subjective norms, perceived behavioural control, food disgust, and food responsibility. Positive attitudes are crucial to their propensity to consume seaweed. This, in turn, is affected negatively by food neophobia, and food disgust, and positively by food responsibility. Food responsibility is the lifestyle dimension with the greatest impact on the constructs analysed. The age, income level, and geographical proximity to the sea have a direct impact on their intention to consume. Finally, it was verified a high neutrality of consumption intention and low willingness to pay the real price of the seaweed-based products mentioned, even though most individuals had consumed seaweed before.

Limitations – Due to the data collection technique, the self-reported data may create bias on responses. The low sociodemographic diversity of the sample may influence the responses. Structural equation modelling could have been used, instead of multiple linear regression models. Also, this study only focused on some of the motivations and barriers, while others were not explored. Finally, it was not possible to analyse several articles that addressed the TPB on novel context, due to the review adopted (systematic literature review (SLR)).

Value/Originality – The originality of this study stems from its rigorous approach, built through a SLR, an essential methodology for summarising the current state of knowledge on the acceptability of seaweed-based products. To the best of the author's knowledge, there are no studies on this topic in Portugal, nor with the extended application of the TPB. This study contributes both to the literature, and to companies that commercialise seaweed as a food, or those that contain products with the possibility of including seaweed.

Keywords – Theory of Planned Behaviour; Consumption Intention; Seaweed; Algae; Systematic Literature Review

CONTENTS

1. Introduction.....	16
2. Systematic Literature Review	20
2.1. Review Method.....	20
2.2. Publication Trends	23
2.2.1. Publication Year	23
2.2.2. Journal.....	23
2.2.3. Keywords	24
2.3. Study Theories	24
2.4. Study Methodologies	25
2.5. Study Contexts.....	26
2.5.1. Countries in Study.....	26
2.5.2. Seaweed Products In Study.....	26
2.6. Study Characteristics	27
2.6.1. Quantitative Method Studies.....	27
2.6.2. Qualitative and Mixed-Method Studies	28
2.7. The Big Themes and Key Findings	29
2.7.1. Consumer's Responses Towards Seaweed Products.....	29
A. Consumer Response towards NOVELTY of Seaweed Products	29
B. Consumer Response towards EDIBILITY of Seaweed Products	31
C. Consumer Response Towards HEALTHINESS of Seaweed Products.....	32
D. Consumer Response Towards SUSTAINABILITY of Seaweed Products	33
E. Consumer Response Towards ACCESSIBILITY of Seaweed Products	34
F. Consumer Response Towards VERSATILITY of Seaweed Products	35
G. Consumer Response Towards PACKAGING of Seaweed Products	35

2.7.2.	Consumer's Responses Based on Sociodemographic Factors	36
A.	Age	36
B.	Gender	37
C.	Education Level	37
D.	Dietary Patterns	38
E.	Income	38
F.	Geographic Location	38
2.7.3.	Consumer's Responses Towards Food-Related Lifestyle	39
2.7.4.	Attitudes and Behaviours Towards Seaweed Products	40
A.	Attitude	40
B.	Subjective Norms	41
C.	Perceived Behavioural Control	42
2.8.	Future Research Directions	43
2.8.1.	New Theoretical Frameworks	43
2.8.2.	New Contexts	45
2.8.3.	New Variables and Relationships	46
2.8.4.	New Methodologies	48
3.	Conceptual Model of Analysis and Research Hypotheses	51
3.1.	Development of the Conceptual Model of Analysis	51
3.1.1.	Scale Theory of Planned Behaviour	53
3.1.2.	Scale Intention to Consume	54
3.1.3.	Scale Food Neophobia	54
3.1.4.	Scale Food Disgust	55
3.1.5.	Scale Food-Related Lifestyle	56
3.2.	Hypotheses Formulation	57
4.	Research Methodology	61
4.1.	Justification of the Method	61

4.2.	Data Collection Technique	62
4.2.1.	Pre-Test	62
4.2.2.	Questionnaire Structure	63
4.2.1.	Dissemination of the Questionnaire	65
4.3.	Population and Sample	66
4.4.	Data Treatment.....	66
5.	Analysis of Results	68
5.1.	Sample' Characterisation	68
5.1.1.	Sociodemographic Characteristics.....	68
5.1.2.	Dietary Patterns.....	69
5.1.3.	Seaweed Products	70
A.	Products Already Tried by Individuals	70
B.	Willingness to Eat	71
C.	Willingness to Pay	72
D.	Preferred Origin	73
5.2.	Exploratory Factor Analysis	74
5.3.	Factor Frequency Analysis.....	77
5.3.1.	Food-Related Lifestyle.....	77
5.3.2.	Food Neophobia.....	79
5.3.3.	Theory of Planned Behaviour	79
5.3.4.	Food Disgust	81
5.3.5.	Intention To Consume	82
5.4.	Verification of the Hypotheses.....	83
5.4.1.	Multiple Linear Regression Models.....	83
A.	Multiple Linear Regression Model A	83
B.	Multiple Linear Regression Model B	85
C.	Multiple Linear Regression Model C	86

D. Multiple Linear Regression Model D	88
E. Multiple Linear Regression Model E.....	89
F. Multiple Linear Regression Model F	90
5.4.2. T-Test for Equality of Means	91
5.4.3. One-Way ANOVA Tests.....	93
A. One-Way ANOVA Test for AGE.....	93
B. One-Way ANOVA Test for EDUCATION.....	94
C. One-Way ANOVA Test for INCOME.....	95
D. One-Way ANOVA Test for DISTANCE FROM SEA	97
6. Discussion & Conclusion of Results & Further Research.....	98
6.1. The answer to the Research Specific Objectives	99
6.1.1. Specific Objective 1	99
6.1.2. Specific Objective 2.....	101
6.1.3. Specific Objective 3	103
6.1.4. Specific Objective 4.....	107
6.1.5. Specific Objective 5	109
6.1.6. Specific Objective 6.....	113
6.2. Implications of this Study	114
6.2.1. Theoretical Implications	114
6.2.2. Practical Implications.....	116
6.3. Limitations and Future Research	118
6.3.1. Limitations of this Study.....	118
6.3.2. Future Research Directions.....	119
7. Bibliographical References	120
8. Appendix.....	126
8.1. Appendix A Articles selected	126
8.2. Appendix B Products Under Study	129

8.3.	Appendix C Variables of the Quantitative Studies.....	130
8.4.	Appendix D Hypotheses to be Tested	131
8.5.	Appendix E Questionnaire	133
8.6.	Appendix F Price of the Selected Products.....	140
8.7.	Appendix G Leaflet.....	141
8.8.	Appendix H Statistical Tests	141
8.9.	Appendix I Component Matrix	143
8.10.	Appendix J T-Test & ANOVA Results	145

LIST OF FIGURES

Figure 1. <i>Word cloud of the keywords used in the selected articles</i>	24
Figure 2. <i>Conceptual model of analysis</i>	52
Figure 3. <i>Leaflet distributed with the survey' QR Code.</i>	141

LIST OF TABLES

Table 1. <i>General and Specific Objectives.</i>	19
Table 2. <i>The SLR process using the PRISMA Protocol.</i>	21
Table 3. <i>Screening and Eligibility Phase.</i>	22
Table 4. <i>Number of publications per year</i>	23
Table 5. <i>Number of articles per journal.</i>	23
Table 6. <i>Key theories identified in the selected articles.</i>	25
Table 7. <i>Characteristics of research design in the selected articles.</i>	25
Table 8. <i>General and specific objectives of this research.</i>	51
Table 9. <i>Items, code, and author of scale used to measure TPB constructs.</i>	53
Table 10. <i>Items, code, and author of scale used to measure intention to consume.</i>	54
Table 11. <i>Items, code, and author of scale used to measure food neophobia.</i>	54
Table 12. <i>Items, code, and author of scale used to measure food disgust.</i>	55
Table 13. <i>Items, code, and author of scale used to measure FRL.</i>	56
Table 14. <i>Sociodemographic characteristics of the sample - 391 individuals.</i>	68
Table 15. <i>Dietary type of the 391 individuals.</i>	70
Table 16. <i>Products that individuals have already tried.</i>	71
Table 17. <i>Willingness to Eat the presented seaweed products.</i>	71
Table 18. <i>Individual's responses towards different seaweed products.</i>	72
Table 19. <i>Willingness to pay for the selected seaweed products.</i>	72
Table 20. <i>Average market product's price and the respective range of prices selected.</i>	73
Table 21. <i>KMO' Test, Bartlett's Sphericity Test and Variance Test.</i>	75
Table 22. <i>The items of food neophobia.</i>	76
Table 23. <i>Cronbach Alpha's Values.</i>	76
Table 24. <i>Likert Scale used in the questionnaire.</i>	77
Table 25. <i>Involvement' descriptive analysis.</i>	77
Table 26. <i>Innovativeness' descriptive analysis.</i>	78
Table 27. <i>Responsibility' descriptive analysis.</i>	78
Table 28. <i>Food neophobia' descriptive analysis.</i>	79
Table 29. <i>Attitude' descriptive analysis.</i>	80
Table 30. <i>Subjective norms' descriptive analysis.</i>	80
Table 31. <i>Perceived behavioural control' descriptive analysis.</i>	81

Table 32. <i>Food disgust' descriptive analysis.</i>	82
Table 33. <i>Intention to consume' descriptive analysis.</i>	82
Table 34. <i>Variables and Hypotheses of MLRM A.</i>	83
Table 35. <i>Coefficients of MLRM A.</i>	84
Table 36. <i>Hypotheses of MLRM A and its confirmation/effect.</i>	85
Table 37. <i>Variables and Hypotheses of MLRM B.</i>	85
Table 38. <i>Coefficients of MLRM B.</i>	85
Table 39. <i>Hypotheses of MLRM B and its confirmation/effect.</i>	86
Table 40. <i>Variables and Hypotheses of MLRM C.</i>	86
Table 41. <i>Coefficients of MLRM C.</i>	87
Table 42. <i>Hypotheses of MLRM C and its confirmation/effect.</i>	87
Table 43. <i>Variables and Hypotheses of MLRM D.</i>	88
Table 44. <i>Coefficients of MLRM D.</i>	88
Table 45. <i>Hypotheses of MLRM D and its confirmation/effect.</i>	89
Table 46. <i>Variables and Hypotheses of MLRM E.</i>	89
Table 47. <i>Coefficients of MLRM E.</i>	89
Table 48. <i>Hypotheses of MLRM E and its confirmation/effect.</i>	90
Table 49. <i>Variables and Hypotheses of MLRM F.</i>	90
Table 50. <i>Coefficients of MLRM F.</i>	90
Table 51. <i>Hypotheses of MLRM F and its confirmation/effect.</i>	91
Table 52. <i>Independent T-Test for equality of means with gender as the grouping variable....</i>	91
Table 53. <i>Confirmation of the hypotheses tested.</i>	92
Table 54. <i>One-Way ANOVA Test for age by classes factor.</i>	93
Table 55. <i>One-Way ANOVA Test for education level factor.</i>	94
Table 56. <i>One-Way ANOVA Test for income factor.</i>	95
Table 57. <i>One-Way ANOVA Test for distance from sea factor.</i>	97
Table 58. <i>Articles from the SLR.</i>	126
Table 59. <i>Seaweed products detected in the selected articles.</i>	129
Table 60. <i>Non-Seaweed products detected in the selected articles.</i>	129
Table 61. <i>Overview of the variables found in the 25 quantitative selected studies.</i>	130
Table 62. <i>Resume of all hypotheses to be tested.</i>	131
Table 63. <i>Seaweed products available on two Portuguese supermarkets.</i>	140
Table 64. <i>Statistical Tests developed in this research.</i>	142

Table 65. <i>Component Matrix.</i>	143
Table 66. <i>Results of T-Test for equality of means.</i>	145
Table 67. <i>Results of One-Way ANOVA Test for age classes as a factor.</i>	145
Table 68. <i>Confirmation of the hypotheses tested.</i>	145
Table 69. <i>Results of One-Way ANOVA Test for education level as a factor.</i>	146
Table 70. <i>Confirmation of the hypotheses tested.</i>	146
Table 71. <i>Results of One-Way ANOVA Test for income as a factor.</i>	146
Table 72. <i>Confirmation of the hypotheses tested.</i>	147
Table 73. <i>Results of One-Way ANOVA Test for distance from sea as a factor.</i>	147
Table 74. <i>Confirmation of the hypotheses tested.</i>	147

LIST OF QUESTIONNAIRES

Questionnaire 1. <i>Sample of the questionnaire</i>	133
--	-----

LIST OF ABBREVIATIONS

Att	Attitude
AVE	Average Variance Extracted
CLT	Central Limit Theorem
EFA	Exploratory Factor Analysis
FAO	Food and Agriculture Organization
FD	Food Disgust
FN	Food Neophobia
FNS	Food Neophobia Scale
FRL	Food-Related Lifestyle
Inn	Innovativeness
Inv	Involvement
ItC	Intention to Consume
KMO	Kaiser-Meyer-Olkin Test
MRLM	Multiple Regression Linear Model
PBC	Perceived Behavioural Control
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analysis
Res	Responsibility
SDF	Sociodemographic Factors
SEM	Structural Equation Model
SLR	Systematic Literature Review
SN	Subjective Norms
TAM	Technology Acceptance Model
TCCM	Theory, Context, Characteristics, Methodology
TPB	Theory of Planned Behaviour
VAB	Value-Attitude-Behaviour Theory

1. INTRODUCTION

By 2050, the world's population is projected to reach a peak of approximately 9 billion individuals. According to the Food and Agriculture Organization (FAO), an estimated 500 million tonnes of protein will be required to meet the population's nutritional needs (Nature, 2020). Considering the planet's current state of overcapacity, and the limited and declining availability of natural resources, it is imperative to explore and adopt more sustainable dietary habits, that not only meet the nutritional needs of the population, but also align with the pursuit of culinary satisfaction. The plant-based food market has emerged as a response to the challenges posed by unsustainable animal foods, and it is gradually attracting consumers who opt for this type of product, which is less traditional but more innovative and sustainable (Kurek et al., 2022). According to Onwezen et al. (2021), alternative proteins include pulses, seaweed (or algae), insects, plant-based meat alternatives, and cultured meat.

As is apparent, the focus of these protein alternatives is predominantly on land production, which has already attained its maximum capacity. Despite covering 70% of the Earth's surface, the ocean – despite their vast extent – contributes a mere 2% to human food sources. As is the case on land, the sea also contains a variety of marine species that can be considered as alternatives to the animal and plant proteins (Dias, 2022). The Portugal Foods Association has highlighted the importance of exploring the ocean as a potential source of food, metaphorically referring to it as *the farm of the future*, emphasising the potential for exploring the depths of the ocean to yield novel and sustainable resources (Portugal Foods, 2024).

In light of the global population boom, it is imperative to maximise the utilisation of existing resources such seaweed, which has the potential to significantly contribute to ensuring food security for the planet's population (Nature, 2020). FAO underscores the pivotal role of seaweed in expanding the world's food supply by 10% while utilising a mere 3% of the world's oceans (Dias, 2022). Projections indicate that by the year 2050, the consumption of alternative proteins will reach 33%, with seaweed contributing 11% of the total (Dias, 2022).

Innova Market Insights has reported that there is an increasing inclination amongst consumers to experiment new sustainable culinary experiences and flavours. This consumer attitude presents a valuable opportunity for companies to expand their range of products to include alternative proteins – such seaweed – which are prevalent in other regions of the world. Portugal, with its extensive coastline and diverse array of seaweed suitable for consumption, is well-positioned to capitalise on this growing trend. It is predicted that there will be an

increasing presence of products of marine origin in consumer diet, particularly microalgae. Given the perception of seaweed as a valuable resource for the future of the planet and its limited presence in Europe, its potential growth is significant, driven by the increasing demand not only from consumers following a vegetarian diet but also from those seeking to diversify their eating habits. Indeed, the commercialisation of foods and drinks containing seaweed has increased by more than 42% between 2020 and 2023 (Portugal Foods, 2024).

Providing a huge potential for human nutrition as well as for the environment (Michel et al., 2021; Palmieri & Forleo, 2022; Weinrich & Elshiewy, 2023), seaweed has been recognized as a promising alternative to animal-based proteins, having a great potential as a natural, healthy, and sustainable food source (Bahraseman et al., 2025; Embling et al., 2022; Mellor et al., 2022). Traditionally consumed in Asian and Pacific cultures, seaweed is considered a novel food in the Western world (Young et al., 2022) and, for this reason, its consumption is quite low in these countries (Moss et al., 2024). Novel foods refer to foods typical of other regions of the world or produced using innovative food production technologies that do not have a history of large-scale consumption in European Union countries before 15 May of 1997 (European Commission, 2024a, 2024b).

Giacalone and Jaeger (2023) also mentioned that consumers are generally hesitant to try novel foods, due to their food neophobia (the unwillingness to try new foods or flavours, typically from other regions of the world), disgust, and unfamiliarity. For this reason, Fischer and Reinders (2022) added that it is important to understand the consumer's perceptions and their drivers and barriers to the acceptance of this innovative foods. Consumer's negative perceptions can result in the rejection of these environmentally friendly products, underscoring the significance of consumer acceptance in this regard.

Some studies have focused on the factors influencing consumer's behaviour tendencies towards seaweed food products (Bahraseman et al., 2025; Embling et al., 2024; Govaerts & Ottar Olsen, 2023; Rombach & Dean, 2024; Young et al., 2022), however more is needed to better understand and propose seaweed as a beneficial ingredient to be incorporated into foods in the Western countries (Moss et al., 2024). Thus, to progress as a society, it is vital to incorporate novel dietary products into the Portuguese culture. Therefore, a detailed study is required for the introduction of seaweed foods – as a novel food – into this nation's culture.

In fact, there is a necessity to understand consumer's perception and expectation towards this alternative protein in Western societies (Birch et al., 2019; Brayden et al., 2018;

Govaerts & Olsen, 2024; S. Lucas et al., 2019; Palmieri et al., 2023). This understanding is crucial for the success of innovations in the food industry (Fischer & Reinders, 2022).

With the view of providing a deeper understanding of European consumer's intention to purchase aquaculture products – including seaweed –, Tunca et al. (2024) extended the Theory of Planned Behaviour by incorporating subjective knowledge, health consciousness, food neophobia, and background factors (sociodemographic and food-related lifestyle). These authors emphasized the importance of studying these variables in other countries, due to the lack of research on this topic. Moreover, Rombach and Dean (2024) stated that food disgust and food safety towards seaweed foods are promising avenues for further research, given its novelty characteristics. Testing different seaweed-based products were also identified as a potential future research direction to evaluate what type of products consumers are most willing to consume (Govaerts & Ottar Olsen, 2023; Moons et al., 2018; Palmieri et al., 2023; Palmieri & Forleo, 2022; Wassmann et al., 2024; Weinrich & Elshiewy, 2023). Additionally, sociodemographic factors are also considered crucial for future studies, particularly the influence of age, gender, and education level of individuals to predict consumer's intention (Embling et al., 2022; Young et al., 2022).

In view of the above facts and the gap in the existing literature on consumer behaviour towards seaweed-based foods, it is imperative to acknowledge that for these products to achieve success, there is a need for more robust knowledge regarding Portuguese consumer behaviour towards these products. For the sake of a more sustainable, prosperous, and innovative future, this dissertation aims to **explore Portuguese consumer's intention to consume seaweed products, while develop a profile of these consumers**, and in order to answer to this question, the author defined the specific objectives presented on **Table 1**.

Table 1
General and Specific Objectives.

General Objective	Explore Portuguese' intention to consume seaweed products, while develop their profile
Specific Objective 1	Analyse the effect of consumers' attitude, subjective norms, and perceived behavioural control on intention to consume seaweed products.
Specific Objective 2	Analyse the effect of consumers' food neophobia, and food disgust on their attitude towards seaweed products and on their intention to consume them.
Specific Objective 3	Analyse the effect of consumers' food-related lifestyle on their attitude, subjective norms, perceived behaviour control, and intention to consume seaweed products, and food neophobia.
Specific Objective 4	Measure consumers' willingness to eat and pay for specific seaweed-based food products.
Specific Objective 5	Analyse the differences across sociodemographic groups (age, gender, education, income level, and distance from the sea) in relation to the Theory of Planned Behaviour variables, intention to consume, food neophobia, and food disgust.
Specific Objective 6	Identify the profile (key sociodemographic, psychological, and behavioural characteristics) of Portuguese seaweed product consumers.

This dissertation is divided into 6 logical and sequential chapters:

- Chapter 1: **Introduction** – The present chapter explains the relevance of the topic, enlightening the problem under study, and delimitating the main objectives.
- Chapter 2: **Systematic Literature Review** – To analyse the existing literature on this issue, a systematic literature review was carried out and its findings were revealed.
- Chapter 3: **Conceptual Model of Analysis and Research Hypotheses** – Drawing from a comprehensive review of the literature, the conceptual model of analysis and its hypotheses were formulated.
- Chapter 4: **Research Methodology** – After the development of the conceptual model of analysis, the research methodology and the data collection technique were presented.
- Chapter 5: **Analysis of Results** – The data resulting from the methodology applied was analysed, and the acceptability of the hypotheses formulated in Chapter 3 was verified.
- Chapter 6: **Discussion & Conclusion of Results & Further Studies** – All the relevant information mentioned throughout the research were summarised in this chapter. The results of this research were discussed and contrasted with those found in the literature. The specific objectives were answered. In addition, the theoretical and practical implications that derived from this study were presented. Finally, it was identified the study' limitations and future research directions that derive from it.

2. SYSTEMATIC LITERATURE REVIEW

2.1. REVIEW METHOD

Systematic Literature Review (SLR) is a rigorous and structured approach to identify, evaluate and synthesise the existing literature on a specific research question, using pre-defined methods to ensure transparency and minimise bias. Literature reviews are required to be valid and reliable and should also be capable of being reproduced by different researchers, and they can be conducted in diverse ways (Xiao & Watson, 2019).

The author of this review used the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analysis) protocol, given by Moher et al. (2009). As posited by these authors, the PRISMA protocol provides guidelines for the documentation of search strategies, the selection of studies, the extraction of data extraction and the reporting of results.

The author also applied the TCCM (Theories, Contexts, Characteristics and Methods) framework, a widely used tool designed by Paul and Rosado-Serrano (2019), due to its versatility and comprehensibility. Paul et al. (2023) stated that this framework enables the identification, organization, and critical evaluation of relevant information regarding theoretical and methodological approaches, characteristics and various contexts of the articles selected.

As mentioned before, it was used the PRISMA protocol. **Table 2** provides an overview of this SLR's domain, research questions, source strategy and subsequence review steps.

To direct the effort, the subsequent research questions have been formulated: **(RQ1)** Which theory, as clearly outlined in the literature, was applied?; **(RQ2)** Which methodologies have been employed most frequently?; **(RQ3)** What are the variables (dependent, independent, moderator, and mediator) or key themes presented in the articles?; **(RQ4)** Are there any research gaps that need to be exploited in the future?

In the initial stage of this review, the author developed the search strategy and defined the inclusion and exclusion criteria to identify the most relevant studies to be included in the review process while minimizing biases. The author considered only peer-reviewed articles and restricted the language to English due to the author's comprehension capability. In addition, it was excluded from the review books and book chapters, grey literature such as conference proceedings, industry reports, and critiques papers, due to the generally diminished level of independent oversight relative to journal articles.

This literature research was conducted in the following databases: **Scopus**, **Web of Science**, and **Science Direct**. Various terms related to consumer attitudes were included in the research string to access a wider range of literature, such as “attitudes”, “behaviour”, “acceptance”, “acceptability”, and “perception”. Moreover, it was included not only “seaweed” and “algae”, but also “novel food” and “superfood” to expand the scope of the literature focused on consumer behaviour towards novel food-based products.

In December 2024, the following research string was used in all the mentioned databases: **(“consumer attitudes” OR “consumer behaviour” OR “consumer acceptance” OR “consumer acceptability” OR “consumer perception”) AND (“seaweed” OR “algae” OR “novel food” OR “superfood”)**. The search terms were iteratively tested and refined to ensure the resulting number of papers was simultaneously manageable and demonstrated face validity (which means that key relevant papers were successfully included in the search results). The search terms had to be included in the *title*, *abstract* or *keywords* of the articles being searched.

In the beginning, the search retrieved 1044 results (530 from Scopus, 298 from Web of Science, and 216 from Science Direct). Duplicated articles (429) were eliminated, and the inclusion and exclusion criteria were applied. The author redefined the results and obtained 493 articles for the next stage of the review.

In the following phase, the author conducted the *screening and eligibility* assessment of the 493 selected articles in Rayyan, an application designed for processing systematic reviews. In final stage, 29 articles were extracted (presented on **Appendix A**).

Table 2
The SLR process using the PRISMA Protocol.

1st Identification	
Domain	Consumer acceptance of seaweed-based food products
Research Questions	RQ1 Which theory, as clearly outlined in the literature, was applied? RQ2 Which methodology have been employed most frequently in the articles? RQ3 What are the variables (dependent, independent, moderator and mediator) or key themes presented in the articles? RQ4 Are there any research gaps that need to be exploited in the future?
Source Type	Included Peer-reviewed articles in English language Excluded Books, chapter books, conference proceedings, industry reports, critiques papers and duplicated results
Search Databases on December 2024	Scopus <i>n</i> =530 Web of Science <i>n</i> =298 Science Direct <i>n</i> =216

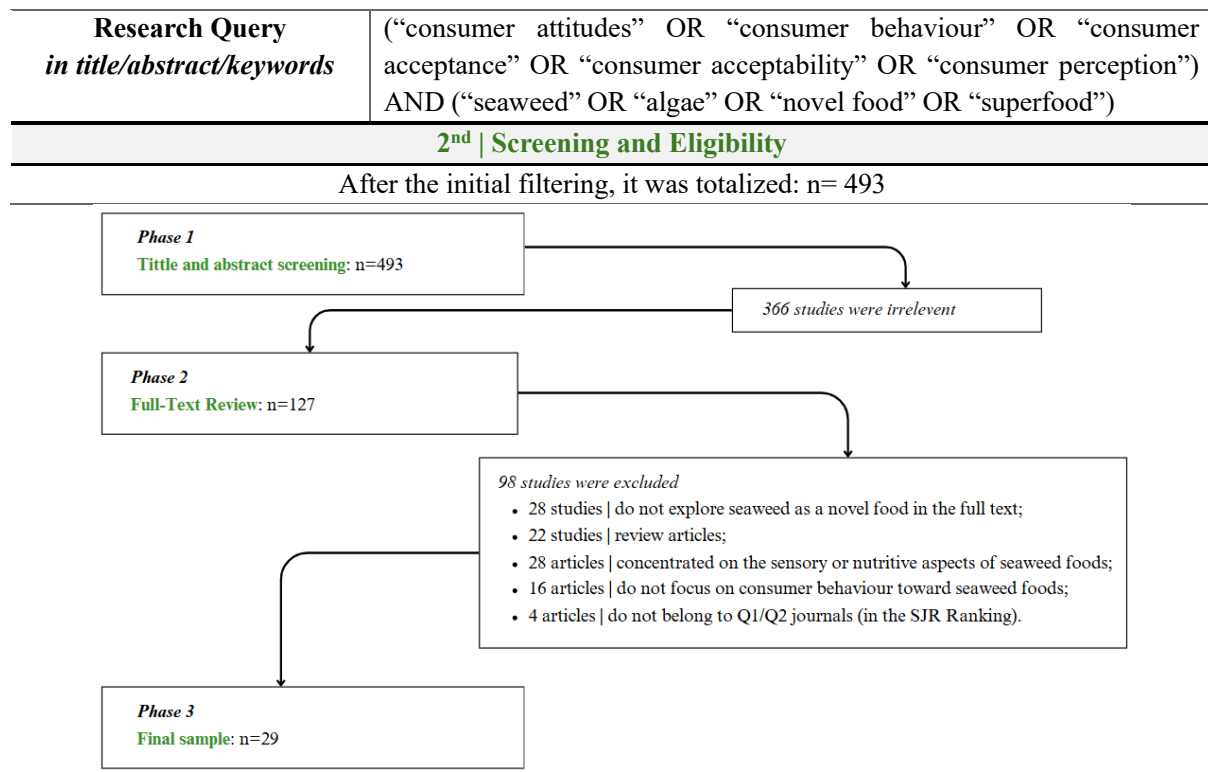


Table 3 aims to resume the **screening and eligibility** phase with more detail.

Table 3.
Screening and Eligibility Phase.

Phase 1 Title and Abstract Screening	The retrieved articles were screened based on their title and abstract, eliminating the irrelevant ones (366 articles), such as articles that do not focus their research on behaviour' explanation or marketing related themes towards novel foods. This resulted in 127 articles.
Phase 2 Full-Text Review	In this stage, the author examined the full-text of the 127 articles to assess their eligibility for data extraction. Articles that do not explore seaweed as a novel food in the full text (28 articles), reviews (22 articles), and those concentrated on the sensory/nutritive attributes of seaweed (28 articles) were excluded. Due to the still high number of articles, the author excluded the ones that were not published in Q1/Q2 journals (4 articles), and those do not focus on seaweed' behavioural consumption (16 articles). This resulted in 29 articles.
Phase 3 Data Extraction	The author extracted the 29 articles.

2.2. PUBLICATION TRENDS

The author analysed the 29 articles by **publication year**, **journal** and **keywords** used with the purpose of understanding publication trends.

2.2.1. PUBLICATION YEAR

According to the results (**Table 4**), the study of seaweed as an alternative protein is becoming more relevant over the years. There is an increasing trend in publication of articles, and more than half of the articles were published since 2023. The year 2020 only has 1 significant article likely due to the global impact of the Covid-19 pandemic, which disrupted research activities worldwide. Moreover, in 2025, only 1 publication has been recorded, as the author extracted the articles early in the year. More contributions are expected over time.

Table 4

Number of publications per year.

Year	N of Articles	# Article (Appendix A)
2018	3	[7, 24, 27]
2019	3	[23, 25, 29]
2020	1	[28]
2021	3	[3, 17, 20]
2022	5	[1, 4, 6, 15, 22]
2023	5	[2, 5, 9, 10 18]
2024	8	[8, 11, 12, 13, 14, 16, 21, 26]
2025	1	[19]

2.2.2. JOURNAL

There is no journal that stood out (**Table 5**). These articles were distributed across 17 journals, of which 10 journals have only 1 article published. *Food Quality Preference* was the journal with most papers published (n=5), followed by *Foods* and *Appetite*, both with 2 articles published per journal.

Table 5

Number of articles per journal.

Articles per Journal	Name of the Journal
1	- Algal Research - LWT - Aquaculture Economics and Management - Journal of Agriculture and Food Research - Food Research International - British Food Journal - Sustainable Production and Consumption - Arab Journal of Basic and Applied Sciences

	• Ecological Economics • Food and Humanity
2	• Sustainability • Marine Resource Economics • International Journal of Gastronomy and Food Science • Journal of International Food and Agribusiness Marketing
3	• Foods • Appetite
5	• Food Quality and Preference

2.2.3. KEYWORDS

Based on the keywords used in the selected articles, a word cloud was created by counting the frequency of each word, as show in **Figure 1**. As expected, the most used keywords are related to consumer behaviour and acceptance (“consumer behaviour” (n=11); “consumer acceptance” (n=7)), as well as those related to seaweed (“seaweed” (n=8); “algae” (n=6); “novel food” (n=5)). Keywords that highlight seaweed as an alternative and sustainable source of protein appear frequently, underscoring their role as a meat alternative (“meat substitutes” and “meat alternatives” or similar).

Figure 1

Word cloud of keywords used in the selected articles.



2.3. STUDY THEORIES

This study pretended to analyse which clearly defined theories of consumer behaviour field, defined by the literature, were used in the 29 selected articles. A mere 5, out of 29 articles, demonstrated a clear application of theories that were consistently supported by the literature, providing a reliable foundation for the empirical studies (**Table 6**).

These key theories were Value-Attitude-Behaviour Theory (VAB) (n=1), Game Theory (n=1), Technology Acceptance Model (TAM) (n=1), and Theory of Planned Behaviour (TPB) (n=2). Although only 2 articles used TPB, a psychological theory, this highlights the importance of understanding the individual beliefs, attitudes, and subjective norms in shaping consumer intention, towards seaweed products.

Table 6

Key theories identified in the selected articles.

Key Theory	N of Articles	# Article (Appendix A)
Value-Attitude-Behaviour Theory (VAB)	1	[10]
Theory of Planned Behaviour (TPB)	2	[13, 19]
Game Theory	1	[20]
Technology Acceptance Model (TAM)	1	[24]

2.4. STUDY METHODOLOGIES

Most articles employ a quantitative methodology (n=25), with only 14% of the articles utilising a qualitative or mixed approach (as can be seen on **Table 7**). The qualitative studies only used focus group to collect data, whereas mixed-method studies utilised interviews, workshops and open-ended questions of surveys. Notably, 21 articles applied surveys for data collection, while the remaining used experiments (n=4), focus group (n=2), interviews (n=1), or workshops (n=1).

Table 7

Characteristics of research design in the selected articles.

	N of Articles	# Article (Appendix A)
Quantitative	25	
<i>Survey</i>	21	[1, 2, 3, 4, 5, 8, 9, 10, 11, 12, 13, 16, 18, 19, 21, 22, 23, 25, 26, 28, 29]
<i>Experiment</i>	4	[7, 17, 20, 24]
Qualitative	2	
<i>Focus Group</i>	2	[6, 14]
Mixed-Method	2	[15, 27]

2.5. STUDY CONTEXTS

In this section, a context analysis was developed. The author identified the **country** covered in each article, as well as the **product categories** that are the subject of study.

2.5.1. COUNTRIES IN STUDY

Most articles were designed for United Kingdom (n=7), followed by France (n=5). Europe is the continent where the most countries were studied (n=11), while Asia, North America, and Oceania studied fewer countries. The non-European countries where most studies were performed were the United States (n=3), and Australia (n=2), although their numbers were not significantly high.

It is also important to note that some papers adopted a cross-country analysis (n=4). The countries selected for this type of study were Germany, Netherlands, France, United Kingdom, and Denmark. France is always a selected country and two of them analysed the same countries (Germany, Netherlands, and France). The articles which conducted a cross-country analysis of the same countries were written by the same authors. While Weinrich and Elshiewy (2019) analysed the consumer acceptability, preference and willingness to pay for meat alternatives based on seaweed, Weinrich and Elshiewy (2023) analysed consumer attitudes towards microalgae in general and identified which food-related lifestyle of consumer drives a positive attitude towards seaweed consumption.

2.5.2. SEAWEED PRODUCTS IN STUDY

Across the selected articles, there are a wide range of seaweed, and non-seaweed products under study. It is important to emphasise that some articles included other products than seaweed (for example, aquaculture, or insect products), with the aim of comparing consumer preferences to other alternative proteins. In order to summarise all the products that have been tested in the selected articles, **Appendix B** was elaborated.

In the 29 articles selected, 64 seaweed-based products were found, with seaweed crackers or cookies (n=8), seaweed salad (n=6), and seaweed meat substitutes (n=6) having the most studies. Seaweed in its natural state was also studied in some articles (n=14), with wakame seaweed type having the most studies (n=3). To a lesser extent, seaweed-based drinks were studied in 9 articles and seaweed smoothies, or shakes were the product with the most studies

(n=3). Seaweed as a general product (the articles do not distinguish between products and treat seaweeds as a single food) is mentioned in 16 articles.

The novel food studied in this SLR is seaweed, but 10 of the articles selected also compared seaweed with other type of products. Some of them were insects, technology-based innovations, and aquaculture products. Indeed, some studies even compared seaweed with animal-based proteins, such beef burgers, and meat.

2.6. STUDY CHARACTERISTICS

Given the inclusion of articles employing a range of methodologies (quantitative, qualitative, and mixed approaches), it was necessary to differentiate between the key characteristics of these distinct studies.

In the case of the quantitative studies (n=25), the author focused on investigating the variables with the purpose of understanding the factors that influence consumer attitudes towards seaweed-based products. On the other hand, the qualitative and mixed-method studies (n=4) involved an examination of the key themes.

2.6.1. QUANTITATIVE METHOD STUDIES

The categorization of all identified variables (independent, mediator, moderator, and dependent) was grouped in two groups, as previous SLR on consumer behaviour of novel foods: **consumer-related variables** and **product-related variables** (Mosikyan et al., 2024; Onwezen et al., 2021). **Appendix C** aims to resume the variables found.

Most of **independent variables** identified were related to the consumer (70%), while only 30% related to the product. Of the consumer-related variables, there was an emphasis on consumer psychological traits, with food neophobia standing out (it was analysed as an independent variable in 10 out 25 articles).

Mediator variables are important to explain the relationship between an independent and a dependent variable (Mosikyan et al., 2024). The findings indicate that only 5 articles used mediator variables. The most used ones belong to the consumer-related variables (68%), whereby only 1 article explored product-related variables as mediators. Focusing on consumer-related factors, consumer attitudes (n=8) were explored more than the consumer traits (n=7).

A **moderator variable** influences the strength of the relationship between an independent (cause) and a dependent variable (effect) (Mosikyan et al., 2024). This study found

that 8 articles analysed moderator variables, which predominantly explored consumer-related variables. The sex/gender, age, and food neophobia were the most studied moderator variables.

The examination of the **dependent variable** revealed that there is a prevalence of behavioural variables over attitudinal, despite this split being very small (55% compared to 45% of quantitative studies). The attitudinal variables with more studies were related to the *consumer attitude* (n=6). The most studied behavioural variables, they were the *consumption intention* (n=6), the *willingness to pay* (n=6), and the *seaweed consumption* (n=5). The split between attitudinal and behavioural categories, whilst reduced, highlights the necessity to address the discrepancy between attitudes and actions in context of consumer research.

2.6.2. QUALITATIVE AND MIXED-METHOD STUDIES

In total, a mere 4 out of the 29 studies employed qualitative or mixed methods. The author identified key themes that are related to the acceptability of consumer, product attributes, and motivations and barriers to the consumption of seaweed products.

The articles highlighted the importance of **understanding the acceptability** – linked to the willingness to try and buy – of seaweed foods, enumerating **motivations and barriers** to its consumption (Embling et al., 2024; Mellor et al., 2022; Moons et al., 2018; Young et al., 2022). In addition, the **sensorial perception** (taste, texture, smell, and appearance) and the foods **attributes** (e.g. naturalness and healthiness) have been evaluated as factors for consumer acceptance (Embling et al., 2024; Mellor et al., 2022). Another crucial theme was the consumer's preference for the **labelling communication**, reinforcing the role of effective communication in product development and marketing strategies that connect novel foods attributes to consumer values and beliefs (Embling et al., 2024). Finally, some studies highlighted the importance of **segmenting consumers** based on their lifestyle, behaviour, and values, profiling their behaviours (Moons et al., 2018; Young et al., 2022).

2.7. THE BIG THEMES AND KEY FINDINGS

Based on the 29 selected articles, a critical analysis of the existing literature on the issue addressed in this research will be presented, providing context for the reader. Structured in a sequential logic, the author deeply analysed the following 4 themes: **(I)** Consumer's responses towards seaweed products; **(II)** Consumer's responses based on sociodemographic factors; **(III)** Consumer's responses towards food-related lifestyle; **(IV)** Attitudes and behaviours towards seaweed products.

2.7.1. CONSUMER'S RESPONSES TOWARDS SEAWEED PRODUCTS

Seaweed consumption is not common in European countries, as it is a new and unfamiliar food source for most individuals (Embling et al., 2022; Mellor et al., 2022). Previous research has generally reported a high consumption intention among consumers in Western countries (Birch et al., 2019; Embling et al., 2022; Losada-Lopez et al., 2021; Palmieri & Forleo, 2020). Thus, the attributes of seaweed-based products (foods or drinks) have a high level of impact on consumer's purchasing decisions (Birch et al., 2019). In the next lines, the author highlighted and explored the seaweed product attributes most discussed on the literature and the respective consumer's response towards them.

A. CONSUMER RESPONSE TOWARDS NOVELTY OF SEAWEED PRODUCTS

Seaweed is considered a novel and unfamiliar food source. The novelty related to novel foods can encourage the curiosity of more adventurous individuals (Li et al., 2019; S. Lucas et al., 2019; Mellor et al., 2022; Moons et al., 2018). However, novelty is perceived as negative for most individuals who are sceptical in relation to innovative foods (Mellor et al., 2022), because as well as not being integrated into their gastronomic culture, familiarity is important for its acceptability (Embling et al., 2022). Thus, positive beliefs about seaweed products affect the intention to consume these products (Embling et al., 2022; Mellor et al., 2022).

Familiarity with seaweed products and knowledge about them can increase the consumer's willingness to consume these products (Embling et al., 2022, 2024). In addition, Palmieri et al. (2023) and Begho (2024) stated that previous and positive experience with seaweed is important to increase the level of acceptance and willingness, since the ones who already consumed seaweed were more likely to consume it in the future than the other

respondents. Along with the last authors, Al-Thawadi (2018) and Tunca et al. (2024) discovered that the knowledge about seaweed has a positive effect on the behavioural intention of consumers, with Mellor et al. (2022) and Young et al. (2022) highlighting the poor knowledge of consumers about seaweed products. Young et al. (2022) reported that individuals use the internet (81,1%), nutritionists (57,8%), sale's points (52,7%), and feedback from relatives/friends (50,8%) as the main sources of information about seaweed.

Related with familiarity and knowledge about novel foods – such seaweed – is the *food neophobia* concept. It is characterized by a personality trait that significantly influences the acceptability and success of novel foods and is defined by the aversion to trying new and unfamiliar foods. Moons et al. (2018) highlighted that the novelty characteristic of seaweed products could be seen as a negative response due to the consumer' neophobia.

In fact, most of the studies characterized this variable as a barrier to the seaweed acceptance (Embling et al., 2022; Losada-Lopez et al., 2021; Michel et al., 2021; Moons et al., 2018; Onwezen et al., 2022; Palmieri et al., 2023; Palmieri & Forleo, 2020; Wassmann et al., 2024; Young et al., 2022). Bahraseman et al. (2025) contradicted this scenario, explaining that food neophobia does not significantly influence consumer attitudes or intention to consume seaweed-based foods. This suggests a high openness and acceptance of dietary innovations by Iran's, a non-European country, population. This can be explained due to the country's long history of trade and cultural exchanges, allowing Iran to blend elements from various cuisines, incorporating unfamiliar elements into their culinary landscape.

Consumers with strong beliefs about the benefits of meat (and consequently negative attitudes towards non-meat diets) can decrease acceptance of seaweed. On the other hand, presenting meat alternatives in familiar shapes (such hamburgers) might encourage the consumption as the meat product they are familiar with (Michel et al., 2021).

Those with high levels of food neophobia are less likely to consume seaweed products, due to this trait negatively affecting their behavioural intention (Birch et al., 2019; Embling et al., 2022; Losada-Lopez et al., 2021; Michel et al., 2021; Palmieri et al., 2023; Tunca et al., 2024; Young et al., 2022).

Building on the same idea, Losada-Lopez et al. (2021) noted that individuals with a lower level of neophobia should be prioritized by the seaweed food companies because individuals with a high level of food neophobia are often influenced over time by early adopters of seaweed-based products. This highlights the significant role of social influence in adopting new eating habits. This point was also supported by Lucas et al. (2019) who reported that

having friends or relatives who have already consumed these products motivates the individual to try them too.

Tunca et al. (2024) studied food neophobia as a moderator variable. It was found a strong moderated effect between subjective norms and subjective knowledge on behavioural intention. This means that consumers with higher levels of food neophobia are less influenced by social pressure and their subjective knowledge when forming behavioural intentions. They also found that this variable moderated the impact of health information on consumer choices.

Promoting consumer's food literacy can increase their curiosity and consequent intention to consume seaweed (S. Lucas et al., 2019). Moreover, to reduce food neophobia, Tunca et al. (2024) emphasized the necessity of delineating educational initiatives highlighting the benefits of aquaculture products, which could reduce the fear of unfamiliar products and enhance the consumer acceptance.

Related to the food neophobia is the *food fussiness* construct. It is defined as the refusal to eat new foods that are unfamiliar with and familiar foods that are often widely accepted, contradicting neophobia phenomenon. Food fussiness is seen as a strong negative predictor for willingness to eat seaweed. Fussy eaters are more receptive to try seaweed products when they are incorporated in other products that are familiar to them (Rombach & Dean, 2024).

B. CONSUMER RESPONSE TOWARDS EDIBILITY OF SEAWEED PRODUCTS

The sensory properties and appeal of seaweed-based products are an important key driver for its acceptance (Al-Thawadi, 2018; Begho, 2024; Birch et al., 2019; Embling et al., 2022; Palmieri & Forleo, 2022; Piwowar et al., 2023; Weinrich & Elshiewy, 2023).

Piwowar et al. (2023) found that taste is a critical factor that can influence the choice of new food products. In fact, 55,6% of respondents referred that taste is crucial when the product is entirely or mainly from seaweed, and 46,6% for those products with added seaweed. Following taste, characteristics such as high nutritional value, price, and appearance were also important to consumers. Some authors found that food neophobia's impact on seaweed acceptance is mediated by beliefs about its taste and familiarity. For that reason, they emphasized that positive perceptions of these attributes can mitigate the negative effects of food neophobia and increase seaweed acceptance (Embling et al., 2022).

Furthermore, as it is a novel food, the product being visually appealing and tasty is also a motivation for individuals (Birch et al., 2019; Piwowar et al., 2023). Not displaying the

natural appearance of seaweed may be a good strategy to enhance willingness to try seaweed products, especially for the picky eaters (Rombach & Dean, 2024).

Bahraseman et al. (2025) explored the *food disgust* concept towards seaweed or seaweed-based food products. It was found that food disgust towards these products significantly negatively impacts individual's attitudes and intentions to consume them, which can reflect a psychological deep-rooted barrier stemming from unfamiliarity and cultural biases.

C. CONSUMER RESPONSE TOWARDS HEALTHINESS OF SEAWEED PRODUCTS

Seaweeds are naturally healthy, and contain beneficial characteristics for human's nutrition (Birch et al., 2019; Govaerts & Ottar Olsen, 2023; B. Lucas et al., 2023). Birch et al. (2019) revealed that individuals feel motivated to consume seaweed products due to their nutritional characteristics and health benefits. Piwowar et al. (2023) added that the nutritional value and food safety were the most critical factors that can influence the choice of new food products. The health factor is crucial for woman over the age of 25 (Young et al., 2022).

Mellor et al. (2022) stated that individuals associate seaweed-based products with processed products that are therefore less healthy. Consequently, individuals tend to evaluate seaweed as healthier and more natural, less calorific, processed, and expensive than seaweed-based products, even though they express a higher level of acceptability for the latter. For that reason, it is important to preserve the nutritional content of seaweed in processed products, providing this information clearly and transparently to the consumer (S. Lucas et al., 2019).

Although the consumers prefer seaweed-based products, they are unsure about seaweed's healthy characteristics, especially if the products have a high level of processing (normally when used as an additional ingredient in food products). For this reason, consumers are less willing to try a product as its level of processing increases (Mellor et al., 2022). In fact, the perceived healthiness of seaweed products can increase their willingness to try them (Al-Thawadi, 2018). The consumer tends to prefer seaweed organic products (Weinrich & Elshiewy, 2019).

The preservation of nutritional value of seaweed is an important key consumer concern. Moreover, the processed level of them is a consumers' concern, because they associate a high level of processing with an unhealthy attribute (Mellor et al., 2022; Young et al., 2022). As Young et al. (2022) emphasize, it is essential to consider the preservation of seaweeds

nutritional composition when processing it into snack foods, in order to maintain the health benefits for which it is renowned. Moreover, this authors have identified an opportunity for seaweed products to feature their nutritional composition on the packaging, thereby addressing consumer concerns about the under and overconsumption of micronutrients as a barrier to intake.

Govaerts and Ottar Olsen (2023) explored the relationship between perceived naturalness and uniqueness of seaweed and the attitudes of those who consume it. They concluded that biospheric values positively influence attitude, and highlighted a positive moderation effect of perceived uniqueness on the relationship between hedonistic values and attitude.

A positive *health consciousness* affects behavioural consumer's intention, with seaweed consumption being more frequent and likely among those who are more health aware (Birch et al., 2019; Moons et al., 2018; Rombach & Dean, 2024; Tunca et al., 2024). For that reason, Birch et al. (2019) added that health consciousness consumers are a primary market for seaweed, which means that marketing claims need to be grounded in evidence and emphasize the significant health and nutritional benefits that can be derived from seaweed consumption.

Related to the health concern is the *food safety* concern. Rombach and Dean (2024) found a significant relationship between food safety concerns and willingness to eat seaweed. The authors also mentioned the relevance of studying food safety in the context of risk information and focusing on food safety risks towards seaweed, confirming the importance of the food safety variable. In consonance, Birch et al. (2019) mentioned that the individuals who are responsible with food and care about food safety issues are more likely to eat seaweed. The marketing strategies need to reflect this desire for more safer food, and this should cover all the supply chain of harvesting, production, and processing of seaweed products.

D. CONSUMER RESPONSE TOWARDS SUSTAINABILITY OF SEAWEED PRODUCTS

According to Mellor et al. (2022), the potential impact of seaweed in the environmental elicits apprehension on consumer, especially in processed products that needed secondary ingredients or technologies. Given that, it is crucial to transmit to consumer if products were produced on a sustainable way (S. Lucas et al., 2019). According to Piwowar et al. (2023), the environmental benefits of seaweed products can encourage consumers to choose them.

Consumer sustainability consciousness and *sustainable concerns* positively influences the consumer acceptance and attitude towards seaweed products (Mellor et al., 2022; Palmieri et al., 2023; Young et al., 2022). In addition, Begho (2024) found that personal health benefits, animal welfare, and environmental reasons are the main motivations that drive to the acceptance of meat alternatives, such as seaweed. Moons et al. (2018) contradicts this idea, referring that consumer's sustainability concerns are not considered a driver to experiment seaweed-products.

Sustainability aspects are a consumer awareness and for this reason, the excessive use of plastic in packaging could be a barrier to the seaweed consumption (Mellor et al., 2022; Young et al., 2022). Mellor et al. (2022) added that the packing should focus on comparing familiar meat and dairy products to seaweed, in order to stimulate familiarity.

Moreover, referring seaweed as a *local product* would incentive its purchase, as individuals are willing to prefer and pay more for local products (Brayden et al., 2018; Mellor et al., 2022; Weinrich & Elshiewy, 2019). Contradicting this information, Lucas et al. (2019) stated that neither the origin (domestic versus imported) nor the type of production (wild versus controlled farming) has a significant impact on consumer preferences.

E. CONSUMER RESPONSE TOWARDS ACCESSIBILITY OF SEAWEED PRODUCTS

Product attributes such taste, texture and benefits, such as nutritional and health-related, are significant drivers of consumer acceptance (Embling et al., 2022; Mellor et al., 2022; Young et al., 2022). However, accessibility and affordability perception are frequently highlighted as barriers to seaweed consumption. Consumers who shop for a family, have a food budget, and buy large quantities of food are more sensitive to the price of these products. Increasing the distribution channels of seaweed-based products may be crucial to reach new markets segments (Mellor et al., 2022).

The price of the seaweed products must be competitive towards meat and meat-based products (Weinrich & Elshiewy, 2023). Seaweed is an abundant food source, do not require expensive investment to create. For this reason, some individuals believe that the products are affordable. However, due to the type of markets where they are commercialised, the level of processing and additional ingredients needed to develop seaweed-based products, some individuals believe that their price is high (Birch et al., 2019; Mellor et al., 2022).

F. CONSUMER RESPONSE TOWARDS VERSATILITY OF SEAWEED PRODUCTS

The lack of product diversity is one of the barriers to consumption of seaweed products (Piwowar et al., 2023; Young et al., 2022). UK consumers mentioned their preference for seaweed-based products (where seaweed is a second ingredient in a familiar food product) instead of the consumption of a standalone seaweed product because they believed seaweed could be more disguised (Mellor et al., 2022). In fact, individuals are more likely to eat seaweed if it is an ingredient in foods they already enjoy, rather than being presented as a standalone food (Birch et al., 2019). To help consumers to integrate seaweed into the preparation of meals and familiar foods, Weinrich and Elshiewy (2023) referred that recipes should be shared with the seaweed product.

Embling et al. (2022) found that UK individuals were more open to seaweed-based sushi and burger, and least accepting seaweed juice drinks and baby sugar kelp. In fact, seaweed received lower rating of acceptance when framed for its use in sweet foods and beverages. However, another study revealed that UK individuals revealed an interest in products that included seaweed in sweet snacks (seaweed chocolate, pudding, mousse, seasonings, and cereal bars), main dishes (pasta, burgers, cannelloni's sauce, and salads), and drinks (smoothies, and sodas) (Mellor et al., 2022). Seaweed in pasta, and cereal bars were also mentioned by other authors (B. Lucas et al., 2023).

Some authors highlighted the importance of consumer tasting seaweed products in order to improve their acceptability of less expected products contexts with this alternative protein (Embling et al., 2022; Palmieri & Forleo, 2020).

G. CONSUMER RESPONSE TOWARDS PACKAGING OF SEAWEED PRODUCTS

Due to the scepticism of individuals and pre-existing thoughts, the packaging of seaweed products must be attractive, referring consumers to traditional and familiar products, to increase their acceptability. However, the excessive plastic contained in packaging of these products, mitigate the individual's intention to buy, existing a disharmony between the characteristics of the product and its packaging (Young et al., 2022).

Consumers value certified products (Brayden et al., 2018). Thus, Lucas et al. (2019) concluded that environmental, quality, health, and fair-trade labels are positively perceived by consumer with a greater preference for the environmental labels. They also point out that

quality labels are not as important for consumers in organic shops, as they assume that since it is an organic shop, their products are always of high quality.

In the future, the healthiness and sustainability of products will be the most important product characteristics for consumers, and seaweed fulfils both (S. Lucas et al., 2019). So, the appropriate food labelling has a large potential to increase market shares for meat substitutes. For this reason, communicating the environmental-friendly production increase the consumer preferences, due to the individual's interest in food product's information (Weinrich & Elshiewy, 2019, 2023).

2.7.2. CONSUMER'S RESPONSES BASED ON SOCIODEMOGRAPHIC FACTORS

Consumer demographic differences may influence seaweed consumption intentions. Understanding these demographic predictors of dietary intentions is crucial to design marketing strategies that effectively target specific population groups (Birch et al., 2019; Begho, 2024).

A. AGE

Age has been identified as a critical factor in shaping consumer perceptions and behaviours towards seaweed consumption. Several studies suggest that older individuals are generally less likely to consume seaweed, primarily due to the higher levels of food neophobia compared to the younger segment (Embling et al., 2022; S. Lucas et al., 2019; Michel et al., 2021; Palmieri et al., 2023).

Embling et al. (2022) and Moons et al. (2018) reported age as a significant predictor of consumer behaviour towards these products. Govaerts and Olsen (2024) support this view, noting that older individuals tend to exhibit more conservative dietary behaviours, which reduce their likelihood of adopting seaweed products. Tunca et al. (2024) referred that age significantly influenced attitude, subjective norms, perceived behavioural control, subjective knowledge, and food neophobia, but no health consciousness, which means that the difference of age did not have a significant impact on health awareness of individuals. Birch et al. (2019) added that the most promising market is woman under of the age of 35 years.

B. GENDER

Gender proved to be crucial to influence consumer's attitude towards seaweed among different European countries (Piwowar et al., 2023; Tunca et al., 2024; Weinrich & Elshiewy, 2023), however some studies reported it as insignificant (Embling et al., 2022; Moons et al., 2018; Palmieri et al., 2023), which underscores the necessity for further investigation.

It is noted that gender has an important impact on individual's attitude, subjective norms, perceived behavioural control, subjective knowledge, and health consciousness, but not on food neophobia (Tunca et al., 2024).

Birch et al. (2019) – who conducted an Australian study – and Begho (2024) – who conducted a United Kingdom – identified women as a key target market for seaweed consumption. Contrasting, Embling et al. (2022), who also conducted a study in United Kingdom, stated that younger and well-educated males showed greater acceptance of seaweed, likely due to lower food neophobia. In consonance, also Wassmann et al (2024) identified the young Singaporean males as a target market. Also, Li et al. (2019) found that in United States, women were less willing to pay for seaweed products than men. This different findings may derive from the country where the studies are carried out.

C. EDUCATION LEVEL

Education is a strong predictor that influences seaweed consumption (Birch et al., 2019; Embling et al., 2022; Moons et al., 2018; Palmieri & Forleo, 2020; Tunca et al., 2024; Wassmann et al., 2024; Young et al., 2022). Individuals with higher education levels are more inclined to adopt seaweed products, because they are more progressive, interested, and open to seaweed products (Birch et al., 2019; Govaerts & Olsen, 2024; Palmieri & Forleo, 2020; Wassmann et al., 2024; Young et al., 2022). Li et al. (2019) added that individuals with high education level were more willing to pay a premium price for seaweed products. Tunca et al. (2024) added that education level impact individual's attitude, perceived behavioural control, health consciousness, and food neophobia, but not subjective norms or subjective knowledge.

D. DIETARY PATTERNS

Individuals who do not consume meat on daily basis, and who adhere to a diet focused on vegetable foods, and are aware of seaweed are more likely to consume these products than those with a more traditional diet rich in animal proteins (Birch et al., 2019; Embling et al., 2022; S. Lucas et al., 2019; Michel et al., 2021). In consonance, Weinrich and Elshiewy (2023) added that the target group for seaweed as a food is the individuals with a vegetarian or low meat consumption (flexitarian lifestyle).

E. INCOME

Individuals with higher incomes allocate more money to food, so they are more likely to represent the potential target market for seaweed consumption. Their purchasing power and openness to trying new foods align with the profile of consumers who are willing to pay for sustainable diet options. In addition, these individuals are identified as the ones who were more likely to have eaten or tasted seaweed and more likely to consume seaweed in future (Wassmann et al., 2024; Young et al., 2022). Contradicting, Tunca et al. (2024) referred that income did not have a strong influence in consumer's behaviour towards seaweed foods.

F. GEOGRAPHIC LOCATION

The individual's country of residence is a critical factor in shaping consumer's perception of seaweed (Piwowar et al., 2023; Tunca et al., 2024). Tunca et al. (2024) found that the country in which the individual lives significantly influenced their attitude, perceived behavioural control, subjective knowledge, health consciousness, and food neophobia. Also, these authors were the only who studied the consumer's geographical proximity to the sea and concluded that this variable affects individual's food-related behaviours and perceptions, significantly influencing attitude, subjective norms, perceived behavioural control, subjective knowledge, health consciousness, and food neophobia. They found that older individuals that lived near to the coast showed higher levels of food neophilia than the ones who live inland, which can consequently affect their eating habits.

2.7.3. CONSUMER'S RESPONSES TOWARDS FOOD-RELATED LIFESTYLE

Food-related lifestyle (FRL) is an instrument that explain how individual's values, thoughts, and habits influence the way they respond towards food, through variables such as **food involvement**, **food innovativeness**, and **food responsibility**, helping to shape food-related attitudes and behaviours (Tunca et al., 2024; Wahyuningtyas et al., 2024; Wassmann et al., 2024). Tunca et al. (2024) added that FRL is an instrument that identifies responsibility, food involvement, and food innovation as the key drivers of sustainable consumption.

Food involvement can be defined as the degree of an individual's involvement towards a certain food or drink product. Food innovation is characterized by the sense of innovation towards foods and drinks of an individual, while food responsibility is the sense of environmental and social responsibility towards foods and drinks (Tunca et al., 2024; Wahyuningtyas et al., 2024).

Some authors concluded that FRL variables have a significant and positive effect on consumer's attitude towards seaweed foods (Tunca et al., 2024; Wahyuningtyas et al., 2024; Wassmann et al., 2024). Tunca et al. (2024) studied this construct and concluded that they were significant predictors towards consumers' attitudes, subjective norms, perceived behaviour control, and food neophobia. In fact, the author found that consumer's food innovation influenced attitude, subjective norms, health consciousness, and food neophobia. Thus, it can be concluded that individual's openness to new food experiences are important for shaping their attitudes and perceptions. Food involvement and responsibility also appeared as significant predictors across attitude, subjective norms, perceived behavioural control, subjective knowledge, health consciousness, and food neophobia. It can be concluded that individuals with higher involvement and a strong sense of responsibility regarding food-related behaviours are more likely to develop positive attitudes and perceptions towards seaweed food.

In conclusion, consumers with a higher involvement and a strong sense of responsibility regarding food-related behaviours are more likely to develop positive attitudes and perceptions towards seaweed food (Birch et al., 2019; Onwezen et al., 2022; Tunca et al., 2024; Wahyuningtyas et al., 2024). Govaerts and Olsen (2024) added that a high level of food innovation is related with a higher level of interest, curiosity, and, consequently, knowledge about seaweed. In fact, individuals with a high level of food neophobia are less likely to eat seaweed, unlike those who are enthusiastic about new experiences and attach symbolic value to food (Birch et al., 2019; Palmieri et al., 2023). Weinrich and Elshiewy (2023) found that the

target group for seaweed products prefers a healthy lifestyle, is open to try new food and recipes, and its alimentation habits are vegetarian or low meat consumption.

Regarding food involvement is the *symbolic value* of food concept. Birch et al. (2019) mentioned that the individuals who are responsible with food and care about food safety issues are more likely to eat seaweed. The marketing strategies need to reflect this desire for more safe food, and this should cover all the supply chain of harvesting, production, and processing of seaweed products. Moreover, the same authors and Wassmann et al. (2024) explained that seaweed consumption was more frequent and likely for those who assign symbolic value to food. Capitalizing positive messages such as *you are what you eat* and using terms like *trendy* or *chic food choice* could augment the consumer appeal for new seaweed products. Contradicting these authors are Rombach and Dean (2024) that discovered that there is no significant relationship between symbolic value and willingness to eat seaweed.

2.7.4. ATTITUDES AND BEHAVIOURS TOWARDS SEAWEED PRODUCTS

The Theory of Planned Behaviour (TPB) is a widely used theoretical framework in consumers studies, due to their capacity to predict acceptance and consumption intention, explaining their decision-making process. The application of this theory enhances the academic rigour and provides predictive insights into consume purchase behaviour across foods in diverse cultural contexts and types of foods, proving its versatility.

The consumer's intention to perform a certain behaviour is determined by motivational factors and individual efforts. Thus, TPB demonstrates that attitude, subjective norms and perceived behavioural control are crucial influencing factors (Bahraseman et al., 2025; Tunca et al., 2024).

A. ATTITUDE

Attitude is defined by a mental construct that indicates a individual's positive or negative feelings towards a certain behaviour. This attitudes towards a product are shaped by their beliefs, perceptions, preferences, and emotions associated with that (Bahraseman et al., 2025; Wahyuningtyas et al., 2024; Weinrich & Elshiewy, 2023).

In fact, attitude is a crucial factor in influencing consumer behaviour and purchasing decisions of novel foods (Bahraseman et al., 2025; Wahyuningtyas et al., 2024). Thus, attitude emerged as a strong and significant predictor of intention to consume seaweed (Bahraseman et

al., 2025; Tunca et al., 2024). Both studies found that a positive attitude towards seaweed, causes a positive intention to consume them, demonstrating the importance of positive attitudes towards seaweed products. Inclusive, Bahraseman et al. (2025) stated that attitude was the strongest predictor towards consumer intention. The last authors added that attitude played a mediating role in the relationship between food disgust, moral norms, knowledge, and environmental concerns with consumption intention.

B. SUBJECTIVE NORMS

Subjective norms are related to an individual's perception of the society expectations and pressures that are in the bottom of a specific behaviour (Al-Thawadi, 2018; Bahraseman et al., 2025; Wahyuningtyas et al., 2024).

Bahraseman et al., (2025) found that subjective norms play a significant role on consumer's intention to consume seaweed products, which means that the social pressure directly contribute to their positive behaviour. In addition, this study investigated the relationship between subjective norms and moral norms. They found that the subjective norms perceived by the consumers strongly impact their moral norms concerning sustainable food consumption and consequently their intention even less than the direct effect of subjective norms on intention.

In an Indonesian scenario, Wahyuningtyas et al. (2024) analysed the mediator effect of subjective norms between consumer's attitude towards seaweed and their willingness to try. Subjective norms showed a significant influence on individual's choices to consume healthy foods. In this study, this variable is positively correlated with indicators of purchasing healthy food due to the social environment, consumer's knowledge about healthy food, their feelings of happiness regarding healthy food purchases, and whether their family supports them in buying it. Tunca et al. (2024) showed a similar result, affirming that subjective norms are the strongest predictor of consumer intention, indicating the power of social pressure on purchasing decisions. Al-Thawadi (2018) corroborates this point, stating that individual's subjective norms have a high and direct effect on intention to consume seaweed or seaweed-based products.

Tunca et al. (2024) also studied the moderator effect of food neophobia on subjective norms, and knowledge, and found that individuals with high levels of food neophobia are less influenced by social pressure and their subjective knowledge about seaweed when forming their behavioural intentions.

C. PERCEIVED BEHAVIOURAL CONTROL

Perceived behavioural control is defined by the confidence and perceived capacity of individuals to enhance a certain behaviour (Bahraseman et al., 2025; Govaerts & Ottar Olsen, 2023).

Bahraseman et al. (2025) found a positive influence of perceived behavioural control on intention to consume seaweed. This means that Iran' consumers who feel more in control over their capacity to consume seaweed products, are more likely to express an intention to do so. It is important to make seaweed products more accessible, affordable, and easy to eat so that individuals can integrate them in their diet. This would help to make individuals more in control of their diet and encourage them to use sustainable protein sources. Tunca et al. (2024) contradicted this finding, stating that perceived behavioural control does not significantly impact consumers intention to consume on Denmark, United Kingdom, and France, which means that the perceptions of individuals to perform a certain behaviour do not contribute to form their intentions.

Perceived behavioural control was also studied as a moderator between attitude and consumption. Govaerts and Ottar Olsen (2023) found that this is a significant moderator with a high predictive power of attitude regarding seaweed consumption, confirming the importance of this variable to reduce the gap between attitude and behaviour.

2.8. FUTURE RESEARCH DIRECTIONS

The SLR provided a comprehensive analysis of the various factors influencing the consumption of seaweed. The investigation yielded several promising areas of study, which will be described below. As other reviews have suggested (Fischer & Reinders, 2022; Mosikyan et al., 2024), this study used the TCCM framework and organised the recommendations into 4 groups: (1) looking at new theoretical frameworks; (2) exploring new contexts; (3) investigating new variables and relationships; and (4) exploring new methodologies.

2.8.1. NEW THEORETICAL FRAMEWORKS

Due to the clearly limited theories used and due to the importance of implementation theoretical frameworks to a more comprehensive understanding of consumer decision-making and comparison across studies making (Onwezen et al., 2021; Rotfeld, 2014), it is imperative to investigate theories that guide and explain consumer behaviour (Bahraseman et al., 2025; Tunca et al., 2024). Consequently, the author proposes that future research explore a more extensive array of theoretical frameworks perspectives, such as the **Dual-Process Theory**, the **Diffusion of Innovation Theory**, and extend the **Theory of Planned Behaviour**.

Dual-Process Theory

The Dual-Process Theory is a comprehensive framework that explains how consumers make decisions using intuitive and reflective cognitive mechanisms. The intuitive mechanism is emotional, relying on cultural beliefs and instant reactions when evaluating novel foods. The reflective mechanism is analytical, leading consumers to assess foods based on factual data such as nutritional value or sustainability claims (Epstein, 1994). Effective marketing strategies should balance emotional appeal (e.g. familiarity, storytelling) with factual information (e.g. labels, certifications). As Albertsen et al. (2020) emphasize, this model helps to explain novel food adoption - where the information has been proven to have a significant impact on decision-making consumer' processes.

Diffusion of Innovation Theory

The Diffusion of Innovation Theory (developed by Everett M. Rogers in 1983) is a highly used framework that focus on rational decision-making processes. This theory is frequently employed in the study of food products and marketing strategies, with the objective of explain how and why new ideas, technologies, and practices spread and are accepted in a specific place or group of

people (Rogers et al., 2014). The theory has three main parts: the innovation (the new practice), the adopters (who accept it), and the diffusion process (how it spreads). This process happens in five stages: knowledge, persuasion, decision, implementation, and, finally, confirmation (when people weigh the benefits and results, which can make them more likely to adopt it) (Kankam et al., 2024). The application of this theory on seaweed' consumption study could help to understand how new foods spread into a population and the key factors on influencing its adoption or rejection.

Extend the Theory of Planned Behaviour

The Theory of Planned Behaviour (TPB) is a widely used theoretical framework due to its capacity to explain behavioural intentions through determinants that shape consumer intentions - attitude, subjective norms, and perceived behaviour (Tunca et al., 2024). Nevertheless, Bahraseman et al. (2025) pointed out that the TPB may not capture all factors influencing the adoption of novel foods, suggesting the inclusion of additional variables, such as price or marketing strategies, in order to provide a deeper understanding of consumer acceptance. In the same vein, Tunca et al. (2024) argued that this theory might not fully encapsulate the complex interplay of factors driving sustainable food consumption behaviours, suggesting the inclusion of other theoretical frameworks (e.g., Value-Belief-Norm or the Technology Acceptance Model). Given these limitations, the author suggests that future studies continue to use the TPB, but with the inclusion of additional variables that have been shown to affect consumers' intention to consume, and variables to enhance the model's predictive power. Specifically, complex food choice behaviours - particularly those associated with alternative and novel protein foods - should incorporate background factors such as sociodemographic and lifestyle characteristics. In fact, Weinrich and Elshiewy (2023) highlighted the pertinence of focus on the food-related lifestyle dimensions, but selecting the most suitable items according to the research question to better understand how lifestyle impacts consumption in other European countries. Expanding the model in this way could improve its explanatory strength and provide a more comprehensive understanding of consumer decision-making towards seaweed-based food products.

2.8.2. NEW CONTEXTS

Exploring the acceptability of seaweed-based products based on new contexts - such as new countries and new products contexts - could make it easier to understand this topic. For that reason, the author suggests the **study of seaweed-based products acceptability on more non-Western countries**, the **study of specific seaweed-based products**, and the **exploration and comparison of seaweed protein to other novel proteins**.

The Dichotomy of Non-Western VS Western countries and the Cross-Country studies

Most studies on the consumer acceptability of seaweed products focused on European countries (Birch et al., 2019; Brayden et al., 2018; Govaerts & Olsen, 2024; Palmieri et al., 2023). This is often justified by the fact that seaweed consumption is relatively uncommon in these regions, in contrast to Asia, where it is a familiar and widely consumed product (Birch et al., 2019; Govaerts & Olsen, 2024). However, expanding research beyond Europe is essential, particularly to regions such as Africa, and America. A significant proportion of the population in these regions is confronted with poverty and has limited access to healthy food options, rendering seaweed a promising meat alternative (FAO, 2024). The introduction of seaweed as a novel product in these regions has the potential to reveal challenges and opportunities related to cultural, economic, and social factors. Furthermore, while seaweed is a staple in many Asian countries, cross-regional comparisons between Asia, Europe, and other parts of the world would provide valuable insights into consumer preferences and behaviours. Govaerts and Olsen (2024) and Palmieri et al. (2023) suggested cross cultural studies, involving different Eastern populations to examine how gastronomic traditions influence consumer attitudes towards alternative protein sources. Also, the author thinks that the identification of critical factors influencing seaweed consumption, including cultural familiarity, perceived health benefits, and sustainability values, could be facilitated by such studies. By examining geographic and cultural differences, researchers could establish clearer parameters for promoting seaweed as a viable and appealing food source across diverse populations. This approach would not only advance the understanding of seaweed acceptability, but also support its potential as a sustainable and nutritious alternative in regions where dietary diversity and food security remain critical concerns.

Specific seaweed-based products

It is imperative to investigate the competitive dynamics between novel seaweed-based products and existing protein sources, given the ambiguity surrounding this relationship (Govaerts & Olsen, 2024; Govaerts & Ottar Olsen, 2023; Moons et al., 2018; Wassmann et al., 2024). Sensory

studies focusing on the influence of product type, seaweed content, and flavour profile on consumer preferences would provide valuable insights (Govaerts & Ottar Olsen, 2023; Onwezen et al., 2022). For further research, the author proposes to analyse consumers' preferences for sweet or savoury seaweed-based products and identify which format is more widely accepted, while comparing to the protein in its natural form. Also, it would be beneficial to compare the acceptability of consumers to food (such as pasta, or cookies) and drinks (juice, or shake), as beverages are much less explored than food. Furthermore, a comparison of different seaweed-based formulations could help to identify which products are more associated with consumer enjoyment, thus guiding product development and enhancing the market potential of seaweed-based alternatives.

Products based on: Seaweed Protein VS Alternatives

Mellor et al. (2022) suggested that comparing seaweed to other alternative proteins in a choice-based paradigm and identifying additional traits associated with consumer acceptance is essential. Based on that, the author suggests that future research study the most common accepted seaweed-based products and change the seaweed protein for other novel-proteins (such as insects, or plant-based alternatives).

2.8.3. NEW VARIABLES AND RELATIONSHIPS

The development of novel foods products still faces challenges related to consumer acceptance and preferences. This underscores the necessity for additional research initiatives, covering other variables and examining more complex relationships (Piwowar et al., 2023). This study identified several variables that can be explored in future research.

Dependent Variable

Given the novelty of seaweed-based products, the author suggests the exploration of willingness to try and eat seaweed foods, as mentioned by Palmieri and Forleo (2022) and Wahyuningtyas et al. (2024). Weinrich and Elshiewy (2023) stated the importance of more research focused on willingness to buy and on the implementation of seaweed in daily food routines. Also, it is important to understand the gap between attitude and beliefs, before and after trying seaweed food products, as stated by Govaerts and Ottar Olsen (2023, 2024). For this reason, the author highlights the importance of comparing the consumption intention with the real consumption of seaweed, as well compare the consumption of seaweed with the consumption of other organic and seafood products.

Sociodemographic Variables

Wahyuningtyas et al. (2024) highlighted the importance of measure consumer willingness to try seaweed foods, following a more precise market segmentation, using sociodemographic factors. To gain a holistic understanding of consumer acceptance and consumption of seaweed, future studies should consider the cultural context in which food will be consumed, and the ethnicity and nationality of participants (Mellor et al., 2022; Young et al., 2022). Also, researchers could investigate the gender differences in consumption behaviour and compare their interest in healthy food, due to the dichotomy of perspectives between different authors (Weinrich & Elshiewy, 2023; Young et al., 2022). Other segmentation factors such as dietary and cooking habits, ways of cooking, self-identity values, convenience orientation, education level – highlighted by Embling et al. (2022) as a key consumer demographic for future studies – generation group, religious affiliation, and lifestyle choices that could impact consumer' food preferences and, consequently, their acceptance should be deeply analysed (Embling et al., 2022; Weinrich & Elshiewy, 2023; Govaerts & Olsen, 2024; Rombach & Dean, 2024). Future studies should also explore the motivations to consume this product in early and late consumer segments, as suggested by Moons et al. (2018).

Sensory Variables

Product-related variables were less explored than consumer-related ones. For that reason, this study believes that examine the public's acceptance of sensory features of products that include a novel ingredient is important for future studies. Also, the author suggests the study of sensory attributes, mainly the taste, of seaweed to deeply understand the product acceptance (Bahraseman et al., 2024; Wahyuningtyas et al., 2024; Wassmann et al., 2024).

Product Packaging

The non-verbal communication channels are a key topic for the consumer. Explore the impact of packaging in consumer acceptance is crucial to understand the consumer perception of these novel products. The exploration of marketing claims based on the benefits of seaweed consumption should be deeply explored, with a special attention to the credibility of health- and eco-related claims, to promote foods made with seaweed (Birch et al., 2019; Embling et al., 2024; Moons et al., 2018; Rombach & Dean, 2024).

Drivers and additional factors that impact consumer intention

This study highlights the comprehension of how the provision of nutritional and sustainability data about seaweed affect consumer acceptance, as suggested previously (Mellor et al., 2022; Moons et al., 2028; Onwezen et al., 2022). Literature also stated the importance of analysing the

health-taste conflict, due to its importance on consumer willingness to adopt novel foods (Moons et al., 2018). The food safety concerns, perceived risk, and uncertainty about product characteristics (such nutritional value, quality, and locality) should be investigated in further research (Al-Thawadi, 2018; Rombach & Dean, 2024). Also, price is a crucial variable that may influence the public's acceptance towards new products, and, for that reason, more studies should be carried out (Embling et al., 2022; Govaerts & Ottar Olsen, 2023; Wassmann et al., 2024). Wahyuningtyas et al. (2024) added that further studies should focus on consumer's allergic reactions, to provide a more comprehensive analysis of consumer behaviour. Even food disgust, food neophobia, and food technology neophobia are extensively analysed themes, they are promising avenues for future studies, aiming to help the development of promoting strategies (Bahraseman et al., 2024; Rombach & Dean, 2024; Wahyuningtyas et al., 2024; Young et al., 2022). To deeper understand consumer motivations, the author suggests the exploration of the impact of emerging trends (e.g. digital marketing, and social media) (Tunca et al., 2024), the role of supply chain, public policy actions, and public awareness (Moons et al., 2018).

2.8.4. NEW METHODOLOGIES

Most of studies (86%) on consumer acceptability of seaweed employed quantitative methodologies, specifically surveys. Despite the observed trend, the author proposes the application of **qualitative and mixed-methods studies, longitudinal studies** and the **optimisation of quantitative methods**.

Qualitative and Mixed-Methods Studies

Regarding future research, the author suggests the development of sensory tests to evaluate consumer predisposition towards seaweed while testing seaweed products, as previously proposed by numerous authors (Weinrich & Elshiewy, 2019; Palmieri et al., 2023; Rombach & Dean, 2024; Wassmann et al., 2024). Rombach and Dean (2024) emphasised the combination of product tasting, and eye-tracking to explore how sensory attributes such as taste, texture, scent, and appearance influence consumer preferences. These techniques could minimize the attitude-intention-behaviour gap by directly observing consumer decisions in real world context (ElHaffar et al., 2020), taking real choices into account (Weinrich & Elshiewy, 2019). Furthermore, the integration of qualitative and mixed-method research focusing on social media reporting could facilitate the investigation of online word-of-mouth and loyalty towards seaweed products (Rombach & Dean, 2024). The use of experimental design involving different levels of

environmental impact of seaweed could be used to measure the perception of consumer towards seaweed-based products (Onwezen et al., 2022). The author also recommends the use of focus group to deeply understand consumer motivations and barriers towards seaweed, a technique emphasised by Tunca et al. (2024), who also highlighted the qualitative methods to understand the impact of emerging trends, such as digital marketing and social media. Additionally, in-depth interviews, media content analysis, and the analysis of online conversations, as suggested by Rombach et al. (2024), could provide deeper insights into consumer behaviour. Finally, the author proposes the implementation of projective techniques or focus groups, as advocated by Birch et al. (2019), to elicit top-of-mind associations, assess the effectiveness of new products, and evaluate packaging concepts and marketing claims. Due to all future research directions cited by the literature, the author believes that adopting a mixed-methods approach has been demonstrated to enhance the rigour of research findings, thereby ensuring greater relevance for both academic and practical implications.

Longitudinal Studies

Brayden et al. (2018), Onwezen et al. (2022), and Tunca et. al, (2024) suggested longitudinal studies to explore consumer behaviour towards alternative proteins over time. Based on that, this study suggests that further research should track consumer attitudes and behaviours towards seaweed foods. In fact, longitudinal research would provide deeper insights into the factors that support or hinder long-term adoption, by analysing the same cause – effect relation between different variables. It would be interesting to analyse how much time the consumers need to accept seaweed, and deeply analyse the variables that influence their behaviour. Also, such studies could identify critical moments, or life events that significantly influence consumer's choices, providing valuable guidance for the novel foods market.

Optimize Quantitative Studies

Given the expensiveness associated with evaluating novel foods prior to their commercial release, qualitative methodologies can be replaced by quantitative ones - to quantify the responses obtained and related the different variables. For this reason, several authors recommended using a quantitative approach (Brayden et al., 2018; Embling et al., 2022; Franco et al., 2021; Moss & McSweeney, 2021; Young et al., 2022; Rombach et al., 2024). If the implementation of alternative methods is prohibitively costly in terms of financial and temporal resources, the author recommends the optimisation of quantitative studies. The use of experimental tests to measure quantitative changes in consumer acceptance of both fortified and non-fortified food formulations, as highlighted by Embling et al. (2024), could be an interesting further research

direction. Exploring the commitment of consumer to eat specific seaweed products across different countries and among diverse consumer groups is essential (Govaerts & Olsen, 2024; Rombach et al., 2024). Furthermore, subsequent studies should be meticulous in the selection of their study population. Wassmann et al. (2024) referred that the studies should exclude participants who may not provide meaningful response, given the absence of a distinction between individuals who have heard about seaweed and those who have not in this study. Consequently, the author proposes that future studies should focus more intently on specific populations to yield more direct and precise answers. For example, studying only the consumption behaviour of individuals who, even if they are not familiar with seaweed, consider eating it; or to understand the barriers and the consumption behaviour of the sceptical individuals that, consequently, are less likely to consume seaweed products.

The SLR synthesized the existing knowledge on the factors that influence food consumption of seaweed, identifying some of the future research directions. In fact, the gaps and inconsistencies found in the literature emphasises the need for a more robust and adapted theoretical model, in order to understand the consumption intentions of seaweed-based foods in the Portuguese context.

Based on the gaps identified, the following chapter proposes a conceptual model of analysis that investigate the intention to consume seaweed-based foods by Portuguese individuals. This model is based on the TPB, extended with food neophobia and food disgust – two of the barriers identified –, food-related lifestyle dimensions, and sociodemographic factors. The proposed model seeks to offer a more comprehensive understanding of consumption intention in this emerging market niche.

3. CONCEPTUAL MODEL OF ANALYSIS AND RESEARCH HYPOTHESES

After presenting the theoretical framework that supports the research problem, this chapter aims to illustrate it, by proposing the conceptual model of analysis. Since this study is based on a deductive approach, it was necessary to develop a research strategy, drawn on the extended version of TPB. In this sense, the hypotheses are initially presented, clearly mapping the relationship between the studied variables (Robson & McCartan, 2016). **Table 8** reminds the objectives of this research.

Table 8

General and specific objectives of this research.

General Objective	Explore Portuguese' intention to consume seaweed products, while develop their profile
Specific Objective 1	Analyse the effect of consumers' attitude, subjective norms, and perceived behavioural control on intention to consume seaweed products.
Specific Objective 2	Analyse the effect of consumers' food neophobia, and food disgust on their attitude towards seaweed products and on their intention to consume them.
Specific Objective 3	Analyse the effect of consumers' food-related lifestyle on their attitude, subjective norms, perceived behaviour control, and intention to consume seaweed products, and food neophobia.
Specific Objective 4	Measure consumers' willingness to eat and pay for specific seaweed-based food products.
Specific Objective 5	Analyse the differences across sociodemographic groups (age, gender, education, income level, and distance from the sea) in relation to the Theory of Planned Behaviour variables, intention to consume, food neophobia, and food disgust.
Specific Objective 6	Identify the profile (key sociodemographic, psychological, and behavioural characteristics) of Portuguese seaweed product consumers.

3.1. DEVELOPMENT OF THE CONCEPTUAL MODEL OF ANALYSIS

As the author did not find any study that analysed the intention to consume seaweed products in Portugal, this research aims to provide pioneering results, based on the TPB – developed by Icek Ajzen in 1985 – a widely used theoretical framework for consumer studies. This theory aims to predict the consumer's intention to perform an act based on their behavioural, normative, and control beliefs (Ajzen, 1991). Its application allows the author the analysis of how each dimension (attitude, subjective norms, and perceived behavioural control) relates to intention to consume seaweed-based products. Furthermore, the utilisation of TPB enhances academic rigour and provides predictive insights into consumer purchase behaviour across seaweed products (Tunca et al., 2024).

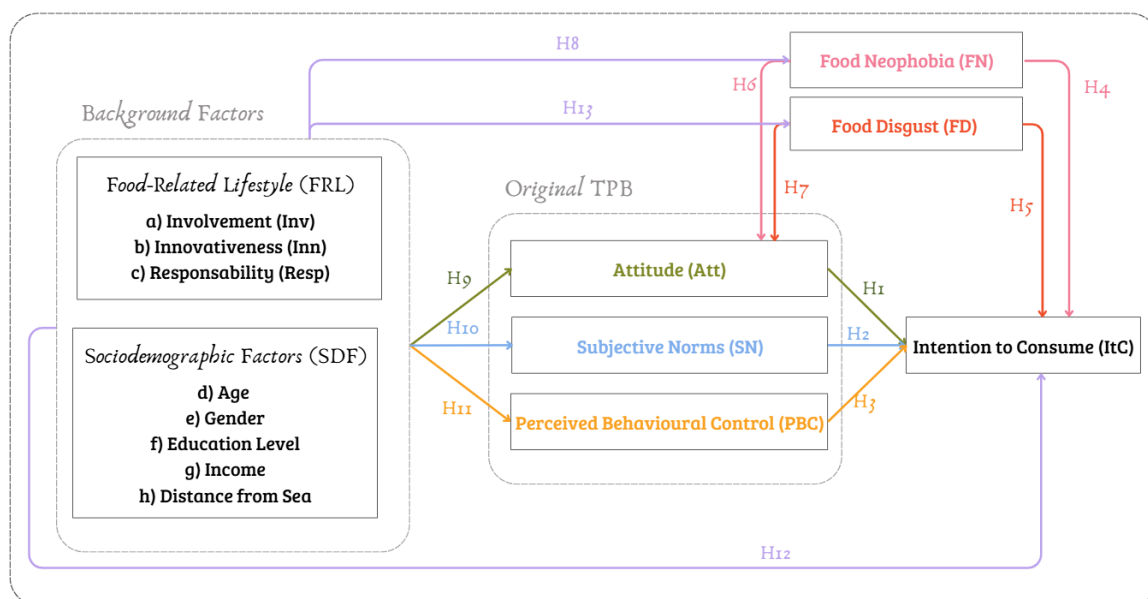
Bahraseman et al. (2025) and Tunca et al. (2024) pointed out that the original TPB may not capsule all factors that influence the individual's adoption of novel foods, such as seaweed. For this reason, the author extended the TPB, adding new constructs that are supported by the literature. The new dimensions selected were the food neophobia and food disgust.

Moreover, the author added the food-related lifestyle construct (that can be divided into food involvement, innovativeness, and responsibility) to enrich the research and analyse its impact on the early mentioned variables. This construct combines cognitive aspects, behaviours, and core life values related to how individuals perceive food and drink and helps to shape food-related attitudes and behaviours (Tunca et al., 2024; Wahyuningtyas et al., 2024).

Finally, the literature refers that understanding sociodemographic variations is crucial when analysing consumer behaviour towards seaweed products, as it revealed conflicting findings that highlight the complexity of this market. Thus, this study pretends to analyse the impact of a range of sociodemographic factors on intention to consume seaweed products (Embling et al., 2022; Govaerts & Olsen, 2024; Mellor et al., 2022; Rombach & Dean, 2024; Wahyuningtyas et al., 2024).

From this standpoint, the conceptual model of analysis is illustrated on **Figure 2**, with its structure based on the dimensions of the TPB (**Att**; **SN**; **PBC**; **ItC**) and their added dimensions (**FN**; **FD**; **Inv**; **Inn**; **Res**; **SDF**).

Figure 2
Conceptual model of analysis.



On the next section, the author presents the selected scales used to measure the dimensions that compose the conceptual model of analysis developed.

3.1.1. SCALE | THEORY OF PLANNED BEHAVIOUR

Table 9 presents the items used to measure the three dimensions of TPB.

Table 9

Items, code, and author of scale used to measure TPB constructs.

Code	Items	Author
<i>Attitude (Att)</i>		Bahraseman et al. (2025)
Att1	I believe that consuming algae or algae-based foods is a good idea.	
Att2	I believe that consuming algae or algae-based foods is beneficial.	
Att3	I am interested in eating algae or algae-based foods.	
Att4	In my opinion, consuming algae or algae-based foods is reasonable.	
<i>Subjective norms (SN)</i>		
SN1	Individuals whose opinions matter to me have endorsed the consumption of algae or algae-based foods.	
SN2	My friends and relatives endorse the consumption of algae or algae-based foods.	
SN3	Individuals whom I respect endorse the use of algae or algae-based foods.	
SN4	Most individuals who are important to me urge me to consume algae or algae-based foods.	
<i>Perceived behavioural control (PBC)</i>		
PBC1	I am confident that I can consume algae or algae-based foods if I choose to.	
PBC2	Whether I consume algae or algae-based foods is entirely up to me.	
PBC3	Consuming algae or algae-based foods is easy for me.	

The measurement scale for TPB' constructs were based on the research of Bahraseman et al. (2025), published in the current year on *Appetite* journal. This study opted for this scale because the questions were directly related to the context of seaweed as a novel food, ensuring that all of them were contextually relevant for the study's aim and for the respondents. To measure the items, this research used a 5-point Likert scale, where 5 means "totally agree" and 1 means "totally disagree".

Att' construct used a 4 items scale, drawn from the study conducted by Bryant et al. (2019), Dupont and Fiebelkorn (2020), and Onwezen et al. (2021). In addition, this scale had a Cronbach's α of 0,930 – which indicates a high internal consistency; a composite reliability of 0,950 – reflecting the reliability of the construct; and an average variance extracted (AVE) of 0,827 – suggesting a strong level of convergent validity.

The 4 items scale used to measure SN' construct belongs to Bahraseman et al. (2025), that drawn it based on Chang et al. (2019), and Menozzi et al. (2017). The original scale demonstrated to have robust reliability, and validity metrics, with a Cronbach's α of 0,870, a composite reliability of 0,912 and an AVE of 0,721.

The scale used to measure PBC is from Bahraseman et al. (2025), that drawn it based on Menozzi et al. (2017), and Thu Thu Aung et al. (2023). The scale showed a moderated validity with a Cronbach's α of 0,672, a composite reliability of 0,816, and an AVE of 0,600.

3.1.2. SCALE | INTENTION TO CONSUME

Table 10 presents the items used to measure the intention to consume construct.

Table 10

Items, code, and author of scale used to measure intention to consume.

<i>Intention to consume (ItC)</i>		
Code	Items	Author
ItC1	I will consume algae or algae-based foods.	Bahraseman et al. (2025)
ItC2	I will make an effort to consume algae or algae-based foods.	
ItC3	I recommend others to use algae or algae-based foods.	

The scale used to measure ItC is from Bahraseman et al. (2025), that used the studies of Boccia and Tohidi (2024), Liu et al. (2020), Thu Thu Aung et al. (2023), and Yadav and Pathak (2016) to construct it. To ensure consistency and theoretical alignment, the author opted to use this scale, also developed by the same authors as the TPB. In fact, using scales from the same authors helps to maintain the measurement reliability and validity across the constructs to be tested. In addition, the items share similar wording, structure, and contextual relevance (specific case of seaweed consumption) for the study. The scale demonstrated a high validity with a Cronbach's α of 0,866, a composite reliability of 0,918, and an AVE of 0,790. The author used the 5-point Likert scale (5 – “totally agree”; 1 – “totally disagree”).

3.1.3. SCALE | FOOD NEOPHOBIA

Table 11 presents the items used to measure food neophobia' construct.

Table 11

Items, code, and author of scale used to measure food neophobia.

<i>Food neophobia (FN)</i>		
Code	Items	Author
FN1	I am constantly sampling new and different foods. (R)	Al-Thawadi (2018); Michel et al. (2021); Palmieri & Forleo (2022); Pliner & Hobden (1992)
FN2	I don't trust new foods.	
FN3	If I don't know what is in a food, I won't try it.	
FN4	I like foods from different countries. (R)	
FN5	Ethnic food looks too weird to eat.	
FN6	At dinner parties, I will try a new food. (R)	
FN7	I am afraid to eat things I have never had before.	
FN8	I am very particular about the foods I will eat.	
FN9	I will eat almost anything. (R)	
FN10	I like to try new ethnic restaurants. (R)	

The author selected the 10 items Food Neophobia Scale, an also known scale developed by Pliner and Hobden (1992). Resulting from the SLR, the author concluded that this is the most used scale to measure individual's food neophobia, with items that evaluate their reluctance towards new foods – not necessarily seaweed. Half of the scale is composed by

items that need to be reversed to be correctly analysed (as is the case of: FN1, FN4, FN6, FN9, FN10). In addition, this scale had a Cronbach's α of 0,857 – which indicates a high internal consistency. In consonance with the previously type of scaling, this research used a 5-point Likert scale, where 5 means “totally agree” and 1 means “totally disagree”.

3.1.4. SCALE | FOOD DISGUST

Table 12 presents the items used to measure the food disgust' construct.

Table 12

Items, code, and author of scale used to measure food disgust.

<i>Food disgust (FD)</i>		
Code	Items	Author
FD1	The thought of consuming algae or algae-based foods is repulsive to me.	Bahraseman et al., 2025)
FD2	Algae or algae-based foods have an unpleasant odour that deters me from trying them.	
FD3	The appearance of algae or algae-based foods gives me a bad feeling.	
FD4	I avoid algae or algae-based foods that have a strong and unfamiliar taste.	
FD5	The idea of consuming algae or algae-based foods it is unpleasant for me and makes me feel nauseous.	
FD6	The slimy and slippery texture of algae or algae-based foods is extremely undesirable for me, and I feel I cannot swallow it.	
FD7	I find algae or algae-based foods to be disgusting and unappetizing.	

The selected scale for measure FD was developed by Bahraseman et al. (2025), drawn from Bryant et al. (2019), Dupont and Fiebelkorn (2020), and Siegrist and Hartmann (2020). This scale had a Cronbach's α of 0,930 – which indicates a high internal consistency; a composite reliability of 0,943 – reflecting the reliability of the construct; and an AVE of 0,704 – suggesting a strong level of convergent validity. For measure the items, the author used a 5-point Likert scale, where 5 means “totally disgusting” and 1 means “nothing disgusting”.

3.1.5. SCALE | FOOD-RELATED LIFESTYLE

Table 13 presents the items used to measure food-related lifestyle (FRL) dimensions.

Table 13

Items, code, and author of scale used to measure FRL.

Code	Items	Author
<i>Involvement (Inv)</i>		Brunso et al. (2021)
Inv1	I just love good food.	
Inv2	Eating and drinking are a continuous source of joy for me.	
Inv3	Decisions on what to eat and drink are very important for me.	
Inv4	Food and drink are an important part of my life.	
Inv5	Eating and food is an important part of my social life.	
<i>Innovativeness (Inn)</i>		
Inn1	I like to try new foods that I have never tasted before.	
Inn2	I love to try recipes from different countries.	
Inn3	Recipes and articles on food from other culinary traditions encourage me to experiment in the kitchen.	
Inn4	I like to try out new recipes.	
Inn5	I look for ways to prepare unusual meals.	
Inn5	I look for ways to prepare unusual meals.	
<i>Responsibility(Res)</i>		
Res1	I try to choose food produced with minimal impact on the environment.	
Res2	I am concerned about the conditions under which the food I buy is produced.	
Res3	It is important to understand the environmental impact of our eating habits.	
Res4	I try to choose food that is produced sustainably.	
Res5	I try to buy organically produced foods if possible.	

The scale that measured FRL construct was authored by Brunso et al. (2021). For all the constructs, the author used the 5-point Likert scale to measure the items, with 5 meaning “totally agree” and 1 “totally disagree”.

3.2. HYPOTHESES FORMULATION

Once the conceptual model of analysis was developed and the respective scales have been exposed, the following step is the formulation of hypotheses, to respond to the outlined specific objectives. Moreover, the hypotheses formulation must be clear and based on literature to ensure scientific validity, guide research design, and align with existence knowledge (Mooi & Sarstedt, 2014). A resume of the hypotheses that were tested is presented on **Appendix D**.

Hypothesis 1 (+)

Positive consumer's attitude (Att) significantly influences their intention to consume (ItC) seaweed products.

Attitude (Att) is a crucial factor in influencing consumer behaviour and purchasing decisions, especially when it comes to novel or unfamiliar food products (Al-Thawadi, 2018; Bahraseman et al., 2025; Wahyuningtyas et al., 2024). Bahraseman et al. (2025) found that consumer's positive attitudes towards consuming seaweed foods directly influence their intention to consume these foods. These authors found that a positive attitude could play a significant role in encouraging the acceptance and adoption of seaweed products. Therefore, due to the influence mentioned, the current study tested the **H1(+)**.

Hypothesis 2 (+)

Positive consumer's subjective norms (SN) significantly influence their intention to consume (ItC) seaweed products.

Subjective norms (SN) are the perceived social pressures or influences that encourage or discourage specific behaviours (Al-Thawadi, 2018; Bahraseman et al., 2025; Tunca et al., 2024; Wahyuningtyas et al., 2024). According to Bahraseman et al. (2025), SN play a stronger role in the intention to consume seaweed products when mediated by moral norms. However, based in other authors, consumer's SN towards consuming seaweed products can strongly and directly affect their behavioural intention and willingness to try them (Al-Thawadi, 2018; Wahyuningtyas et al., 2024). Based on that, this study intended to confirm **H2(+)**.

Hypothesis 3 (+)

Positive consumer's perceived behavioural control (PBC) significantly influences their intention to consume (ItC) seaweed products.

PBC is a key factor that determines the intention to consume seaweed foods (Bahraseman et al., 2025; Tunca et al., 2024). According to Bahraseman et al. (2025), PBC has a meaningful impact on consumer's intention, which means that consumers have a higher

intention or willingness to consume these products if they feel capable of accessing and consuming seaweed products. Contradicting this scenario, Tunca et al. (2024) found that PBC does not significantly impact behavioural intention, which means that it may not be a pivotal factor for aquaculture products. However, these authors stated that a high level of consumer's PBC is crucial to improve their intentions to engage in a specific behaviour. For that reason, the author of this study formulated **H3(+)**.

<i>Hypothesis 4 (-)</i>
Consumer's food neophobia (FN) negative and significantly influences their intention to consume (ItC) seaweed products.
<i>Hypothesis 6 (-)</i>
Consumer's food neophobia (FN) negative and significantly influences their attitude (Att) towards seaweed products.

The integration of FN in behavioural models is imperative for the identification and overcoming of barriers to the adoption of aquaculture products such as seaweed (Tunca et al., 2024). FN is a personality trait defined by the aversion to try new and unfamiliar foods. It has a significant negative impact on the acceptance and success of novel foods and, therefore, most the studies characterise this variable as a consumer barrier to the seaweed consumption (Embling et al., 2022; Losada-Lopez et al., 2021; Michel et al., 2021; Onwezen et al., 2022; Palmieri et al., 2023; Palmieri & Forleo, 2020; Wassmann et al. 2024). Bahraseman et al. (2025) contradicted this scenario, explaining that FN does not present a significant influence in the consumption of seaweed foods, in the Iranian context, likely due to the country's rich history of trade and cultural exchanges. Inspired by the mentioned findings, the author pretends to test the influence of FN on consumer's intention to consume seaweed products (**H4(-)**) and on consumer's attitudes towards these products (**H6(-)**).

<i>Hypothesis 5 (-)</i>
Consumer's food disgust (FD) negative and significantly influences their attitude (Att) towards seaweed products.
<i>Hypothesis 7 (-)</i>
Consumer's food disgust (FN) negative and significantly influences their attitude (Att) towards seaweed products.

FD impacts significantly and negatively the individual's attitudes, and intentions towards seaweed, which can reflect a deep-rooted psychological barrier that stems from unfamiliarity and cultural biases (Bahraseman et al., 2025). This study found that the direct effect of FD on intention to consume seaweed foods is greater than its indirect effect through attitude towards these foods. For this reason, the author developed **H5(-)** and **H7(-)** to be tested.

<i>Hypothesis 8 (a-c) (+)</i>
Consumer's involvement (Inv), innovativeness (Inn), and responsibility (Res) with foods and drinks significantly influence their food neophobia (FN) level.
<i>Hypothesis 9 (a-c) (+)</i>
Consumer's involvement (Inv), innovativeness (Inn), and responsibility (Res) with foods and drinks significantly influence their attitudes (Att) towards seaweed products.
<i>Hypothesis 10 (a-c) (+)</i>
Consumer's involvement (Inv), innovativeness (Inn), and responsibility (Res) with foods and drinks significantly influence their subjective norms (SN) towards seaweed products.
<i>Hypothesis 11 (a-c) (+)</i>
Consumer's involvement (Inv), innovativeness (Inn), and responsibility (Res) with foods and drinks significantly influence their perceived behavioural control (PBC) towards seaweed products.
<i>Hypothesis 13 (a-c)</i>
Consumer's involvement (Inv), innovativeness (Inn), and responsibility (Res) with foods and drinks significantly influence intention to consume seaweed products.

FRL construct helps to shape food-related attitudes and behaviours and can be divided into food involvement (Inv), food innovativeness (Inn), and food responsibility (Res) (Wahyuningtyas et al., 2024). The mentioned authors concluded that FRL had a significant positive effect on attitude towards seaweed-based food. Tunca et al. (2024) also studied this construct and concluded that they were significant predictors towards consumers' attitudes, subjective norms, perceived behaviour control, and food neophobia. Consumers with a higher involvement and a stronger sense of responsibility regarding food-related behaviours are more likely to develop positive attitudes and perceptions towards seaweed food (Birch et al., 2019; Onwezen et al., 2022; Tunca et al., 2024; Wahyuningtyas et al., 2024). Govaerts and Olsen (2024) added that a high level of food innovativeness is related with a higher level of interest, curiosity, and, consequently, knowledge about seaweed. In addition, Weinrich and Elshiewy (2023) found that the target group for seaweed products prefers a healthy lifestyle, is open to try new food and recipes, and is characterized by vegetarian or low meat consumption. In conclusion, FRL framework identifies responsibility, food involvement, and food innovation as the key drivers of sustainable consumption (Tunca et al., 2024), and due to that, the author elaborated **H8-H11(a-c)(+)** to be tested. Moreover, due to the previously findings that related consumer's innovation sense and environmental concerns with intention to consume (Birch et al., 2019; Mellor et al., 2022; Palmieri et al., 2023; Rombach & Dean, 2024; Young et al., 2022), and due to the indirect relation between FRL and intention to consume seaweed products, the author propose an exploratory hypotheses to be tested (**H13(a-c)**).

<i>Hypothesis 8 (d-h)</i>
There are sociodemographic differences (age, gender, education, income, and distance from sea) in consumer's food neophobia (FN) towards seaweed products.
<i>Hypothesis 9 (d-h)</i>
There are sociodemographic differences (age, gender, education, income, and distance from sea) in consumer's attitude (Att) towards seaweed products.
<i>Hypothesis 10 (d-h)</i>
There are sociodemographic differences (age, gender, education, income, and distance from sea) in consumer's subjective norms (SN) towards seaweed products.
<i>Hypothesis 11 (d-h)</i>
There are sociodemographic differences (age, gender, education, income, and distance from sea) in consumer's perceived behavioural control (PBC) towards seaweed products.
<i>Hypothesis 12 (d-h)</i>
There are sociodemographic differences (age, gender, education, income, and distance from sea) in consumer's food disgust (FD) towards seaweed products.
<i>Hypothesis 13 (d-h)</i>
There are sociodemographic differences (age, gender, education, income, and distance from sea) in consumer's intention to consume seaweed products.

Understanding sociodemographic variations is crucial when analysing consumer behaviour towards seaweed, as the literature revealed conflicting findings that highlight the complexity of this market. Many authors suggest further studies to comparing cultural, and sociodemographic variables (Embling et al., 2022; Govaerts & Olsen, 2024; Mellor et al., 2022; Moons et al., 2018; Rombach & Dean, 2024; Wahyuningtyas et al., 2024; Young et al., 2022). While Embling et al. (2022) reported that age, gender, and nationality had no significant effect on consumers' perception of seaweed products, other authors identified these factors as key influencers (Piwowar et al., 2023; Tunca et al., 2024). The last authors also noticed that the geographical proximity to the sea may shape food-related behaviours and openness to marine foods. Age has been frequently associated with food neophobia, with older individuals showing higher levels of reluctance towards trying novel foods (Embling et al., 2022; S. Lucas et al., 2019; Michel et al., 2021; Palmieri et al., 2023). The education level, and income, are other relevant factors that affect consumer's attitude, perception, and willingness to try seaweed foods. For example, individuals with a higher educational level and a higher income, show a higher likelihood of accepting seaweed and are more willing to try these products (Birch et al., 2019; S. Lucas et al., 2019; Moons et al., 2018). Thus, the integration of sociodemographic characteristics aims to provide essential guidance for segmenting the market and designing targeted marketing strategies. By analysing the differences of means in the groups of the selected variables, the author developed the **H8-H12(d-h)**.

4. RESEARCH METHODOLOGY

Upon the completion of the literature review and illustration of the conceptual model of analysis, which is essential for the interpretation of the research problem, the justification, and orientation of the empirical work is presented below (Dubey & Kothari, 2022).

4.1. JUSTIFICATION OF THE METHOD

It is acknowledged that the most efficient approach to obtain answers to the questions previously identified, is the utilisation of a **quantitative methodology** with a **quantitative data collection technique** (Bell et al., 2018; Robson & McCartan, 2016; Saunders et al., 2009).

As mentioned before, most studies regarding consumer acceptance of seaweed utilised a quantitative methodology with data collected by survey. For this reason, few reviews suggested that future research could use qualitative methods (Mosikyan et al., 2024; Onwezen et al., 2021) to capture another type of results (related with the exploratory nature of the qualitative methods). Hunter and Gibson (2021) added that using qualitative techniques in novel research questions – such this one – enrich the results of the investigation.

However, given the expensiveness associated with evaluating novel foods prior to their commercial release, qualitative methodologies can be replaced by quantitative ones (Brayden et al., 2018; Embling et al., 2022; Moss & McSweeney, 2021). Furthermore, to assess the motivations and barriers, beliefs, and perceptions of individuals towards seaweed foods, the literature considers pertinent to develop questionnaire surveys, with the goal of quantifying the responses obtained, and establish relationship between the different variables (Embling et al., 2022; Franco et al., 2021; Young et al., 2022). For this reason, several authors recommended the use of a quantitative approach.

In fact, the quantitative methodology facilitates the attainment of objective results, thereby enabling the deduction of events and the quantification of phenomena (given its deductive approach) (Bell et al., 2018; Brannen, 2017; Mooi & Sarstedt, 2014). Moreover, the specific objectives formulated in this research require quantitative methods to answer them correctly. For all the aforementioned reasons, this dissertation used the quantitative methodology.

4.2. DATA COLLECTION TECHNIQUE

Following the selection of the most appropriate methodology for this study, the subsequent step aims to expose the technique used for data collection (Saunders et al., 2009).

The selected data collection technique was the online **questionnaire**, with the aim to measure the specific objectives 1 to 6 and, consequently, explore the Portuguese consumers' intention to consume seaweed products, while developing their profile. Questionnaires are commonly used in deductive studies, which allow for the collection of quantitative data, allowing the analysis and measurement of trends, attitudes, and opinions of the respondents, by examining a sample of the chosen population (Creswell, 2009; Saunders et al., 2009). These previous authors also mention that although the data may be affected by the characteristics of the respondents (e.g., through personality, motivations, or experiences), and although they may not answer honestly, the use of the questionnaire allows data to be collected simply, quickly, and without any associated monetary costs.

According to Taherdoost (2022), the questionnaire's questions are a translation of the researcher's informational need for their study, which can be addressed through respondents' answers - making the data collection process both standardized and comparable. For that reason, questionnaire's structure needs to be carefully designed. Questionnaires must be easy for the reader to comprehend, with no ambiguous questions, ensuring all of them are straightforward and interpreted as intended (Robson & McCartan, 2016). In this way, the data collection technique of this research required the preparation of a structured questionnaire based on the existing literature, directing all the questions to answer the proposed specific objectives.

4.2.1. PRE-TEST

Pre-testing a questionnaire is fundamental to optimize its quality and minimize errors by obtaining feedback on its construction. For designing an effective questionnaire, it is crucial to ensure that the content, appearance, and usage of the questionnaire are all addressed. If not, it can result in the study yielding inappropriate and biased findings (Mooi & Sarstedt, 2014; Taherdoost, 2022). For that reason, before the publication of the questionnaire, the author carried out a pre-test on a small sample, whose characteristics were similar to the target population.

This pre-test took place between 13th and 16th of March 2025 and was carried out on 8 Portuguese people over the age of 18, with half of the sample being female and the other half male. The time taken to complete the survey was recorded, as well as the questions that respondents hesitated to answer. Respondents were invited to offer their feedback and propose improvements to enhance its clarity and reduce future respondents' fatigue. Then, based on the feedback received, the questionnaire was revised.

Overall, the early participants found the questionnaire to be clear, straightforward, and easy to complete, with a logical, and concise structure. On average, the questionnaire takes around 11 minutes to complete, with half of the respondents completing it in 8 minutes, suggesting this might be a common completion time. After analysing the received feedback, adjustments were made. Due to the confusion caused by some terms used (such as “ethnic restaurants”), the language was adjusted to be more informal. In addition, there was a need to introduce the questions related with the subjective norms, since most people showed difficulty in understanding what the questions meant. These changes aimed to provide a better context for respondents, and to adopt a more informal and approachable tone.

4.2.2. QUESTIONNAIRE STRUCTURE

The questionnaire is composed by close-ended questions, which are highly beneficial in self-administered surveys because they simplify the response process, minimize the need for assistance, and facilitate the collection of data by providing structured answer options (Taherdoost, 2022). Due to the variety of topics in the questionnaire, it is composed by 6 sections, with questions moving from general (food and drink themes) to specific topics (seaweed products themes) (Mooi & Sarstedt, 2014). It was presented in Portuguese, due to the analysis being conducted on Portuguese individuals. Each section of the questionnaire is explained below. A sample of the questionnaire is presented on **Appendix E**.

Section 1 | Introduction and Request for Consent

The questionnaire starts with a short introduction about the purpose of the study, the estimated duration, and the permission for the anonymous and confidential data collection, in accordance with the General Data Protection Regulation. The author's contact details were available for participants who wanted additional information.

Section 2 | Respondent Profile

As the study was aimed to Portuguese citizens aged 18 or over, a filter question was asked. Only those who fit this condition continued. If the participants did not fit the profile (not Portuguese or under 18), the questionnaire was stopped.

Section 3 | Food Behaviour and Preferences | Q1 – Q4

On Section 3, the respondents were asked about their behaviour and food preferences in general, including consumption habits, nutritional choices, and factors that influence their diet. The author aimed to analyse the FRL variables (Q1 – involvement; Q2 – innovativeness; Q3 – responsibility) and food neophobia (Q4). The respondent selected their degree of agreement with the statements, using the 5-point Likert Scale (1 – strongly disagree | 2 – disagree | 3 – neither agree nor disagree | 4 – agree | 5 – strongly agree). To measure FRL, it was used the scale from by Brunsø et al. (2021), while the questions regarding food neophobia were posed using a well-known Food Neophobia Scale from Pliner and Hobden (1992).

Section 4 | Seaweed or Seaweed-Based Products | Q5-Q9

Section 4' questions were about the respondent's behaviour and preferences towards seaweed or products derived from it, including consumption habits, perception, and factors that influence their choice. All the questions refer to the specific case of seaweed as food. The author aimed to analyse the attitude (Q5), subjective norms (Q6), perceived behavioural control (Q7), food disgust (Q8), and intention to consume (Q9). In all questions, the respondents were asked to select their degree of agreement using the 5-point Likert Scale (1 – strongly disagree | 2 – disagree | 3 – neither agree nor disagree | 4 – agree | 5 – strongly agree), except in Q8 where the respondents should select their degree of disgusting towards the presented propositions (1 – not at all disgusting | 2 – not very disgusting | 3 – moderately disgusting | 4 – quite disgusting | 5 – extremely disgusting). The scale used to measure Q5 to Q9 were developed by Bahraseman et al. (2025).

Section 5 | Respondents Preferences Towards Seaweed-Based Products | Q10-Q13

Section 5 focused on the analysis of seaweed-based foods that had been consumed by respondents and their willingness to consume the presented choices. The price and origin of the product were the constructs analysed. In Q10 respondents were asked to indicate which seaweed-based products they had already consumed and in Q11 to indicate their degree of agreement regarding their willingness to consume the selected seaweed products. Q12 and Q13 concern, respectively, about the price that respondents were willing to pay for the seaweed products presented, and their preferences among their origin. These questions were drawn from the research conducted by Brayden et al. (2018). In relation to the product's origin, the last authors

defined as *imported* a seaweed product that was harvested and processed in a country outside of the country in analyse. The products chosen in Q10, Q11, and Q12 are the seaweed products available in the two major Portuguese supermarkets (Continente and Pingo Doce) on 03rd March of 2025. The selection of these supermarkets was based on their leading positions in the Portuguese retail market. In fact, both supermarkets are among the most trusted and well-known by the Portuguese consumers. As explored in a market study by *Kantar Worldpanel*, Continente leads the market share of food retail sector (27%), followed by Pingo Doce (21,2%) (Cardoso & Lima, 2024). Also, according to the *Superbrands Portugal*, these are the two brands with the highest brand referencing in the *2025 Consumer Study*, that evaluate brand according to *notoriety, uniqueness, trust, identification, and satisfaction of needs* (Freire, 2025). The significant representation of both supermarkets in the food retail sector justifies their selection as primary sources for analysing the availability and price of seaweed products. The price ranges mentioned on the questionnaire were calculated by averaging the products price from both supermarkets (more details on **Appendix F**).

Section 6 | Sociodemographic Data Collection

Lastly, the author focused on the collection of sociodemographic information of the respondents. The age, gender, level of education completed, household size, distance from sea, type of diet, and individual net annual income were the variables selected.

4.2.1. DISSEMINATION OF THE QUESTIONNAIRE

The questionnaire was available for 10 weeks since 17th March of 2025. It was developed on *Google Forms*, a platform that allows the personalization of its appearance, making it more interactive and visual appealing to the reader (Creswell & Creswell, 2018). The questionnaire was disseminated via *link* on online platforms (WhatsApp, Facebook, Instagram, and LinkedIn), due to the convenience and ease to collect data through these channels (Ong et al., 2023). Respondents were encouraged to share it with their network. Additionally, a leaflet with the survey's QR Code (**Appendix G**) was distributed in physical locations such as coffee shops, herbalist shops, libraries, and universities.

4.3. POPULATION AND SAMPLE

A population is defined as the set of individuals with one or more common characteristics previously defined (Saunders et al., 2009). According to Robson and McCartan (2016), a sample is a selection from the population. Thus, considering the purpose of the research, the sample selected for this study were **Portuguese individuals over 18 years old**.

It is uncommon to be able to deal with the entire population in a survey, which is why the use of sampling becomes imperative. In this study, it was used a **non-probabilistic convenience** sampling. This widely used method of sampling consists in choosing the most convenient individuals to act as respondents, knowing that the probability of the inclusion in the sample of each respondent is unknown. For that reason, it is not possible to generalise the results, and assume that the data collected could be common to the whole population (Robson & McCartan, 2016).

The quality of the research depends partly on the **sample size**, due to its effect on statistical tests (Jr. et al., 2014). However, Mooi and Sarstedt (2014) refers that the strength of the sample often depends more on its selection than its size. While some studies indicate that each variable analysed should have between 15 and 20 observations, Jr. et al. (2014) stated that, at least, each variable should have 5 observations. In total, this research has 9 variables and 46 items to measure, meaning that the ideal sample size should be between 920 (20 observations $\times$ 46 items) and 690 (15 observations $\times$ 46 items). Nevertheless, it was not possible to fulfil this ideal requirement, but the minimum required was met (230 observations = 5 minimum observations $\times$ 46 items). In fact, the sample size of this research was 400 observations, 391 of which were validated (9 were eliminated due to the previously defined criteria).

4.4. DATA TREATMENT

To determine the most suitable statistical tests for this research, it was essential to consider the design of the conceptual model of analysis, and its hypotheses. The sample size exceeded 30 respondents, so the normality of the variable distributions was assumed, based on the Central Limit Theorem (CLT) (Marôco, 2021; Mooi & Sarstedt, 2014; Pestana & Gageiro, 2014). Accordingly, and since the distribution approximated normality, parametric tests were employed. It is important to note that, as the sample is not representative of the whole population (non-probabilistic convenience sampling), the significant level for rejecting or accepting the null hypotheses was $\alpha \leq 0,05$ (Mooi & Sarstedt, 2014).

In order to explore the dimensionality and validity of the scales, exploratory factor analyses were developed for all the constructs (Mooi & Sarstedt, 2014). Afterwards, a descriptive analysis was performed to summarise the main characteristics of the data collected (**specific objective 4** was analysed by the descriptive analysis of the questions in Section 5).

With the aim of testing the hypotheses and respond to **specific objectives 1, 2, 3, 5, and 6**, the author carried out different statistical tests (summarised on **Appendix H**), using the statistical software *SPSS Statistics vs29*. To analyse **specific objectives 1, 2, 3, and 6**, 6 Multiple Linear Regression Models (MLRM) were developed, to measure the relationship and effects between a dependent variable and two or more independent variables (Robson & McCartan, 2016). In addition, to analyse **specific objective 5** and **6**, an Independent T-Test and a One-Way ANOVA Tests were developed. The Independent T-Test was carried out to compare the means of two independent groups in order to determine if there are statistical and significant differences between them. Finally, 4 One-Way ANOVA Tests were developed to compare the means of three or more independent groups in order to determine if there are statistical and significant differences among them (Robson & McCartan, 2016).

As the methodology framework has been defined, and the statistical tests had been rigorously chosen to respond to the specific objectives, the following chapter focus on the practical application of these tools, and validating the conceptual model and its research hypotheses.

5. ANALYSIS OF RESULTS

This chapter aims to present, and analyse the results obtained from the developed questionnaire, confirming, or rejecting the proposed hypotheses. The data was analysed using the software *SPSS Statistics vs29*. Firstly, a descriptive analysis was carried out to characterise the sample – through demographic data –, and describe the results obtained. Afterwards, the reliability of the sample and scales was checked. Lastly, hypotheses tests were carried out to verify if they were acceptable, or rejected (Bell et al., 2018).

5.1. SAMPLE' CHARACTERISATION

The sample of the questionnaire obtained 400 respondents. However, the author only considered 391 valid responses, due to the previously defined criteria (having Portuguese nationality and being aged 18 or over). Consequently, the following analysis focuses exclusively on the **391 responses**.

5.1.1. SOCIODEMOGRAPHIC CHARACTERISTICS

Table 14 aims to resume the sociodemographic characteristics of the selected sample.

Table 14

Sociodemographic characteristics of the sample - 391 individuals.

	Sociodemographic Factor	Frequency (n)	Percentage (%)
Gender	Female	237	60,6
	Male	154	39,4
	Total	391	100,0
Age (by classes)	18-24	109	27,9
	25-34	43	11,0
	35-44	36	9,2
	45-54	77	19,7
	55-64	97	24,8
	More than 65	29	7,4
	Total	391	100,0
Education Level	Primary Education	18	4,6
	Secondary Education	95	24,3
	High Education	278	71,1
	Total	391	100,0
Household Size	1 member	37	9,5
	2 members	81	20,7
	3 members	110	28,1
	More than 4 members	163	41,7
	Total	391	100,0

Individual Annual Net Income	Less than 24.000€	111	28,4
	24.001€ - 36.000€	78	19,9
	36.001€ - 60.000€	44	11,3
	60.001€ or more	13	3,3
	I do not have	51	13,0
	I prefer not to say	94	24,0
	Total	391	100,0
Distance to the Sea	Near (I can go by walk)	185	47,3
	Relatively close (by car)	165	42,2
	Relatively far away	41	10,5
	Total	391	100,0

The sample is composed by 60,6% women, and 39,4% men. Although there is a prevalence of feminine gender, the presence of males is still significant.

The sample covers a wide range (18 – minimum age; 92 – maximum age), and has a bimodal profile with a notable concentration of ages at the extremes: the youngest age group (18-24), and pre-retirement (55-64). Most respondents are aged up to 54 (67,8%) and there is a relevant number of seniors. The middle-aged adults (25-44) are under-represented, with the age groups with the fewest representatives (20,2%).

Most respondents (71,1%) reported having a completed higher education, and only 4,6% with basic education. This indicates a highly educated sample, with a reduced representation of individuals with lower educational backgrounds. The annual income distribution shows a significant disparity, with a high concentration of low incomes. Almost 30% earns less than 24.000€ per year, and almost half of respondents earns above 36.000€ per year. Only 3,3% have higher incomes. Moreover, 13% does not have incomes (they can be students, or individuals without professional activity), and the high rate of non-disclosure (24%) suggests potential sensitivity around this topic that limits the generalizability of the income data.

Most respondents live in households with 4 or more members, and only 9,5% live alone, suggesting that most of them are part of medium to large family units. Almost 90% live near or relatively near to the sea (in coastal areas), with a minority living relatively far from the sea.

5.1.2. DIETARY PATTERNS

The distribution of dietary patterns of this sample is highly unbalanced (as can be seen on **Table 15**). Most individuals have an omnivorous diet (including both meat and fish), and only 11,8% follow another types of diet (such as flexitarian, or pescetarian diet).

Table 15
Dietary type of the 391 individuals.

		Frequency (n)	Percentage (%)
Dietary Type	Omnivorous	345	88,2
	Flexitarian	32	8,2
	Pescetarian	6	1,5
	Vegetarian	4	1,0
	Vegan	4	1,0
	Total	391	100,0

5.1.3. SEAWEED PRODUCTS

The following section aims to describe the responses related to specific seaweed products. Firstly, the author analysed the products that were already tried by the individuals, and then the products that consumers are more willing to eat. The willingness to pay, and the preferred product origin were also studied.

A. PRODUCTS ALREADY TRIED BY INDIVIDUALS

To evaluate the level of familiarity of consumer with seaweed products, the author posed the following question: “Have you ever consumed any of these seaweed products?” (responses on **Table 16**). A considerable number of individuals (24%) have never consumed seaweed products. Most of respondents have already tried seaweed-based products, mainly in Asian contexts (such as seaweed in sushi rolls, or in salads and soups). In fact, seaweed in sushi rolls were the item most consumed (67,3%), followed by seaweed in salads, soups and stew (44,7%). Only 19,7%, and 18,2%, respectively, consumed aromatics seaweed, and seaweed snacks, and a mere 5,4% consumed the seaweed and carrot hamburger. The variety of “other products” that were mentioned is broad, but the representation is low, which may indicate a very occasional consumption, or limited awareness of these forms of presentation. Although, the fact of existing 7% of “other responses” can demonstrate a market growth potential for innovative forms of seaweed (such as seaweed cereals, paste, smoothies, or jelly).

Table 16

Products that individuals have already tried.

Seaweed Products	%
I have never tried seaweed	24%
Seaweed in sushi rolls	67,3%
Seaweed in salads, pasta, soups, etc.	44,7%
Aromatic seaweed	19,7%
Seaweed snacks	18,2%
Seaweed and carrot burger	5,4%
Seaweed powder	0,9%
Energetic seaweed bars	0,7%
Seaweed cereals	0,6%
Seaweed crepes	0,3%
Seaweed tinned food	0,3%
Seaweed smoothies	0,3%
Seaweed jelly	0,3%
Seaweed pastes	0,3%
Pokes	0,3%
Rice of seaweed	0,3%

B. WILLINGNESS TO EAT

Respondents were asked about their willingness to eat the selected seaweed products. Apparently, seaweed in sushi rolls is the most accepted product for future consumption, due to the highest mean (3,80) and mode (5), which revealed a general positive intention to consume (as can be seen on **Table 17**).

Table 17

Willingness to eat the presented seaweed products.

	M	Mode	SD
Seaweed in sushi rolls	3,80	5	1,428
Seaweed in salads, pasta, soups, etc.	3,69	5	1,291
Aromatic seaweed	3,75	5	1,209
Seaweed snacks	3,41	5	1,356
Seaweed and carrot burger	3,07	3	1,397

In fact, 67,3% of respondents demonstrated interest on eating sushi rolls (**Table 18**). Seaweed and carrot burger had the lowest consumption intention (M=3,07), which suggests a neutral, and, consequently, less enthusiastic opinion among respondents. Moreover, it was the product with a highest standard deviation (SD= 1,397), as the respondents did not have a similar opinion in their desire to try this product (34,3% did not revealed interest, 25,3% had a neutral opinion and 40,4% have shown interest). The standard deviation of all products demonstrates some results variability, with the highest dispersion on sushi rolls and seaweed and carrot burger, which indicate more polarized willingness to eat these products. In conclusion, all the products proved to be interesting for individuals, due to the favourable consumption intention.

Table 18
Individual's responses towards different seaweed products.

"Are you willing to eat...?" (values on %)					
	<i>Strongly disagree</i>	<i>Disagree</i>	<i>Neither agree nor disagree</i>	<i>Agree</i>	<i>Strongly agree</i>
Seaweed in sushi rolls	13,6	6,6	12,5	21	46,3
Seaweed in salads, pasta, soups, etc.	9,7	8,4	19,9	27,1	34,8
Aromatic seaweed	7,4	7,4	22	29,4	33,8
Seaweed snacks	13,3	11,5	24	23	28,1
Seaweed and carrot burger	19,7	14,6	25,3	19,9	20,5

C. WILLINGNESS TO PAY

The author analysed the willingness to pay for the selected seaweed products (**Table 19**). Individuals are more willing to pay a low price for aromatic seaweed (M= 1,91; mode=1), followed by seaweed snacks (M= 1,94; mode= 1), and seaweed in salads or soups (M= 2,06; mode=1). In fact, most individuals mentioned that would be willing to pay up to 2,50€ for aromatic seaweed, seaweed snacks and seaweed in salads or soup (42,2%, 39,9% and 34,3% respectively). Seaweed and carrot burger (M= 2,30; mode= 1) and seaweed in sushi rolls (M= 2,40; mode= 3) acquired the highest willingness to pay. More than half of individuals would be willing to pay up to 3,50€ for the seaweed in the sushi rolls and for the seaweed and carrot burger (52,2% and 55,8% respectively). Although these are the products that individuals would be willing to pay the most for, this is also where there is the greatest disparity in data (due to the most pronounced standard deviation).

Table 19
Willingness to pay for the selected seaweed products.

	M	Mode	SD
Seaweed in sushi rolls – 5 pieces	2,4	3	1,077
Seaweed in salads, pasta, soups, etc. – 1 package of 35 gr	2,06	1	0,947
Aromatic seaweed – 1 jar of 35 gr	1,91	1	0,938
Seaweed snacks – 1 package of 55 gr	1,94	1	0,911
Seaweed and carrot burger – 1 burger of 75 gr	2,3	1	1,098

However, the pertinent question is whether consumers are willing to pay the full cost of the mentioned products. **Table 20** aims to resume the average market price of the products and the respective range of prices that consumers are willing to pay for them.

Table 20

Average market product's price and the respective range of prices selected.

	Average Price	Most mentioned price range	Individuals willing to pay the price (%)	Individuals willing to pay the more than the price (%)
Seaweed in sushi rolls – 5 pieces	2,66€/13 gr	3,50€ - 4,50€	25,6%	47,8%
Seaweed in salads, pasta, soups, etc. – 1 package of 35 gr	4,31€/35 gr	Less than 2,50€	24,8%	32,5%
Aromatic seaweed – 1 jar of 35 gr	4,68€/35 gr	Less than 2,50€	6,4%	-
Seaweed snacks – 1 package of 55 gr	2,93€/55 gr	Less than 2,50€	30,7%	29,4%
Seaweed and carrot burger – 1 burger of 75 gr	1,75€/75 gr	Less than 2,50€	32%	68%

Consumers are not fully aware of the actual market prices of the selected seaweed-based products. In the most cases, the most mentioned price range were significantly lower than the actual prices, which suggests an underestimation of value, or unfamiliarity with these items in the Portuguese' markets. On the other hand, products such seaweed in sushi rolls, and seaweed burgers showed a higher willingness to pay – in the last case, exceeding the actual price – which can indicate a better price alignment and perceived value. Increasing product visibility could help to mitigate this gap, supporting more accurate price expectations.

D. PREFERRED ORIGIN

In relation to the origin of seaweed products, there is a clear preference for locally sourced options. Most respondents (95,7%) are willing to pay more for a seaweed product of national origin, whose seaweed was harvested and processed in Portuguese territory.

5.2. EXPLORATORY FACTOR ANALYSIS

With the aim to validate the proposed conceptual model, it became necessary to analyse the variables that compose it. In this way, it was carried out the Exploratory Factor Analysis (EFA), a statistical method for “investigating common but unobserved sources of influence in a collection of variables” (Cudeck, 2000). According to the same author, EFA allows the reduction of data dimensionality, and enable the transformation of variables into factors, which explains the relationships among the studied variables.

Initially, before starting the principal component analysis, fundamental requirements had to be checked. The variables used needed to be of scale and independents type, which proved to be the case (Mooi & Sarstedt, 2014).

To determine whether the study sample was suitable for EFA, the Kaiser-Meyer-Olkin (KMO) test was carried out to measure the homogeneity of the variables. KMO’ test aims to assess the quality of correlations between variables (Pestana & Gageiro, 2014). According to Marôco (2021), KMO values range from 0 to 1 and they need to be above 0.5 for conducting a subsequent factor analysis. KMO’ values between 0.9 and 1.0 are excellent; between 0.8 and 0.9 are good; between 0.7 and 0.8 are medium; between 0.6 and 0.7 mediocre; between 0.5 and 0.6 are poor but still acceptable; and less than 0.50 are unacceptable.

Then, the factor adequacy required the Bartlett’s Sphericity Test, a test used to verify the existence of correlations between the variables. The significance value had to be less than 0.05, otherwise there was no correlation between variables. If the significance is less than 0.05, the conditions are formed to reject the null hypotheses, confirming that variables correlate significantly (Marôco, 2021).

Lastly, regarding to the factor extraction, a minimum number of factors must be extracted. It must represent at least 50% of the total variance (Marôco, 2021; Mooi & Sarstedt, 2014).

Table 21 aims to summarise the results obtained for each construct in the previously contextualized tests (KMO’s Test, Bartlett’s Sphericity Test, and Variance Test).

Table 21
KMO' Test, Bartlett's Sphericity Test and Variance Test.

Construct	Items	KMO	Bartlett	% Variance
Inv	Inv1; Inv2; Inv3; Inv4; Inv5	0,823	<,001	65,581
Inn	Inn1; Inn2; Inn3; Inn4; Inn5	0,826	<,001	71,945
Res	Res1; Res2; Res3; Res4; Res5	0,868	<,001	71,705
Att	Att1; Att2; Att3; Att4	0,852	<,001	82,046
SN	SN1; SN2; SN3; SN4	0,860	<,001	83,536
PBC	PBC1; PBC2; PBC3	0,671	<,001	70,992
ItC	Int1; Int2; Int3	0,752	<,001	84,723
FN	Factor 1: FN1; FN4; FN6; FN9; FN10 Factor 2: FN2 ; FN3; FN5; FN7; FN8	0,825	<,001	66,359 (Factor 1: 46,943; Factor 2: 19,416)
FD	FD1; FD2; FD3; FD4; FD5; FD6; FD7	0,936	<,001	78,560

An analysis of the **Table 26** indicates that:

KMO' Test

KMO' Test obtained values between 0,7 and 0,9 in all constructs, except on perceived behavioural control variable that obtained a lowest and mediocre value (0,671). The highest and unique excellent value was 0,936 that belongs to food disgust construct. Concluding, all the constructs demonstrated the suitability of the sample for the factor analysis.

Bartlett' Test

Bartlett's Test showed that variables correlate with each other, since the significance level is always less than 0,05 ($p < 0,001$).

Variance' Test

The variables' variance had great values, between 65,581% (Inv), and 84,723% (ItC). This study found that food neophobia has divided into 2 factors, the Factor 1 with a variance of 46,943 and the Factor 2 with a variance of 19,416.

To assess the suitability of the items of constructs to form factors, the communality values were analysed (the results can be seen on **Appendix I**). The communality value must be above 0,50, ensuring that it contributes to the formation of the factor. The items below 0,5 must be eliminated, due to the low explanatory power (Mooi & Sarstedt, 2014). Thus, were disregarded 2 items belonged to food neophobia construct. The items were "I don't trust new foods." (FN2) and "I am very particular about the foods I will eat." (FN8).

This study revealed that food neophobia scale was divided into two factors, depending on the values obtained in the rotating component matrix. For this reason, as happened in the research of Szakály et al. (2021), this scale gained a different name, separating the negative, and positive (reversed) FNS items: *willingness and trust* and *rejection and particularity* (**Table**

22). In fact, the items that compose *food neophobia – willingness and trust* are related to the neophilic (opposite of neophobic) consumer behaviour, representing food curiosity and willingness to innovate in food terms; while the *food neophobia – rejection and particularity* are related to the neophobic consumer behaviour, representing fear towards novel foods. The strongest factor was *willingness and trust*, which explains 46,943% of the variance and includes questions related to the adventurous behaviour towards new foods. This means that in the Portuguese context, FNS measure neophilia better than it measure neophobia.

Table 22

The items of food neophobia divided into: Willingness and Trust and Rejection and Particularity.

Food Neophobia	Code	Item
Willingness and Trust (WT) <i>Factor 1</i>	FN1	I am constantly sampling new and different foods. (R)
	FN4	I like foods from different countries. (R)
	FN6	At dinner parties, I will try a new food. (R)
	FN9	I will eat almost anything. (R)
	FN10	I like to try new ethnic restaurants. (R)
Rejection and Particularity (RP) <i>Factor 2</i>	FN3	If I don't know what is in a food, I won't try it.
	FN5	Ethnic food looks too weird to eat.
	FN7	I am afraid to eat things I have never had before.

With the aim of analysing the scales' reliability, it was necessary to do the analysis of internal consistency index of the items – *Cronbach Alpha*. This index varies between 0 and 1, although the instrument has appropriate reliability when its value is at least 0,70. If *Cronbach Alpha* is higher than 0,9 it is very good; between 0,8 and 0,9 it is good; between 0,7 and 0,8 it is reasonable; between 0,6 and 0,7 it is weak but still acceptable; and if it is less than 0,6 it is unacceptable (Marôco, 2021). Since all the items have a *Cronbach Alpha* greater than 0,7, it can be concluded that the scales used were reliable, as it can be seen on **Table 23**.

Table 23

Cronbach Alpha's Values.

Construct	Cronbach's Alpha	Items N	Classification
Inv	0,868	5	Good
Inn	0,902	5	Very good
Res	0,900	5	Very good
Att	0,927	4	Very good
SN	0,934	4	Very good
PBC	0,794	3	Good
ItC	0,910	3	Very good
FN-WT	0,867	5	Good
FN-RP	0,739	3	Reasonable
FD	0,954	7	Very good

Once the necessary conditions have been verified, the factor calculation is performed, as well as the descriptive analysis of response frequencies for each factor generated.

5.3. FACTOR FREQUENCY ANALYSIS

In this section, it was developed the factor frequency analysis, using the calculation of the mean, and standard deviation. To analyse these results, it is crucial to remember the Likert Scale utilised to measure the statements that belong to the different constructs (**Table 24**).

Table 24

Likert Scale used in the questionnaire.

	Inn	Inv	Res	Att	SN	PBC	FN	ItC	FD
1	Strongly disagree								Not disgusting at all
2	Disagree								Not very disgusting
3	Neither agree nor disagree								Moderately disgusting
4	Agree								Quite disgusting
5	Strongly agree								Extremely disgusting

5.3.1. FOOD-RELATED LIFESTYLE

The involvement construct was measured using 5 statements about consumer involvement in food and drink topics, which results are presented on **Table 25**. All the items proved to be crucial for the individuals, due to the mean of the answers. The statement with the highest score was “I love good food.” (M= 4,56, mode= 5), where 92,8% of respondents agreed/strongly agreed. On the other hand, the item with the lowest score was “Eating and food is an important part of my social life.” (M= 3,86), which can reveal that despite “food and drink” being a topic with a great significance, it does not have the same impact in the social context for some respondents. In fact, this statement shows more variation (SD= 1,052) than the others and was the one in which there was the greatest neutrality of agreement (22,5%) or disagreement (10,2%), despite the majority agreeing with it (67,2%). In conclusion, the sample demonstrates a high level of involvement with food - particularly at the personal and emotional level - even though there exists a less uniform perception of the social dimension of food.

Table 25

Involvement' descriptive analysis.

<i>Involvement (Inv)</i>					
Code	Items	M	Mode	SD	
Inv1	I love good food.	4,56	5	0,717	
Inv2	Eating and drinking are a continuous source of joy for me.	4,01	4	0,927	
Inv3	Decisions on what to eat and drink are very important for me.	4,19	4	0,831	
Inv4	Food and drink are an important part of my life.	4,19	5	0,828	
Inv5	Eating and food is an important part of my social life.	3,86	4	1,052	

In relation to the innovativeness, the mean of the statements was moderate (as can be seen on **Table 26**), with the highest value being “I like to try out new recipes.” ($M=3,8$). The item with the lowest mean ($M=3,31$) was “Recipes and articles on food from other culinary traditions encourage me to experiment in the kitchen.”, which also shows the greatest disparity in responses ($SD=1,162$). Most individuals either disagreed, or strongly disagreed with this statement (24,8%), or were neutral (28,4%), revealing their indifference towards external sources (such as articles) in motivating them to try new foods.

Table 26
Innovativeness' descriptive analysis.

<i>Innovativeness (Inn)</i>				
Code	Items	M	Mode	SD
<i>Inn1</i>	I like to try new foods that I have never tasted before.	3,74	4	1,079
<i>Inn2</i>	I love to try recipes from different countries.	3,66	4	1,126
<i>Inn3</i>	Recipes and articles on food from other culinary traditions encourage me to experiment in the kitchen.	3,31	4	1,162
<i>Inn4</i>	I like to try out new recipes.	3,80	4	1,081
<i>Inn5</i>	I look for ways to prepare unusual meals.	3,58	4	1,111

The items that measured responsibility showed a moderately high mean, with most individuals expressing agreement, or strong agreement with the statements (**Table 27**). The one that demonstrated the highest mean ($M=4,05$), and the lowest data dispersion ($SD=0,924$) was “It is important to understand the environmental impact of our eating habits”. In fact, 78,7% of respondents agreed, or strongly agreed with it, underscoring a high sense of concern regarding environmental impact of their dietary choices. Whereas the item with the lowest mean ($M=3,43$) and mode (3) was “I try to choose food produced with minimal impact on the environment.”. Also, this item had the highest standard deviation ($SD=1,121$). More than half of individuals (51,4%) showed a lack of conviction towards this affirmation, revealing their indifference among the food products with a minimal environmental impact.

Table 27
Responsibility' descriptive analysis.

<i>Responsibility (Res)</i>				
Code	Items	M	Mode	SD
<i>Res1</i>	I try to choose food produced with minimal impact on the environment.	3,43	3	1,121
<i>Res2</i>	I am concerned about the conditions under which the food I buy is produced.	3,84	4	1,032
<i>Res3</i>	It is important to understand the environmental impact of our eating habits.	4,05	4	0,924
<i>Res4</i>	I try to choose food that is produced in a sustainable way.	3,70	4	1,044
<i>Res5</i>	I try to buy organically produced foods if possible.	3,63	4	1,121

5.3.2. FOOD NEOPHOBIA

Food neophobia was measured using 10 statements (results presented on **Table 28**). It was concluded that respondents tend not to be afraid or mistrustful of new foods, due to the lowest mean in statements such as “I don’t trust new foods.” (M= 2,38), “Ethnic food looks too weird to eat.” (M= 2,38), and “I am afraid to eat things I have never had before.” (M= 2,54). Consequently, the individuals also demonstrated a high openness to try new foods, and have different culinary experiences, especially in social contexts, given the high concordance (the statements with a highest mean) in statements such as “I like to try new ethnic restaurants.” (M= 3,65), “I like foods from different countries.” (M= 3,63), “At dinner parties, I will try a new food.” (M= 3,49), and “I will eat almost anything.” (M= 3,48). Finally, although there exists some food’ selectivity, there is no general rejection of different foods, due to the moderated mean of statements such as I am very particular about the foods I will eat.” (M= 3,05), “If I don’t know what is in a food, I won’t try it.” (M= 2,80), and “I am constantly sampling new and different foods.” (M= 2,66).

Table 28

Food neophobia' descriptive analysis.

<i>Food neophobia (FN)</i>				
Code	Items	M	Mode	SD
FN1	I am constantly sampling new and different foods.	2,66	3	1,154
FN2	I don’t trust new foods.	2,38	2	1,023
FN3	If I don’t know what is in a food, I won’t try it.	2,80	2	1,192
FN4	I like foods from different countries. (R)	3,63	4	1,127
FN5	Ethnic food looks too weird to eat.	2,38	2	1,060
FN6	At dinner parties, I will try a new food. (R)	3,49	4	1,102
FN7	I am afraid to eat things I have never had before.	2,54	2	1,176
FN8	I am very particular about the foods I will eat.	3,05	3	1,121
FN9	I will eat almost anything. (R)	3,48	4	1,161
FN10	I like to try new ethnic restaurants. (R)	3,65	4	1,142

5.3.3. THEORY OF PLANNED BEHAVIOUR

Attitude construct, one of the three items of TPB, was measured using 4 statements, which results are presented on **Table 29**. All these items had a moderated mean (between 3,29 and 3,62), and for all of them the mode was 3. The statement with a highest mean (M= 3,62) was “I believe that consuming seaweed or seaweed-based foods is beneficial.”, underscoring the healthy character of seaweed. By analysing the statement “I believe that consuming seaweed or seaweed-based foods is a good idea.”, it can be concluded that half of individuals (50,4%) are indifferent (40,4%), or in disagreement (10%) with it. With results very similar to

the last question, the respondents manifested a neutral position about the benefits (“I believe that consuming seaweed or seaweed-based foods is beneficial.”), and about the reasonableness of consuming seaweed (“In my opinion, consuming seaweed or seaweed-based foods is reasonable.”). The statement with the lowest mean ($M= 3,29$), and the highest standard deviation ($SD= 1,143$) was “I am interested in eating seaweed or seaweed-based foods.”, which can indicate a significant variation in responses, despite of a general lack of interest in eating seaweed products. In fact, more than half of respondents (59,3%) revealed a neutral or disagreement position about their interest in consuming that type of food.

Table 29
Attitude' descriptive analysis.

<i>Attitude (Att)</i>				
Code	Items	M	Mode	SD
<i>Att1</i>	I believe that consuming algae or algae-based foods is a good idea.	3,57	3	1,015
<i>Att2</i>	I believe that consuming algae or algae-based foods is beneficial.	3,62	3	0,979
<i>Att3</i>	I am interested in eating algae or algae-based foods.	3,29	3	1,143
<i>Att4</i>	In my opinion, consuming algae or algae-based foods is reasonable.	3,55	3	0,964

Subjective norms were measured by 4 statements (results presented on **Table 30**). The mean of these items was low (less than 3), as so the median (3), and mode (3). In all statements, most individuals selected the neutral option (“neither agree nor disagree”), showing that they do not feel supported or encouraged by their peers to consume seaweed. The standard deviation is high for all statements, being highest in “Most individuals who are important to me urge me to consume algae or algae-based foods.” ($M= 1,108$), which also has the lowest mean ($M= 2,58$). Only 17,6% of respondents agreed, or strongly agreed with it, which reinforces the conclusion that subjective norms are generally weak in seaweed consumption context.

Table 30
Subjective norms' descriptive analysis.

<i>Subjective norms (SN)</i>				
Code	Items	M	Mode	SD
<i>SN1</i>	Individuals whose opinions matter to me have endorsed the consumption of algae or algae-based foods.	2,96	3	1,070
<i>SN2</i>	My friends and relatives endorse the consumption of algae foods.	2,85	3	1,058
<i>SN3</i>	Individuals whom I respect endorse the use of algae foods.	2,91	3	1,052
<i>SN4</i>	Most individuals who are important to me urge me to consume algae.	2,58	3	1,108

Perceived behavioural control was measured using 3 statements (**Table 31**), and the mean of the items was moderate. The statement that showed the lowest mean, median, and mode was “Consuming seaweed or seaweed-based foods is easy for me.” ($M= 3,25$; mode= 3) and consequently the standard deviation was the highest ($SD= 1,178$). In fact, more than half of respondents (59,6%) revealed a neutral opinion, or disagreement with the sentence, proving

their difficulty about eating these foods. Only 40,4% are sure about their capacity of eating seaweed, proving the mixed feelings related to this topic. The item with the highest mean, and lowest standard derivation was “Whether I consume seaweed or seaweed-based foods is entirely up to me.” (M= 3,92; SD= 1,022). Most individuals agreed (37,1%), or strongly agreed (33,8%) with this point, proving that individuals generally feel in control of their own food choices. Therefore, related with the last item, most respondents revealed confidence in their ability to consume seaweed products if they choose to, as 61,4% agreed/totally agreed with the statement “I am confident that I can consume algae or algae-based foods if I choose to.”.

Table 31
Perceived behavioural control' descriptive analysis.

<i>Perceived behavioural control (PBC)</i>				
Code	Items	M	Mode	SD
PBC1	I am confident that I can consume algae if I choose to.	3,70	4	1,093
PBC2	Whether I consume algae or algae-based foods is entirely up to me.	3,92	4	1,022
PBC3	Consuming algae or algae-based foods is easy for me.	3,25	3	1,178

5.3.4. FOOD DISGUST

Food disgust was measured using 7 items related to individual's disgust towards seaweed (Table 32). The mean, and mode of the statements was generally low, which demonstrate a neutral, or slightly positive attitude towards seaweed. The lowest mean belongs to “The thought of consuming algae or algae-based foods is repulsive to me.” (M= 2,06), which indicates that individuals do not feel repulsed by the idea of consuming seaweed. In addition, the individuals demonstrated minimal symptoms of discomfort with this idea, and the appearance of seaweed did not cause marked rejection. The items with a highest, and moderated mean were related to the sensory characteristics of seaweed (taste, texture, and odour). It can be concluded that the biggest barriers are taste and texture. In fact, individuals have a slight hesitation when faced with unfamiliar flavours and textures (“I avoid algae or algae-based foods that have a strong and unfamiliar taste.” (M= 2,61), and “The slimy and slippery texture of algae or algae-based foods is extremely undesirable for me, and I feel I cannot swallow it.” (M= 2,57)), probably due to the unfamiliarity towards them. Moreover, the odour received a neutral evaluation, indicating it is not perceived as a significant barrier, although it may be discouraging for some individuals (“Algae or algae-based foods have an unpleasant odour that deters me from trying them.” (M= 2,35; mode= 3)). Concluding, most respondents do not consider seaweed to be repulsive, which may indicate a high potential of acceptance of seaweed products. Furthermore, the potential rejection is not emotional, but connected to the sensory

characteristics of seaweed, such as texture, and strong or unfamiliar tastes. It is essential to note that the neutral responses may stem from a general lack of knowledge about seaweed.

Table 32
Food disgust' descriptive analysis.

<i>Food disgust (FD)</i>				
Code	Items	M	Mode	SD
FD1	The thought of consuming algae or algae-based foods is repulsive to me.	2,06	1	1,110
FD2	Algae have an unpleasant odour that deters me from trying them.	2,35	3	1,092
FD3	The appearance of algae or algae-based foods gives me a bad feeling.	2,27	1	1,134
FD4	I avoid algae or algae-based foods that have a strong and unfamiliar taste.	2,61	3	1,195
FD5	The idea of consuming algae or algae-based foods it is unpleasant for me and makes me feel nauseous.	2,20	1	1,133
FD6	The slimy and slippery texture of algae or algae-based foods is extremely undesirable for me, and I feel I cannot swallow it.	2,57	1	1,267
FD7	I find algae or algae-based foods to be disgusting and unappetizing.	2,30	1	1,200

5.3.5. INTENTION TO CONSUME

The construct that measures individual's intention to consume seaweed used 3 statements (**Table 33**), and their mean was moderate (slightly more than 3), as so the mode and median. Despite the highest mean was on "I will consume algae or algae-based foods." (M= 3,14), almost half of respondents (44%) revealed a neutral urge to consume seaweed, which may indicate indecision about the future consumption. The lowest mean was on "I will make an effort to consume algae or algae-based foods." (M= 3,03), where standard derivation is the highest. This indicates a wide variability of responses, and a lack strong of motivation among individuals to actively seek the seaweed consumption. It was also the item with the highest response rate of disagreement, or strongly disagreement (27,1%). Lastly, the item with the lowest standard derivation was "I recommend others to use algae or algae-based foods.", indicating less variability in responses. Nearly half of respondents (48,1%) selected the neutral option, suggesting hesitation about recommending seaweed to others. This option was followed by a smaller proportion who agreed (15,6%), reinforcing the idea that most individuals neither oppose nor actively promote the consumption of seaweed.

Table 33
Intention to consume' descriptive analysis.

<i>Intention to Consume (ItC)</i>				
Code	Items	M	Mode	SD
ItC1	I will consume algae or algae-based foods.	3,14	3	1,100
ItC2	I will make an effort to consume algae or algae-based foods.	3,03	3	1,117
ItC3	I recommend others to use algae or algae-based foods.	3,11	3	1,099

5.4. VERIFICATION OF THE HYPOTHESES

With the aim to analyse the data obtained from the questionnaire, parametric tests were developed. As noted before, the sample size is greater than 30, which permit to assume the normal distribution of the variable's values, according to the Central Limit Theorem (CLT). For that reason, parametric tests were used (Marôco, 2021; Pestana & Gageiro, 2014). To measure the strongness of correlation between the variables, it was used the Pearson's coefficient – that range between -1 and 1 (when it is closer to 1, there is a stronger correlation) (Marôco, 2021).

As mentioned before, this study performed 6 Multiple Linear Regression Models, 1 Independent T-Test, and 4 One-Way ANOVA Tests. The following section aims to present the analysis of the results derived from these statistical tests.

5.4.1. MULTIPLE LINEAR REGRESSION MODELS

A. MULTIPLE LINEAR REGRESSION MODEL A

To study the impact of consumer's attitude, subjective norms, perceived behavioural control, food neophobia, food disgust, and food-related lifestyle on intention to consume seaweed products, it was developed the MLRM A, with its hypotheses presented on **Table 34**.

Table 34
Variables and Hypotheses of MLRM A.

Multiple Linear Regression Model A		
Dependent Variable	Intention to Consume (ItC)	
Independent Variable		
	• Attitude (Att)	• H1
	• Subjective norms (SN)	• H2
	• Perceived behavioural control (PBC)	• H3
	• FN – willingness and trust (FN-WT)	• H4a
	• FN – rejection and particularity (FN-RP)	• H4b
	• Food disgust (FD)	• H5
	• Involvement (Inv)	• H13a
	• Innovativeness (Inn)	• H13b
	• Responsibility (Res)	• H13c

It was concluded that 68,7% ($R^2=0,687$) of the variance on the intention to consume seaweed products can be explained by this model, which has a strong explanatory power. This model is statistically significant ($F= 95,960$; $p<,001$), which means that the set of predictor variables (Att; SN; PBC; FN-WT; FN-RP; FD; Inv; Inn; Res) contributed significantly to predict consumer intention. **Table 35** resumes the results of the coefficients of MLRM A.

Table 35
Coefficients of MLRM A.

MLRM A dependent variable: ItC	Non-Standardised Coefficients		Standardised Coefficients		
	B	Error error	Beta	T	Sig.
1 (Constant)	-,065	,370		-,176	,861
Att	,505	,050	,461	10,024	<,001
SN	,214	,038	,206	5,669	<,001
PBC	,144	,049	,132	2,919	,004
FN-WT	-,029	,051	-,026	-,562	,574
FN-RP	,047	,039	,043	1,209	,228
FD	-,127	,036	-,128	-3,546	<,001
Inv	,377	,046	-,011	-,337	,736
Inn	,520	,050	,050	1,083	,280
Res	,231	,039	,091	2,682	,008

The original constructs of TPB, responsibility with foods and drinks, and food disgust prove to be significant factors of intention to consume seaweed products, due to the significance level to be lower than 0,05 ($p < ,05$). Thus, it may be rejecting H_0 for this variables, which indicates that the regression coefficients are equal to zero.

Attitude ($\beta = ,461$; $t = 10,024$; $p < ,001$) is the predictor with more strength, and its effect on dependent variable is positive, which means that consumer' positive attitude towards seaweed positively affects their intention to consume it. This predictor is followed by subjective norms ($\beta = ,206$; $t = 5,669$; $p < ,001$), and perceived behavioural control ($\beta = ,132$; $t = 2,919$; $p = ,004$), which means that both positively influence consumption of seaweed products. These items, constructs that belong to TPB, have demonstrated to be the main facilitators of seaweed consumption intention, due to their positive effect on dependent variable. Responsibility with foods and drinks showed a significant positive effect on intention ($\beta = ,091$; $t = 2,682$; $p = ,008$), which can mean that individuals who feel more responsible about their dietary choices are more likely to consume seaweed products. On the other side, it was concluded that the consumer' food disgust ($\beta = -,128$; $t = -3,546$; $p < ,001$) towards these products negatively affects their intention to consume them. Thus, food disgust appears to be the consumer's main barriers to seaweed consumption, due to their negative effect on consumer intention to consume. Concluding, **H1(+)**, **H2(+)**, **H3(+)**, **H5(-)** and **H13c(+)** are confirmed.

The food neophobia factors, involvement and innovativeness are not statistically significant, which means that its effect on intention to consume is uncertain, not significantly predicting consumption intention. Concluding, **H4(a;b)** and **H13(a;b)** are rejected.

Table 36 resumes the hypotheses confirmation.

Table 36

Hypotheses of MLRM A and its confirmation/effect.

Hypotheses		Confirmation	Effect
H1	Att → ItC	Confirmed	+
H2	SN → ItC	Confirmed	+
H3	PBC → ItC	Confirmed	+
H4a	FN-WT → ItC	Rejected	
H4b	FN-RP → ItC	Rejected	
H5	FD → ItC	Confirmed	-
H13a	Inv → ItC	Rejected	
H13b	Inn → ItC	Rejected	
H13c	Res → ItC	Confirmed	+

B. MULTIPLE LINEAR REGRESSION MODEL B

To study the impact of consumer's involvement, innovativeness, responsibility, food neophobia, and food disgust on attitude, it was developed the MLRM B (Table 37).

Table 37

Variables and Hypotheses of MLRM B.

Multiple Linear Regression Model B			
Dependent Variable	Attitude (Att)		
Independent Variable	- Involvement (Inv) - Innovativeness (Inn) - Responsibility (Res) - FN – willingness and trust (FN-WT) - FN – rejection and particularity (FN-RP) - Food disgust (FD)		
			- H9a - H9b - H9c - H6a - H6b - H7

It was concluded that 35,6% ($R^2=0,356$) of the variance of consumer' attitude towards seaweed can be explained by this model, which has a moderated explanatory power. This model showed to be statistically significant ($F= 36,924$; $p<,001$), which means that the set of predictor variables (Inv; Inn; Res; FN-WT; FN-RP; FD) contributed significantly to predict consumer attitude. Table 38 aims to resume the results of the coefficients obtained on MLRM B.

Table 38

Coefficients of MLRM B.

MLRM B dependent variable: Att	Non-Standardised Coefficients		Standardised Coefficients		
	B	Error error	Beta	T	Sig.
1 (Constant)	3,938	,429		9,186	<,001
Inv	,060	,060	,046	1,003	,317
Inn	-,008	,065	-,008	-,124	,901
Res	,240	,048	,231	4,990	<,001
FN-WT	-,308	,065	-,304	-4,768	<,001
FN-RP	-,050	,050	-,050	-1,010	,313
FD	-,258	,044	-,286	-5,924	<,001

As can be observed, only 3 factors (responsibility, food neophobia – willingness and trust, and food disgust) are significant to predict consumer' attitude, due to the significance level to be less than 0,05 ($p < 0,05$). Thus, it may be rejecting H_0 , which indicates that the regression coefficients are equal to zero.

The MLRM B shows that food neophobia – willingness and trust ($\beta = ,304$; $t = -4,768$; $p < ,001$) and food disgust ($\beta = ,286$; $t = -5,924$; $p < ,001$) have a negative impact on consumer' attitude, while responsibility ($\beta = ,231$; $t = 4,990$; $p < ,001$) is the only with a positive impact. The strongest predictor in the formation of attitude is food neophobia on willingness and trust factor, followed by food disgust and responsibility. These results demonstrates that individuals with a highest disgust' sensibility and a higher distrust and fear on novel foods show a more negative attitude towards seaweed-based food products. On the other hand, consumers with a high level of responsibility towards foods and drinks show a more positive attitude towards seaweed products. Concluding, **H6a(-)**, **H7(-)** and **H9c(+)** are confirmed

Factors related to consumer' sense of involvement ($p = ,317$), innovativeness ($p = ,901$) and food neophobia – rejection and particularity ($p = ,313$) do not statistically and significantly influence their attitudes to seaweed. Concluding, **H6b** and **H9(a;b)** are hypotheses rejected.

Table 39 resumes the hypotheses confirmation.

Table 39

Hypotheses of MLRM B and its confirmation/effect.

	Hypotheses	Confirmation	Effect
H6a	FN-WT → Att	Confirmed	-
H6b	FN-RP → Att	Rejected	
H7	FN → Att	Confirmed	-
H9a	Inv → Att	Rejected	
H9b	Inn → Att	Rejected	
H9c	Res → Att	Confirmed	+

C. MULTIPLE LINEAR REGRESSION MODEL C

To study the impact of consumer's food-related lifestyle on consumer's subjective norms towards seaweed products, it was developed the MLRM C, with its hypotheses presented on **Table 40**.

Table 40

Variables and Hypotheses of MLRM C.

Multiple Linear Regression Model C			
Dependent Variable	Subjective norms (SN)		
Independent Variable	- Involvement (Inv) - Innovativeness (Inn) - Responsibility (Res)	- H10a - H10b - H10c	

It could be concluded that the model has a moderated explanatory capacity, with 18,5% of the variance ($R^2=0,185$) of consumer's subjective norms being explained by the three items of food-related lifestyle construct. This model was found to be statistically significant ($F=29,304$; $p<,001$), which means that the set of predictor variables (Inv; Inn; Res) contributed significantly to predict consumer subjective norms. **Table 41** aims to resume the results of the coefficients obtained on MLRM C.

Table 41
Coefficients of MLRM C.

MLRM C dependent variable: SN	Non-Standardised Coefficients		Standardised Coefficients		
	B	Error error	Beta	T	Sig.
1 (Constant)	,926	,295		3,140	,002
Inv	-,047	,071	-,034	-,665	,506
Inn	,266	,054	,256	4,941	<,001
Res	,306	,055	,279	5,526	<,001

Moreover, it was observed that consumer's sense of innovativeness and responsibility are significant to predict their subjective norms, due to the significance level to be less than 0,05 ($p<,05$). Thus, it may be rejecting H_0 , which indicates that the regression coefficients are equal to zero. The only construct rejected was consumer's involvement ($p=,506$), which means that consumer's involvement with food is not statistically significant to influence consumer's subjective norms towards seaweed-based food products. For that reason, **H10a** is rejected.

The MLRM C also demonstrate that consumer's highest food responsibility ($\beta=-,279$; $t=5,526$; $p<0,001$) and innovativeness ($\beta=-,256$; $t=4,941$; $p<,001$) cause a positive impact on consumer's subjective norms. This means that how more sense of innovation and responsibility towards foods and drinks of individuals, the stronger the perceived social pressure to behave accordingly. Concluding, innovativeness and responsibility act as a cognitive reinforcement of subjective norms, which helps to predict consumer's behavioural intention to consume seaweed-based food products. For that reason, **H10(b;c)** are confirmed.

Table 42 resumes the hypotheses confirmation.

Table 42
Hypotheses of MLRM C and its confirmation/effect.

	Hypotheses	Confirmation	Effect
H10a	Inv → SN	Rejected	
H10b	Inn → SN	Confirmed	+
H10c	Res → SN	Confirmed	+

D. MULTIPLE LINEAR REGRESSION MODEL D

To study the impact of consumer's involvement, innovativeness and responsibility towards foods and drinks on consumer's perceived behavioural control towards seaweed products, it was developed the MLRM D, with its hypotheses presented on **Table 43**.

Table 43
Variables and Hypotheses of MLRM D.

Multiple Linear Regression Model D		
Dependent Variable	Perceived behavioural control (PBC)	
Independent Variable	• Involvement (Inv) • Innovativeness (Inn) • Responsibility (Res)	• H11a • H11b • H11c

It was concluded that this model has an explanatory capacity of 21,1% ($r^2=0,211$), indicating that involvement, innovativeness and responsibility explains 21,1% of the variance in the perceived behavioural control factor. This model was found to be statistically significant ($F= 34,435$; $p<,001$), which means that the set of predictor variables (Inv; Inn; Res) contributed significantly to predict consumer perceived behavioural control. **Table 44** aims to resume the results of the coefficients obtained on MLRM D.

Table 44
Coefficients of MLRM D.

MLRM D dependent variable: PBC	Non-Standardised Coefficients		Standardised Coefficients		
	B	Error error	Beta	T	Sig.
1 (Constant)	1,410	,276		5,102	<,001
Inv	,062	,067	,047	,933	,351
Inn	,300	,050	,304	5,955	<,001
Res	,231	,052	,221	4,444	<,001

Through the analysis of results, it was concluded that consumer's innovativeness, and responsibility have a statistically significant effect on consumer's perceived behaviour control towards seaweed, due to their significance level ($p<,05$). In contrast, involvement does not have a significant effect on PBC ($p=,351$), suggesting that the level of personal involvement with food does not meaningfully influence perceived control. Thus, **H11a** is rejected.

The regression model shows that innovativeness ($\beta=,304$; $t= 5,955$; $p<,001$), and responsibility ($\beta=,221$; $t= 4,444$; $p<,001$) are significant and positive predictors of perceived behavioural control. This shows that individuals who perceived themselves as more food innovative and responsible, tend to feel more in control of their food behaviours towards seaweed-based food products. Concluding, **H11(b;c)** are confirmed.

Table 45 resumes the hypotheses confirmation.

Table 45

Hypotheses of MLRM D and its confirmation/effect.

	Hypotheses	Confirmation	Effect
H11a	Inv → PBC	Rejected	
H11b	Inn → PBC	Confirmed	+
H11c	Res → PBC	Confirmed	+

E. MULTIPLE LINEAR REGRESSION MODEL E

To study the impact of consumer's involvement, innovativeness and responsibility towards foods and drinks on consumer's food neophobia on willingness and trust factor, it was developed the MLRM E, with its hypotheses presented on **Table 46**.

Table 46

Variables and Hypotheses of MLRM E.

Multiple Linear Regression Model E			
Dependent Variable	Food Neophobia – willingness and trust (FN_ WT)		
Independent Variable	• Involvement (Inv) • Innovativeness (Inn) • Responsibility (Res)	• H8a-WT • H8b-WT • H8c-WT	

This model has an explanatory capacity of 57,6% ($R^2=0,576$), indicating that involvement, innovativeness, and responsibility explains 57,6% of the variance in the FN-WT. This model was found to be statistically significant ($F= 175,469$; $p<,001$), which means that the set of predictor variables (Inv; Inn; Res) contributed significantly to predict this food neophobia factor. **Table 47** resumes the results of the coefficients obtained on MLRM E.

Table 47

Coefficients of MLRM E.

MLRM E dependent variable: FN-WT	Non-Standardised Coefficients		Standardised Coefficients		
	B	Error error	Beta	T	Sig.
1 (Constant)	5,396	,199		27,086	<,001
Inv	-,075	,048	-,058	-1,571	,117
Inn	-,733	,036	-,754	-20,163	<,001
Res	,054	,037	,052	1,432	,153

It was concluded that consumer's innovativeness is the only variable with a statistically significant effect on consumer's FN-WT, due to their significance level ($p<,05$). Innovativeness ($\beta=-,754$; $t= -20,163$; $p<,001$) is the variable with more influence on the model, and has a negative impact, meaning that a higher perceived innovation leads to lower neophobia' levels. Thus, **H8b-WT(-)** is confirmed.

On the other hand, involvement ($p=,117$), and responsibility ($p=,153$) demonstrated to have no significant effect on this factor of food neophobia, suggesting that the level of personal

involvement and responsibility with food themes does not meaningfully influence food neophobia. Concluding, **H8(a;c)-WT** are rejected.

Table 48 resumes the hypotheses confirmation.

Table 48

Hypotheses of MLRM E and its confirmation/effect.

	Hypotheses	Confirmation	Effect
H8a-WT	Inv → FN-WT	Rejected	
H8b-WT	Inn → FN-WT	Confirmed	-
H8c-WT	Res → FN-WT	Rejected	

F. MULTIPLE LINEAR REGRESSION MODEL F

To study the impact of consumer's involvement, innovativeness, and responsibility towards foods and drinks on consumer's food neophobia – rejection and particularity, it was developed the MLRM F, with its hypotheses presented on **Table 49**.

Table 49

Variables and Hypotheses of MLRM F.

Multiple Linear Regression Model F			
Dependent Variable	Food Neophobia – rejection and particularity (FN-RP)		
Independent Variable	• Involvement (Inv) • Innovativeness (Inn) • Responsibility (Res)	• H8a-RP • H8b-RP • H8c-RP	

This model has a low explanatory capacity, with 12,9% ($R^2=0,129$) of the variance in the dependent variable being explained by the 3 selected predictors. However, this model was found to be statistically significant ($F= 19,116$; $p<,001$), which means that collectively the predictors (Inv; Inn; Res) contributed significantly to explain a significant portion of the variance in FN-RP. **Table 50** resumes the results of the coefficients obtained on MLRM F.

Table 50

Coefficients of MLRM F.

MLRM F dependent variable: FN-RP	Non-Standardised Coefficients		Standardised Coefficients		
	B	Error error	Beta	T	Sig.
1 (Constant)	2,817	,288		9,774	<,001
Inv	,066	,069	,050	,950	,343
Inn	-,378	,053	-,385	-7,192	<,001
Res	,230	,054	,222	4,248	<,001

It can be concluded that consumer's innovativeness, and responsibility have a statistically significant effect on consumer's FN-RP, due to their significance level ($p<,05$).

Although innovativeness ($\beta=-,385$; $t= -7,192$; $p<,001$) demonstrated to have a negative meaningful negative effect on consumer's food neophobia, responsibility showed a positive

effect on the same variable ($\beta=.222$; $t= 4,248$; $p<.001$). Thus, it can be concluded that individuals who perceived higher level of food innovation are less likely to reject novel foods. And individuals who have a stronger sense of food responsibility are more selective towards such foods. The last paradox conclusion may indicate that consumers with a higher sense of responsibility may have more ethical caution and selectiveness towards new foods, not immediately accepting new foods. Concluding, **H8(b;c)-RP** are confirmed.

Consumer's involvement with foods and drinks showed no significant effect on food neophobia ($p=.343$), suggesting that the level of personal involvement with foods does not meaningfully influence their rejection towards new foods. For that reason, **H8a-RP** is rejected.

Table 51 resumes the hypotheses confirmation.

Table 51

Hypotheses of MLRM F and its confirmation/effect.

	Hypotheses	Confirmation	Effect
H8a-RP	Inv $\rightarrow$ FN-RP	Rejected	
H8b-RP	Inn $\rightarrow$ FN-RP	Confirmed	-
H8c-RP	Res $\rightarrow$ FN-RP	Confirmed	+

5.4.2. T-TEST FOR EQUALITY OF MEANS

To analyse the differences between genders in TPB constructs, food neophobia, food disgust, and intention to consume, it was developed a T-Test for equality of means (**Table 52**). The grouping variable was the gender, making possible to compare the means of the two groups (female and male) on the selected variables (Robson & McCartan, 2016). This test was pivotal to identify possible disparities in consumer behaviours regarding the gender.

Table 52

Independent T-Test for equality of means with gender as the grouping variable

Independent T-Test		
Grouping Variable	Gender (Feminine and Masculine)	
Test Variable	• Attitude (Att) • Subjective norms (SN) • Perceived behavioural control (PBC) • FN – willingness and trust (FN-WT) • FN – rejection and particularity (FN-RP) • Food disgust (FD) • Intention to consume (ItC)	• H9e • H10e • H11e • H8e-WT • H8e-RP • H12e • H13e

Firstly, it was analysed the significances obtained on Levene Test. If the variable obtained $p>.05$, it was assumed that the variances were equal; and if $p\leq.05$, it was assumed that the variances were not equal. Only 2 factors have variances not equal (Att and ItC) (Mooi & Sarstedt, 2014; Robson & McCartan, 2016). **Appendix J** resumes the results obtained.

The author concluded that the gender has an insignificant impact on most variables, with exception of food neophobia – willingness and trust ($t= 3,533$; $df= 389$; $p<,001$), and food disgust ($t= 2,650$; $df= 389$; $p=,008$). This results suggests that the female and male gender do not considerably differ their attitude, subjective norms and perceived behavioural control towards seaweed products, food neophobia – rejection and particularity and intention to consume seaweed products. In fact, only in food disgust and food neophobia – willingness and trust were observed statistically differences between feminine and masculine individuals.

By analysing the difference of means, it can be concluded that the male gender ($M=2,166$) shows significantly less food disgust towards seaweed, when compared to women ($M=2,446$), due to the mean of responses represent a lower level of seaweed' disgust. The same happens on food neophobia construct, which demonstrates that men ($M=2,431$) were significantly more willing and trusting of novel foods than women ($M=2,762$). Although there is a statistical difference between men and women, the general level of disgust and aversion is considered low for both genders. Both the averages of responses were lower than 3 – the midpoint of the scale – with means that male and female individuals reported a low degree of disgust and aversion, even women consistently show slightly higher averages.

Table 53 resumes the hypotheses confirmation.

Table 53

Confirmation of the hypotheses tested.

	Hypotheses	Confirmation
H9e	There are age differences in consumer's attitude (Att) towards seaweed products.	Rejected
H10e	There are age differences in consumer's subjective norms (SN) towards seaweed products.	Rejected
H11e	There are age differences in consumer's perceived behavioural control (PBC) towards seaweed products.	Rejected
H8e-WT	There are age differences in consumer's food neophobia – Willingness and Trust (FN_WT) towards seaweed products.	Confirmed
H8e-RP	There are age differences in consumer's food neophobia – Rejection and Particularity (FN_RP) towards seaweed products.	Rejected
H12e	There are age differences in consumer's intention to consume towards seaweed products.	Confirmed
H13e	There are age differences in consumer's food disgust (FD) towards seaweed products.	Rejected

5.4.3. ONE-WAY ANOVA TESTS

A One-Way ANOVA Test was carried out to verify if there is a significant difference in means of attitude, subjective norms, perceived behavioural control, food neophobia, food disgust, and intention to consume between different age classes, education levels, income levels, and individual's distance to the sea. With this test, it was possible to compare multiple groups, and find the differences between them.

Moreover, for all One-Way ANOVA Tests, this study carried out **Post Hoc Tests** to verify in which pairs of groups the results differ. Through the variance homogeneity, the author verified for which constructs the variances between groups are homogenised ($p > .05$) and applied the **Tukey Test**; for the dimensions with variances no heterogeneous between groups ($p \leq .05$), the **Games-Howell Test** was applied (Robson & McCartan, 2016). To simplify the lecture of the reader, the results (One-Way ANOVA Tests and Post Hoc Tests) are presented on **Appendix J**, as well as the confirmation of the hypotheses tested.

A. ONE-WAY ANOVA TEST FOR AGE

The following One-Way ANOVA Test pretends to analyse if there are significant differences on means on age by classes. **Table 54** aims to resume the hypotheses tested.

Table 54

One-Way ANOVA Test for age by classes factor.

One-Way ANOVA A		
Factor	Age by classes	
Dependent List	• Attitude (Att) • Subjective norms (SN) • Perceived behavioural control (PBC) • FN – willingness and trust (FN-WT) • FN – rejection and particularity (FN-RP) • Food disgust (FD) • Intention to consume (ItC)	• H9d • H10d • H11d • H8d-WT • H8d-RP • H12d • H13d

Analysing the results, it is possible to conclude that the dimensions that has a difference between ages ($p \leq .05$) is on TPB' constructs, intention to consume, and food disgust. There is no significant difference between ages on FN-WT ($p = .286$) and FN-RP ($p = .344$), which means that regarding FN, the individuals tend to exhibit similar perceptions and behaviours.

Individuals with more than 65 years tend to have the highest attitude ($M = 3,915$), and subjective norms ($M = 3,226$). Individuals aged between 35 and 44 tend to have a more positive perceived behavioural control (3,980) towards seaweed. Also, young individuals (18-34) are

more likely to exhibit higher disgust, contradicting the 55-64 group. Finally, the individuals with the highest intention to consume seaweed are the ones with 65 years or more ($M=3,656$), followed by the 35-44 group ($M=3,500$). In contrast, the younger range showed a lower, and negative consumption intention ($M(18-24)= 2,785$; $M(25-34)= 2,984$).

Through the Post Hoc Test, it was concluded that there is no significant difference between age classes on attitude, and subjective norms. On **perceived behavioural control** it was concluded that young individuals (18-24) have less behavioural control towards seaweed consumption than the ones aged between 35 and 44, due to the significance level be less than 0,05 ($p=,008$) and the difference of means be -0,614. On **intention to consume**, it was concluded that the individuals with 18-24 have significantly less intention to consume seaweed products than the adults with 35-44 years ($p=,011$; difference of means=-,715). And, finally, on **food disgust**, it was concluded that individuals between 55 and 64 years seems to have a highest food repulsion when comparing to the youngest individuals (18-24), due to the significance level be above 0,001 and the difference of means be 0,565.

B. ONE-WAY ANOVA TEST FOR EDUCATION

The following One-Way ANOVA Test pretends to analyse if there are significant differences on means on education level. **Table 55** aims to resume the hypotheses tested.

Table 55

One-Way ANOVA Test for education level factor.

One-Way ANOVA B		
Factor	Education Level	
Dependent List	- Attitude (Att) - Subjective norms (SN) - Perceived behavioural control (PBC) - FN – willingness and trust (FN-WT) - FN – rejection and particularity (FN-RP) - Food disgust (FD) - Intention to consume (ItC)	- H9f - H10f - H11f - H8f-WT - H8f-RP - H12f - H13f

Significant mean differences ($p \leq ,05$) were found on the consumer's subjective norms ($p=,031$), food neophobia – willingness and trust ($p=,018$), and food neophobia – rejection and particularity ($p=,018$). There is no significant difference between education level on the other's variables.

Although the results are considered low, the individuals that demonstrated a highest subjective norms have a secondary degree ($M= 2,978$). The individuals that show a higher food neophobia – for both factors of this construct – was the ones with a low degree of education

(M(FN-WT)= 3,188; M(FN-RP)=2,577), and the ones that demonstrated a lower degree were the ones with a high degree (M(FN-WT)= 2,577; M(FN-RP)=2,578).

Through the Post Hoc Test, it can be concluded that for subjective norms there is no significant difference between groups. For **food neophobia – willingness and trust** there is a significant difference between individuals with basic education, and the higher level ($p=,017$). Those with higher education had a higher average in this variable (difference of means= ,611), which means that individuals with more studies have more aversion to new foods. For the **food neophobia – rejection and particularity** it was concluded that there is a significant difference between individuals with basic education, and the higher level ($p=,022$). Those with higher education had a higher average in this variable (difference of means= ,595), which means that individuals with more studies have more aversion to new foods.

C. ONE-WAY ANOVA TEST FOR INCOME

The following One-Way ANOVA Test pretends to analyse if there are significant differences on means on income. **Table 56** aims to resume the hypotheses tested.

Table 56

One-Way ANOVA Test for income factor.

One-Way ANOVA C		
Factor	Income	
Dependent List	• Attitude (Att) • Subjective norms (SN) • Perceived behavioural control (PBC) • FN – willingness and trust (FN-WT) • FN – rejection and particularity (FN-RP) • Food disgust (FD) • Intention to consume (ItC)	• H9g • H10g • H11g • H8g-WT • H8g-RP • H12g • H13g

The level of income showed significant mean differences ($p\leq,05$) on the consumer's attitude, subjective norms, perceived behavioural control, food disgust, intention to consume, and food neophobia – rejection and particularity. There is no significant difference between the income on the rest of variables ($p>,05$). The point estimate per eta square informs the author about the effect between groups. It can be concluded that the effects of all variables are small or moderated. Intention to consume is the variables with the highest effect, which means that there is the variable more influenced by the consumer's level of income.

The individuals with an income between 36.001€ and 60.000€ ($M=3,637$) demonstrated to have a most positive level of intention to consume seaweed and the ones with the highest incomes (60.001€ or more) have the most negative consumption intention ($M=2,234$).

The author carried out the Post Hoc Test. For **attitude**, it was concluded that the individuals that earn between 36.001€ and 60.000€ show a more significantly positive attitudes towards seaweed products when compared to those who earn less than 24.000€ ($p=,002$), and those who preferred not to share their income ($p=,040$). For **subjective norms**, it was concluded that the group who earn 60.001€ or more has significantly lower subjective norms when compared to those who earn between 36.001€ and 60.000€ ($p=,008$), who preferred not to share the income ($p=,039$), and those who have no income ($p=,004$). This results show that consumers with higher incomes perceive less social pressure or expectation related to their behaviour towards seaweed products. For **perceived behavioural control**, it was concluded that individuals who earn between 36.001€ and 60.000€ reported to have a significantly higher perceived behaviour control than those who earn less than 24.000€ ($p=,033$). For **food disgust**, it was concluded that consumers with a lower income (less than 24.000€) have a significantly higher levels of foods disgust, when compared to those who earn between 24.001€ and 36.000€ ($p=,038$), and 36.001€ and 60.000€ ($p=,043$), suggesting that lower-income individuals may have more aversion and disgust towards seaweed products. For **intention to consume**, it was concluded that consumers with an income between 36.001€ and 60.000€ showed a significantly higher intention to consume when compared to those who earn less than 24.000€ ($p=,007$), and to those who preferred not to share their income ($p=,026$). In addition, those who earn more than 60.001€ reported a significantly higher intention than the 24.001€ - 36.000€ group ($p=,023$), and more than the 36.001€ - 60.000€ ($p=,003$). Based on that, it can be concluded that individuals with higher incomes have a stronger behavioural intention to consume seaweed products, reflecting that having a high level of economic resources encourages them to try these type of alternative protein. Finally, for **food neophobia – rejection and particularity**, it was concluded that consumers with an income lower than 24.000€ showed a higher aversion to new foods than those who earn between 24.001€ and 36.000€ ($p=,024$) and those who earn more than 60.001€ ($p=,026$). This means that individuals who have a higher income, are less likely to reject unfamiliar foods.

D. ONE-WAY ANOVA TEST FOR DISTANCE FROM SEA

The following One-Way ANOVA Test pretends to analyse if there are significant differences on means on distance from sea. **Table 59** aims to resume the hypotheses tested.

Table 57

One-Way ANOVA Test for distance from sea factor:

One ANOVA D		
Factor	Distance from Sea	
Dependent List	• Attitude (Att) • Subjective norms (SN) • Perceived behavioural control (PBC) • FN – willingness and trust (FN-WT) • FN – rejection and particularity (FN-RP) • Food disgust (FD) • Intention to consume (ItC)	• H9h • H10h • H11h • H8h-WT • H8h-RP • H12h • H13h

Mean differences were verified on distance to the sea ($p \leq 0,05$) in the consumer's attitude ($p=0,004$), perceived behavioural control ($p=0,021$), food disgust ($p=0,034$), and intention to consume ($p=0,003$). The point estimate per eta square informs the author about the effect between groups. It can be concluded that, despite minor effects (range between 0,017 to 0,029), the distance from sea has a highest statistically significant impact on consumer's attitudes.

Despite a more accentuated food disgust barrier among individuals that live far from the sea ($M=2,497$), these individuals tend to have a more positive attitude ($M=3,954$), a higher level of perceived behavioural control ($M=3,982$) towards seaweed products, and a strong intention to consume them ($M=3,520$).

Through the Post Hoc Test, it was concluded that all the variables with difference of means have a statistically significant difference between groups. For **attitude**, individuals who lives far from the sea have more negative attitudes towards seaweed, than those who lives near ($p=0,012$), or relatively near ($p=0,002$). In conclusion, individual's positive attitudes decrease with distance from the sea. For **perceived behavioural control**, those who lives far from the sea have a more negative perceived behavioural control towards seaweed, than those who lives near ($p=0,047$) or relatively near ($p=0,015$). Thus, individual's positive perceived behavioural control decreases with distance from the sea. For **food disgust**, individuals who lives relatively near to the sea demonstrate a higher food disgust towards seaweed products than those who lives near to the sea ($p=0,046$). Finally, for **intention to consume** it was concluded that individuals who lives far away from the sea have an intention to consume seaweed significantly lower than the ones who lives relatively near ($p=0,015$; difference of means=-0,580).

6. DISCUSSION & CONCLUSION OF RESULTS & FURTHER RESEARCH

Reaching the end of this dissertation, it is crucial to summarise the most relevant outcomes that will help the reader to fully understand the contribution made by this research.

After contextualizing the research problem and clearly defining the general and specific objectives, it was crucial to research the knowledge that existed in the literature. Due to its rigours and replicable nature, a SLR on the acceptability of seaweed products was developed, guided by the PRISMA protocol. After defining the criteria for this research, through the TCCM framework, each of the 29 selected articles – out of an initial total of 1044 – was analysed thoroughly. It was concluded that the topic of this research is constantly growing, with seaweed being mostly studied as a novel food in European countries, where its consumption is not common. Most of the studies used a quantitative methodology, with only 4 out of 29 using a mixed or qualitative methodology. After identifying the characteristics of this articles, it was possible to organise, in a logical and sequential way, different concepts that allowed the author to address concepts that responded to the studied general objective. The 4 big themes are: consumer responses towards seaweed products, which explored the response that the consumer gives towards the most talked attributes of seaweed products; consumer responses based on sociodemographic, which explores the impact of some sociodemographic factors on the response that the consumer gives; consumer responses based on food-related lifestyle, which explores the impact of involvement with foods and drinks, sense of innovation and consumer responsibility; and, finally, consumer attitudes and behaviours towards these products, where the dimensions of the TPB were explored.

Due to the dichotomy of perspectives between the articles analysed in the SLR, the author opted for a quantitative methodology using the questionnaire as the data collection technique due to its deductive nature, which better enables to respond to the specific objectives outlined. Primary data was collected using the valid responses of 391 individuals, in order to later be able to contrast this data with the secondary data, identified throughout the SLR. No studies which used the TPB and aimed to respond to this problem have been identified in Portugal. Therefore, it is assumed that the contributions of this research are pioneer and, for this reason, can be updated or challenged in the same context.

This chapter is organized in a sequential way. First, the delimited specific objectives were answered, and contrasted with the literature. Then, the theoretical and practical implications were reported. And, finally, the limitations and future works were presented.

6.1. THE ANSWER TO THE RESEARCH SPECIFIC OBJECTIVES

The following section discusses the results obtained in this research – in the Portuguese context – with the results obtained in others research – all of them outside of the Portuguese context. In addition, the author responded to the delimited specific objectives. For this reason, the information is organized by the order of specific objectives.

6.1.1. SPECIFIC OBJECTIVE 1

Specific Objective 1	Analyse the effect of consumers' attitude, subjective norms, and perceived behavioural control on intention to consume seaweed products.
-----------------------------	---

The first specific objective aimed to analyse the effect of consumers' attitudes, subjective norms and perceived behavioural control (the variables that belong to the original TPB) on intention to consume seaweed products. For this reason, specific objective 1 refers to the hypotheses **H1** (Att→ItC), **H2** (SN→ItC), **H3** (PBC→ItC).

Attitude is one of the predictors of behavioural intention (Ajzen, 1991; Bahraseman et al., 2025; Wahyuningtyas et al., 2024). The results of this research indicate that consumer's attitude is a significant and positive factor of intention to consume seaweed products, being the predictor with the most strength. In other words, the consumer's positive attitude towards seaweed products positively affect their intention to consume them. This was an unanimous conclusion throughout the literature review. In fact, both authors that analyse this direct effect, Bahraseman et al. (2025) and Tunca et al. (2024), mentioned that a positive attitude of consumer towards seaweed products, causes a positive intention to consume them. Moreover, Bahraseman et al. (2025) stated that attitude was the strongest predictor, as so happened in this research in the Portuguese context.

Subjective norms refer to an individual's perception of society expectations and pressures that influence a specific behaviour (Al-Thawadi, 2018; Bahraseman et al., 2025; Wahyuningtyas et al., 2024). In this research, subjective norms was the second most significant predictor of intention to consume seaweed, following the attitude construct. In consonance, the author discovered that positive subjective norms have a positive effect on intention to consume seaweed products, which means that the social pressure applied on consumer's directly contributes to their positive behaviour. This conclusion is supported by other authors that also studied this relationship (Al-Thawadi, 2018; Bahraseman et al., 2025; Tunca et al., 2024;

Wahyuningtyas et al., 2024). In addition, Lucas et al. (2019) reported that having friends or relatives who have already consumed these products would motivate the individual to try them too, suggesting that high subjective norms cause a high consumption intention.

Finally, **perceived behavioural control** reflects the confidence and perceived capacity of consumers to have a specific behaviour (Bahraseman et al., 2025; Govaerts & Ottar Olsen, 2023). On this research, the author found that perceived behavioural control demonstrated to have a significant and positive effect on consumer's intention to consume seaweed products, which means that the higher the perceived control of the individuals to consume seaweed, the higher their real intention to consume it. This result contradicted Tunca et al. (2024) that stated that perceived behavioural control does not have a significant impact on consumer's intention to consume seaweed products; however, Bahraseman et al. (2025) was in line with the results of the present study, referring that consumers who feel more in control over their capacity to consume seaweed products are more likely to express an intention to do it. They stated that due to this relationship, increasing the accessibility, affordability, and convenience of seaweed products could enhance individual's sense of control over their diet's consumption choices, which would encourage them to the integration of sustainable protein sources (such as seaweed) into their diet.

Answer to the Specific Objective 1

The results addressing specific objective 1 confirm all the relationships hypothesized in H1, H2, H3. The hypotheses were statistically significant and positive, which indicates that consumer's attitudes towards seaweed, the perceived social pressure to consume it, and their perceived control over consuming it contributes meaningfully to their intention to consume seaweed products. Moreover, attitude was the highest predictor of intention, followed by subjective norms, and perceived behavioural control. These findings align with the assumptions of the Theory of Planned Behaviour (Ajzen, 1991), reinforcing its applicability in predicting consumption behaviours, specifically in the sustainable food consumption intention of seaweed context.

6.1.2. SPECIFIC OBJECTIVE 2

Specific Objective 2	Analyse the effect of consumers' food neophobia and food disgust on their attitude towards seaweed products, and on their intention to consume them.
-----------------------------	---

The second specific objective aimed to analyse the effect of consumer's food neophobia and food disgust (two variables that are seen as a barrier to the consumption of novel foods) on their attitude and consumption intention of seaweed products. For this reason, specific objective 2 refers to the hypotheses **H4** (FN→ItC) – which is divided into **H4a** (FN_WT→ItC) and **H4b** (FN_RP→ItC) –, **H5** (FD→ItC), **H6** (FN→Att) – which is divided into **H6a** (FN_WT→Att) and **H6b** (FN_RP→Att) –, and **H7** (FD→Att).

Food neophobia, characterized by the aversion of trying new and unfamiliar foods, proved to be an insignificant predictor for consumer's intention towards seaweed products, due to the rejection of H4. This suggests a high potential for acceptance of emerging protein alternatives – such as seaweed – in the Portuguese population. This result goes hand in hand with Bahraseman et al. (2025), which found that food neophobia does not have a significant impact on consumer's intention towards seaweed products. However, most of the studies denoted food neophobia as a significant barrier towards seaweed consumption, referring that consumers with a high level of neophobia are less likely to eat seaweed products, due to their aversion to try novel foods (Al-Thawadi, 2018; Embling et al., 2022; Losada-Lopez et al., 2021; Michel et al., 2021; Moons et al., 2018; Onwezen et al., 2022; Palmieri et al., 2023; Palmieri & Forleo, 2020; Tunca et al., 2024; Wassmann et al., 2024; Young et al., 2022).

The construct of food neophobia was divided by the author in 2 factors (willingness and trust, and rejection and particularity). When analysing the direct effect of food disgust on consumer's attitude, it can be concluded that the individual's level of food neophobia significantly affects their attitude on just one dimension (willingness and trust). This suggests that food neophobia – willingness and trust plays a more influential role in shaping consumer attitudes towards seaweed products, possibly because it captures more impactful aspects of the construct in this context. Since this component of the variable has a negative effect on consumer attitudes, then food neophobia has a negative impact on consumer attitude. Moreover, it was discovered that food neophobia – willingness and trust in this study is the most influential predictor in the formation of the consumer attitudes towards seaweed. This suggests that consumers who are more open to try unfamiliar foods and who exhibit greater trust in novel

food products are more likely to form positive attitudes towards seaweed. Conversely, higher levels of food neophobia on this dimension, can act as a strong psychological barrier, discouraging the acceptance of seaweed-based foods. These results contradicted the results by Bahraseman et al. (2025), which studied the direct effect of food neophobia on consumer attitudes and found no significant effect between these variables. In this study, food neophobia directly and negatively impacts consumer attitude, and, therefore, only indirectly affects consumption intention. This suggests that the fear or aversion of try novel foods causes a more negative attitude on consumer, but that attitude is not strong enough to change their behaviour intentions, due to the other variables that have a higher impact on this decision.

Food disgust towards seaweed products proved to be a significant predictor of both individual's attitude and intention to consume seaweed. This study concluded that food disgust represents a barrier, due to the negative effect on their attitude and intention. In fact, this research found that food disgust negatively affects the consumer attitude towards seaweed and their intention to consume. This effect is higher on attitude than on intention, meaning that high levels of sensibility towards the attributes of seaweed causes a more negative attitude and lower intention to consume them. These results may have arisen due to the expected sensory characteristics of seaweed. In fact, in the descriptive analysis, it was concluded that the individuals showed a high level of disgust towards the sensory characteristics of seaweed, such as taste, texture, and odour. If the product is visually appealing and tasty, it will motivate the individuals to try seaweed (Birch et al., 2019; Piwovar et al., 2023; Rombach & Dean, 2024). This negative and significant effect on both variables was also confirmed in the study of Bahraseman et al. (2025), the only authors of the conducted SLR that analysed this relationship. These authors stated that food disgust reflects a psychological deep-rooted barrier, which stems from unfamiliarity and cultural biases. In fact, through the questionnaire analysis, it was concluded that 24% of the individuals never tasted or consumed any type of seaweed products and those who already consumed were commonly in an Asian scenario (such as sushi rolls, or dried seaweed in soups or salads). These findings highlight the pivotal role of cultural exposition and familiarity in shaping food acceptance and consumption behaviour. By normalizing the seaweed as food and educating people from countries that are not familiar with seaweed as food, it may be possible to overcome the food disgust barrier, promoting a wider adoption of this aliment as a sustainable protein source.

Answer to the Specific Objective 2

After analysing and comparing the results, it can be concluded that the results addressing specific objective 2 confirm the relationships between food disgust and attitude, and food disgust and intention to consume (H5 and H7, respectively), and the relationship between one of the dimensions of food neophobia (willingness and trust) and attitude (H6a). However, the hypotheses related to the effect of food neophobia on intention to consume (H4) is rejected, and so is the relationship between rejection and particularity dimension of food neophobia and attitude (H6b). Therefore, it can be concluded that food disgust acts as a psychological barrier that strongly inhibits consumer attitude and willingness to incorporate seaweed into their diet. Such aversion could origin from a negative sensory expectations of seaweed products, which reinforces the importance of promoting novel or sustainable food products. Food neophobia, on the other hand, does not showed a significant impact on consumers intention, and just have a meaningful impact on willingness and trust dimension on consumer's attitude. This reveals that even the aversion of trying novel foods can shape the individual's overall evaluation and feelings towards seaweed, but it does not directly affect their behavioural intention to consume it. This means that food neophobia influences how consumers perceive seaweed, but this perception alone is not sufficient to affect their intention to incorporate it into their diet. These results underscore the importance of examining psychological barriers to food innovation and distinguishing between attitudinal and intention behaviours.

6.1.3. SPECIFIC OBJECTIVE 3

Specific Objective 3	Analyse the effect of consumers' food-related lifestyle on their attitude, subjective norms, perceived behaviour control, and intention to consume seaweed products, and food neophobia.
-----------------------------	---

The third specific objective aimed to analyse the effect of consumer's food-related lifestyle variables on their attitude, subjective norms, perceived behavioural control, food neophobia, and intention to consume seaweed products. For this reason, specific objective 3 refers to the hypotheses **H8(a-c)** (FRL→FN) – which is divided into **H8_WT** (FRL→ FN_WT) and **H8_RP** (FRL→ FN_RP) –, **H9(a-c)** (FRL→Att), **H10(a-c)** (FRL→SN), **H11(a-c)** (FRL→PBC), and **H13(a-c)** (FRL→ItC).

Food-related lifestyle construct is divided into food involvement, food innovativeness, and food responsibility, the key drivers of sustainable consumption according to Tunca et al. (2024). The author of this research tested the effect of these variables on TPB, and on food neophobia, as happened on the research of Tunca et al. (2024). With an exploratory approach,

the author also aimed to explore the direct effect of these variables on the intention to consume seaweed products, due to the previous findings that related consumer's innovative sense, and environmental concerns with their intention to consume (Birch et al., 2019; Mellor et al., 2022; Palmieri et al., 2023; Rombach & Dean, 2024; Young et al., 2022). These conclusions are organized by the impact of each food-related lifestyle variable.

- **The influence of involvement**

Consumers who are more involved with food are generally expected to show a greater openness and responsiveness towards food-related behaviours (Birch et al., 2019; Onwezen et al., 2022; Tunca et al., 2024; Wahyuningtyas et al., 2024; Wassmann et al., 2024). Tunca et al. (2024) found that consumer's food involvement significantly influenced attitude, subjective norms, and food neophobia, suggesting that individuals who are more engaged with food tend to have more positive behaviours towards them.

However, in the present study, food involvement does not show a statistically significant effect on any of the variables analysed. This indicates that – contrary to previous findings – a higher level of involvement with food does not necessarily translate into more favourable attitudes, or normative influences or even a reduced level of food neophobia. Such discrepancy may be due to the cultural differences or the specific characteristics of the seaweed products. Based on the descriptive analysis, it was concluded that although most of individuals demonstrated a high level of involvement with food – particularly on a personal and emotional level – this does not appear to influence how they act or reduce their reluctance to try foods that are unfamiliar with their cultural context.

- **The influence of innovativeness**

It is expected that individual's sense of innovation towards food and drinks topic positively affects their sustainable consumption behaviour (Tunca et al., 2024). In this study, food innovativeness has been shown to have a meaningful and positive effect on just two of the dimensions: **subjective norms** and **perceived behavioural control**. This means that the more innovative, regarding food, an individual is, the more social pressure they feel to act in a certain way and the stronger the perceived social pressure to behave accordingly. Also, the strongest predictor of perceived behavioural control is innovativeness, highlighting the role of open-minded individuals to new experiences in shaping consumer's confidence and perceived ability to engage with novel foods such as seaweed. Not fully agreeing with these results is Tunca et al. (2024), who found that consumer's level of food innovation just influenced their attitude and subjective norms. In this case, the author found a significant effect of food

innovation on perceived behavioural control and no effect on attitude. Also, Weinrich and Elshiewy (2023) found that the target group for seaweed products are open to try new food and recipes, being individuals with a high sense of innovation. However, in this study, there is no significant relation between a consumer's sense of innovation and their real intention to consume seaweed.

Regarding **food neophobia**, it was concluded that food-related lifestyle significantly contributed to predict it on the *willingness and trust* dimension, more than in the *rejection and particularity* dimension. In the *willingness and trust* dimension, although it is only having food innovativeness to negatively impact food neophobia, this impact is considered high. This means that the higher the perceived innovation level of an individual, the lower their neophobia is, and, consequently, a lower probability to reject novel foods is verified. On the other side, the food neophobia on the dimension *rejection and particularity*, proved to be significantly influenced by individual's sense of innovation. The sense of innovation is the most significant factor of this variable and proved to be negative on food neophobia. This means that individuals who perceived themselves as more innovative regarding food are less likely to reject novel foods. This result aligns with the one by Tunca et al. (2024), who found that consumer's food innovation negatively influenced food neophobia. Govaerts and Olsen (2024) added that a high level of food innovation is related with a higher level of interest, curiosity, and knowledge about seaweed, and, consequently, a lower level of neophobia towards these products, conclusion in line with the findings of this research.

- **The influence of responsibility**

Food responsibility is the sense of environmental and social responsibility towards foods and drinks, and some authors discovered that this has a positive and significant effect on consumer's attitude towards seaweed products (Tunca et al., 2024; Wahyuningtyas et al., 2024; Wassmann et al., 2024). In this study, individual's responsibility with foods and drinks showed to have a meaningful positive impact on, respectively, consumer's **subjective norms, attitude and perceived behavioural control**. This means that individuals with higher levels of responsibility with foods and drinks are more likely to develop favourable attitudes towards seaweed and perceive greater social encouragement. These results go hand in hand with Tunca et al. (2024), who found that consumer's food responsibility directly influenced attitude, subjective norms, and perceived behavioural control.

Responsibility also has a strong and positive impact on consumer's **intention to consume** seaweed, which means that individuals who feel more responsible about their dietary

choices express a stronger intention to consume seaweed, possibly due to the health, ethical, or environmental concerns. In fact, this result was previously studied by other authors, who found that responsibility is related with sustainable concerns that are proved to positively influence consumer acceptance and attitude towards seaweed products (Mellor et al., 2022; Palmieri et al., 2023; Young et al., 2022). In consonance, Rombach and Dean (2024) found a significant relationship between food safety concerns and willingness to eat seaweed. As so did Birch et al. (2019), who mentioned that individuals who are responsible with food and care about food safety issues are more likely to eat seaweed. In this way, marketing strategies need to reflect this desire for more safer food, and this should cover all the supply chain, from harvesting, production, and processing of seaweed products. Conversely, Moons et al. (2018) contradicts this results, mentioning that consumer's sustainability concerns are not considered a driver to experiment seaweed products.

Responsibility was the only significant predictor of food-related lifestyle construct that shows a meaningful effect on attitude and intention to consume. Also, food responsibility is the strongest subjective norms' predictor, which reinforces the importance of this dimension on food-related lifestyle construct to promote sustainable food behaviours.

On the other side, **food neophobia** on *rejection and particularity* dimension, proved to be significantly influenced by the individual's sense of responsibility. Food responsibility has been proved to have a positive impact on food neophobia. It is possible to contrast this result with the study of Tunca et al. (2024), who found that consumer's responsibility negatively affected their food neophobia. In the present study, however, a positive effect was observed, suggesting that – in the Portuguese context – individuals who feel more responsible about their food choices may also be more cautious towards unfamiliar foods. This may indicate that consumers with a higher sense of responsibility may have more ethical caution and selectiveness towards new foods, not immediately accepting new foods, even those considered healthy and environmentally friendly.

Answer to the Specific Objective 3

After analysing and comparing the results, it can be concluded that food-related lifestyle dimensions generally affect the consumer's purchase behaviour. Food involvement was the only variable that was proved to be insignificant in the prediction of this behaviour. Food innovativeness showed a strong and negative effect, respectively, on both food neophobia factors. It was also affected, in a positive way, the individual's perceived behavioural control, and subjective norms. Food responsibility was the dimension with the most impact on the selected

variables. It has a positive effect with a greater robustness in, respectively, subjective norms, attitude, food neophobia – rejection and particularly, perceived behavioural control, and, ultimately, on intention to consume.

6.1.4. SPECIFIC OBJECTIVE 4

Specific Objective 4	Measure consumers' willingness to eat and pay specific seaweed-based food products.
-----------------------------	--

The specific objective 4 aims to analyse the consumer's behaviour towards a range of specific seaweed products. As highlighted by some authors, testing the product acceptability among individuals could improve their willingness to try them. However, due to the cost of testing novel foods, measuring its acceptability is the most recommended solution (Embling et al., 2022; Palmieri & Forleo, 2020).

Seaweed consumption is not common in European countries, as it is a new and unfamiliar food source for most individuals (Embling et al., 2022; Mellor et al., 2022). This study concluded that, although a significant portion of the sample (24%) has never consumed seaweed products, most of respondents are familiar with them, primarily through Asian cuisine contexts. In fact, seaweed in sushi rolls were the most consumed item (67,3%), followed by dried seaweed in salads, or soups (44,7%). This suggests that while seaweed is still relatively novel for some consumers, there is a growing exposure and acceptance of seaweed products. Moreover, some respondents provided personalized answers, mentioning additional seaweed-based products already consumed by them – such as seaweed cereals, paste, smoothies, or jelly. Although this research does not study the subjective knowledge of individuals towards these products, the last fact may indicate a broader familiarity and interest in seaweed consumption, which contrasts with Young et al. (2022) who highlighted the poor knowledge of consumers.

For a range of specific seaweed products – selected based on their availability in the two main reference supermarkets from Portugal – this study examined consumer's willingness to eat and pay them. All the products proved to be interesting for individuals due to the favourable consumption intention. In fact, according to several authors, the sensory properties and appeal of seaweed-based products are an important key driver for its acceptance (Al-Thawadi, 2018; Begho, 2024; Birch et al., 2019; Embling et al., 2022; Palmieri & Forleo, 2022; Piwowar et al., 2023; Weinrich & Elshiewy, 2023).

Seaweed in sushi rolls were the product with the highest level of willingness to eat, with 67,3% of respondents demonstrating interest on eating this product. On the other side, seaweed and carrot burger was the item with the lowest level of willingness to eat, while most of the answers revealed a neutral desire to try this product. Mellor et al. (2022) stated that individuals associate seaweed-based products (when seaweed is used as a secondary ingredient) with processed foods that are, therefore, less healthy, which can decrease their willingness to try them (Al-Thawadi, 2018). This contradicts Michel et al. (2021), who revealed that presenting meat alternatives in familiar shapes – such as hamburger – might encourage its consumption, as they are familiar with them. Moreover, tasting experiences could improve the acceptability of less expected products with seaweed, which could enhance the willingness to try them (Embling et al., 2022; Palmieri & Forleo, 2020).

In addition, the author examined their willingness to pay for these same products, aiming to understand not only the acceptance of these products, but also their perceived value. Individuals showed a lower willingness to pay for aromatic seaweed, followed by seaweed snacks and dried seaweed used in salads, or soups. The products with the highest willingness to pay were the sushi rolls, and the seaweed and carrot burger. Despite the seaweed and carrot burger being the item with the lowest willingness to eat among respondents, it is still one of the products for which they are most willing to pay, probably due it being perceived as a more satisfying meal option, potentially justifying a higher price.

Since these were the products that exist in the Portuguese market, it is possible to compare the price that the individuals were willing to pay with the actual retail prices of the products. As stated by Weinrich and Elshiewy (2023), the price of seaweed products must be competitive with meat alternatives, and this characteristic is frequently noted as a barrier to its consumption (Mellor et al., 2022). In this study, it was concluded that individuals are not completely aware of the actual prices of the selected products. In most cases, the most mentioned price range were significantly lower than the actual price, which suggests an underestimation of the products. Only one of the items exceeded the actual market price: seaweed and carrot burger. This indicates a high perceived value of this product, due to the individual's nutritional and satisfying perception. Increasing product visibility and consumer's familiarity could help to mitigate this gap, supporting more accurate price expectations.

In relation to the origin of the seaweed products, there is a clear preference for locally sourced options. Most respondents (95,7%) were willing to pay more for a seaweed product of Portuguese origin, contrasting with a mere 4,3% that are willing to pay more for imported

seaweed products. These results are supported by Brayden et al. (2018), Mellor et al. (2022), and Weinrich and Elshiewy (2019), who found that individuals are more willing to eat and pay more for local products.

Answer to the Specific Objective 4

Seaweed in sushi rolls and dried seaweed were the most consumed forms of seaweed and 24% of the respondents never tasted any product with this alternative source. Individuals generally showed a high level of willingness to eat seaweed in sushi rolls, dried seaweed, aromatic seaweed, snacks, and burgers. The product with the lowest intention to consume was the last one, probably due to the low level of familiarity with it (only 5,4% have already consumed it). Consumers are not fully aware of the actual market prices of the selected seaweed-based products, and, in the most cases, they were willing to pay less than the actual price. Finally, most of individuals were willing to pay more for Portuguese products.

6.1.5. SPECIFIC OBJECTIVE 5

Specific Objective 5	Analyse the differences across sociodemographic groups (age, gender, education, income level, and distance from the sea) in relation to the Theory of Planned Behaviour variables, intention to consume, food neophobia, and food disgust.
-----------------------------	---

The fifth specific objective aimed to analyse the differences across sociodemographic groups (age, gender, education, income, and distance from the sea) in relation to the consumer's attitude, subjective norms, perceived behavioural control, intention to consume, food neophobia, and food disgust. Specific objective 5 refers to the hypotheses **H8(d-h)**, **H9(d-h)**, **H10(d-h)**, **H11(d-h)**, **H12(d-h)**, and **H13(d-h)**.

- **Differences in Age**

In this research, it was found that age plays a significant role in most of the variables, with the exception of food neophobia. This means that the age of an individual does not significantly affect the aversion of them towards unfamiliar foods, contradicting various authors (Embling et al., 2022; Govaerts & Olsen, 2024; B. Lucas et al., 2023; Michel et al., 2021; Palmieri et al., 2023; Tunca et al., 2024). These authors stated that older individuals show generally higher levels of neophobia compared to the younger segment, admitting that they are less likely to consume seaweed. However, Young et al. (2022) stated that individuals with a higher degree of neophobia were the younger ones. Neither perspective could be proved in this research.

It was found a difference of ages regarding individual's attitudes, subjective norms, perceived behavioural control, food disgust, and intention to consume, which means that age shapes the individual's psychological, and behavioural responses towards seaweed consumption. In attitude and subjective norms no significant difference between age classes was found. These conclusions were in line with Tunca et al. (2024), who identified age as a critical factor in shaping consumer perceptions and behaviours.

In food disgust, young individuals (18-24) showed lower levels of food disgust than the older individuals (55-64). In fact, Govaerts and Olsen (2024) noted that older individuals tend to exhibit more conservative dietary habits, which can reduce its likelihood of adopting novel and unfamiliar foods in their diet. In addition, knowledge about seaweed and prior experiences with this novel source play a crucial role in shaping consumer's perceptions and, consequently, their likelihood of consumption (Al-Thawadi, 2018; Begho, 2024; Embling et al., 2022, 2024; Mellor et al., 2022; Palmieri et al., 2023; Tunca et al., 2024). Given the novelty characteristic of seaweed, younger individuals appear to exhibit less disgust towards it, possibly because they are more familiar with such trendy products and more exposed to emerging food trends.

Finally, the adults aged between 35 and 44 denoted to have a higher intention to consume seaweed than those who are younger (18-24). This contrasts with the findings of Young et al. (2022) and Birch et al. (2019), who identifies young consumers as the most promising market for seaweed products. In contrast, the present study suggests that the intention to consume seaweed may be stronger among more mature age groups, indicating that in the Portuguese context, consumer openness towards seaweed may be associated with older and, potentially, more health-conscious individuals.

- **Differences in Gender**

In this study, the differences of gender have a significant difference of means on food neophobia – willingness and trust, and food disgust. Only in these variables statistical differences between the behaviour of feminine and masculine individuals were observed. This results are contrasting with Tunca et al. (2024) who found differences between genders in attitude, subjective norms, and perceived behavioural control, but not on food neophobia.

In this study, women showed a higher level of food disgust towards seaweed and a high level of neophobia towards novel foods. This means that – in the Portuguese context – the female gender shows a greater tendency to reject unfamiliar foods, reflecting a more conservative approach to dietary experiences and a lower openness to culinary diversity. This leads to a significantly higher disgust towards seaweed products, possibly due to the previous

stated aversion towards novel foods or lack of knowledge and experiences with these products. As a result, female individuals may be less willing to incorporate such items into their diet, even though there is no significant difference on the intention to consume seaweed on both genders. These results were similar with Li et al. (2019), Embling et al. (2022), and Wassmann et al. (2024) that found the male gender to be more open to novel foods, contradicting Birch et al. (2019), and Begho (2024), who identified women as a key target market for seaweed.

- **Differences in Education**

Education level plays a significant role on individual's subjective norms and food neophobia. On the other variables, its effect is insignificant, and does not affect the individual's behaviours or intention towards seaweed. On the study of Tunca et al. (2024), it was not found any significant evidence of differences between education levels on subjective norms, as happens in this study.

This study found that individuals with a higher education tend to exhibit a higher food neophobia, when compared to the ones with a basic education level, as happened in Tunca et al. (2024). This finding suggests that higher educational levels does not necessarily correlate with greater openness to novel foods. It may reflect a more critical or cautious approach to unfamiliar food items among the highly educated, possibility due to other variables such as health or environmental awarenences, or food safety concerns.

According to various authors from literature, education is a strong predictor of influence the seaweed consumption (Embling et al., 2022; Moons et al., 2018; Tunca et al., 2024; Wassmann et al., 2024; Young et al., 2022). However, in this study, it was not found any significant different between education levels on intention to consume seaweed.

- **Differences in Income Level**

Consumer's income level affects the way they shop and choose their food. In this study, it was found that income level played a crucial role in the formation of attitudes, subjective norms, perceived behavioural control, food disgust, food neophobia (only in rejection and particularity dimension) and, finally, intention to consume.

Individuals with high income levels (36.000€ - 60.000€) tend to show a higher attitude and perceived behavioural control towards seaweed products than the ones with lowest incomes (less than 24.000€). However, the individuals with higher incomes (more than 60.000€) showed a lower level of subjective norms than the ones that do not have income and more than the ones with income between 36.000€ and 60.000€. This means that individuals with higher financial autonomy may feel less social pressure or external influences when

making food-related choices. Their consumption choices may be driven by other factors such as internal motivations rather than by the perceived expectations from others. Individuals with a higher level of food neophobia, and food disgust tend to have lower incomes. Finally, in a gradual pattern, the higher the level of income, the greater the individual's intention to consume seaweed. For example, individuals with incomes lower than 24.000€ showed a lower intention to consume seaweed than the ones who gain between 36.000€ and 60.000€. Consequently, individuals who gain between 24.000€ and 60.000€ are less likely to eat seaweed, than those who have an income level higher than 60.000€.

These results contradict Tunca et al. (2024) who referred that income did not have influence in consumer's behaviours towards seaweed products, in the Iranian context. However, the results of this study go hand in hand with Mellor et al. (2022), Wassmann et al. (2024), and Young et al. (2022) who identify the individuals with a high purchasing power, who have higher incomes and larger funds available to allocate to food, as the ones who are more likely to represent the potential target market for seaweed consumption.

- **Differences in Distance from the Sea**

Geographic location of consumers is a critical factor in shaping consumer's perception of seaweed (Piwowar et al., 2023; Tunca et al., 2024). In this study, the author found statistical differences on attitude, perceived behavioural control, food disgust, and intention to consume related to the individual's distance to the sea.

Individuals who live far from the sea are expected to have a more positive attitude and higher perceived behavioural control towards seaweed than those who live close or relatively close to the sea. Those who live at an intermediate distance to the sea, showed a higher disgust level towards seaweed than those who live close to the sea. Finally, individuals who live relatively close to the sea are more likely to show a lower openness to consume seaweed than those who live far away from it, possibility due to their sense of innovation and curiosity.

Tunca et al. (2024) were the only authors that studied the effect of individual's distance to the sea on consumer's behaviour. Due to the familiarity of individuals with the marine foods, they found that geographical proximity to the sea positively influenced individual's attitude and perceived behavioural control, contradicting the scenario on the Portuguese context. These authors also found significant differences in subjective norms and food neophobia, which was not encountered in the Portuguese context. Also, these authors did not find an influence of distance from the sea with level of disgust towards seaweed, and, consequently, intention to consume them, which was proved to be crucial in the Portuguese context.

Answer to the Specific Objective 5

Gender proved to be pivotal on shaping individual's level of disgust towards seaweed and food neophobia (willingness and trust). There were also denoted differences between age classes on individual's attitude, subjective norms, perceived behavioural control, food disgust, and intention to consume. Education level played a crucial role on subjective norms and food neophobia. Individual's income level also showed importance on predicting attitude, subjective norms, perceived behavioural control, food neophobia (rejection and particularity), food disgust, and intention to consume. Finally, different geographic distance to the sea proved to be fundamental in shaping individual's attitude, perceived behavioural control, food disgust, and intention to consume seaweed products.

6.1.6. SPECIFIC OBJECTIVE 6

Specific Objective 6	Identify the profile (key sociodemographic, psychological, and behavioural characteristics) of Portuguese seaweed products consumers.
-----------------------------	--

Finally, the sixth specific objective aims to characterize the profile of the Portuguese individuals who express a higher intention to consume seaweed products, based on the hypotheses formulated and studied before.

Based on sociodemographic factors, it was concluded that age, distance from the sea, and level of income were the sociodemographic factors who directly affect the individual's intention to consume these products. The individuals that showed a high and positive intention to consume seaweed were the ones with 65 years or more. To the best of author's knowledge, all the studies mentioned that younger individuals were more likely to consume seaweed, due to their adventurous profile. However, the Portuguese individuals studied in this research contradicted these findings, as mentioned on specific objective 5 (Birch et al., 2019; Embling et al., 2022; Govaerts & Olsen, 2024; S. Lucas et al., 2019; Michel et al., 2021; Palmieri et al., 2023). The individuals with higher incomes (between 36.001€ and 60.000€) demonstrated to have the most positive level of intention to consume seaweed, however the ones that gain 60.001€ or more have the most negative consumption intention. Some authors of the literature have also reported similar findings, suggesting that purchasing power facilitates the choice of sustainable dietary options (Wassmann et al., 2024; Young et al., 2022). Finally, this study found that Portuguese individuals that live far away from the sea showed a strong intention to consume seaweed. This result contradicted Tunca et al. (2024), who found that individuals who

lived near to the sea showed a higher propensity to consume seaweed than the ones who lived inland.

Moreover, individuals with a more positive attitude, subjective norms, perceived behavioural control, and responsibility with food, and a lower level of food disgust towards seaweed demonstrated to have the highest intention to consume them. These findings were previously analysed on specific objective 1.

Answer to the Specific Objective 6

Generally, individuals showed a moderated intention to consume seaweed products. Almost half of respondents (44%) showed a neutral urge to consume seaweed, which may indicate indecision about the future consumption. However, specific objective 6 delimited the profile of most expected consumer of seaweed. The Portuguese key target market identified in this research were the 65+ individuals with high incomes who lives inland. They have a responsible behaviour towards foods, positive attitudes, subjective norms, perceived behavioural control, and a low level of disgust towards seaweed.

6.2. IMPLICATIONS OF THIS STUDY

On the next section, the theoretical and practical implications will be presented, aiming to summarise the importance of this study.

6.2.1. THEORETICAL IMPLICATIONS

The theoretical implications of this study are at the heart of its contribution to scientific knowledge. This study can be regarded as unique for several reasons.

As a foundational element, a SLR was employed. This rigorous and replicable method allowed the author to understand and identify critical unexplored areas in the current literature about the consumer acceptability of seaweed products. The gaps were delimited, and, based on some of them, this research was carried out.

The elements of TPB, originally developed for more general behaviours (Ajzen, 1991), proved to be good predictors of the intention to consume seaweed, reinforcing its applicability in novel food contexts. This highlights the relevance of attitude, subjective norms, and perceived behavioural control as the main drivers of intention, even for an emerging food in Portugal. All these predictors were deemed crucial for the consumption of seaweed by individuals, notably the attitude – which has a stronger power in this model. This suggests that

the personal beliefs and evaluations about seaweed products are pivotal to shape individual's purchase behaviour. Moreover, this research revealed that consumer's attitude towards seaweed products was significantly influenced by consumer's food disgust and one of the dimensions of food neophobia – both on a negative way – and by responsibility towards foods and drinks – in a positive way. This highlights the crucial interplay of visceral emotional responses, and established dietary values in determining the acceptance of emerging food sources.

This study also makes a theoretical contribution by demonstrating how food neophobia and food disgust can be integrated into a TPB model, acting as predictors of intention to consume seaweed products. To the best of the author's knowledge, this study was the first to adapt and validate the Food Neophobia Scale in Portugal – developed by Pliner and Hobden (1992). Factor analysis based on the FNS did not verify the one-dimensionality case of this scale. In the results of the present survey, it can be observed that two factors clearly distinguished the negatively and positively worded items. The factors were: willingness and trust, and rejection and particularity, which separate the negatively and positively worded (reversed) food neophobia' scale items, with the rejection and particularity having a stronger explanatory power.

Literature refers to food neophobia as one of the main barriers to consumption of novel foods, however, in this Portuguese study, this predictor proved to be insignificant. This suggests that Portuguese' individuals do not have a strong neophobia towards foods that are unfamiliar to their culture – such as seaweed – that can meaningfully affect their consumption intentions. Although food neophobia does not significantly affect consumer's intention to ingest seaweed, it negatively affects consumer' attitudes, as previously stated, representing an indirect predictor of intention. It means that food neophobia does not directly block individuals from consuming seaweed, but it does make them feel a certain way about it, which affects their intention. Moreover, individual's level of disgust towards seaweed (particularly towards textures, smells, or appearance) proved to be crucial in purchase behaviours. This specific emotion can inhibit purchase intention, even if the overall attitude is positive – representing, therefore, a consumer barrier. Meanwhile, food disgust towards seaweed is a consumer's characteristic rarely studied in the literature. Yet, for the Portuguese context, it proved to be a powerful emotion. Thus, studies about unfamiliar food sources could be enriched with this construct that proved to be a barrier in seaweed consumption, enhancing the understand of the factors that affect consumer's behaviours.

Including individual's food-related lifestyle choices on TPB enriched its explanatory power regarding seaweed acceptance. This suggests that pre-existing dietary orientations provide crucial contextual understanding of consumer's attitudes, subjective norms, and perceived behavioural control. It was also analysed the effect of FRL dimensions on food neophobia, which lead to an unexpected conclusion, in the Portuguese context: a high level of responsibility towards foods reflects into a high level of aversion to try unfamiliar foods, potentially driven by concerns over safety, quality, or perceived dietary integrity.

This research contributes to the TPB by demonstrating how age, gender, education, income level, and individual's distance from the sea contextualize the formation of consumption intentions of seaweed products, through the analysis of the differences between groups. The geographic proximity to the sea strongly reflects different behaviours towards seaweed products, which is a factor often overlooked in the broader literature regarding seaweed acceptance, but proved to influence multiple variables within the theoretical model of this study.

Finally, this research theoretical contributes to the existent body of knowledge on the drivers and barriers to the adoption of seaweed as a *future* food. The results of this study identified different relationships between the variables that directly and indirectly influence purchase intention, helping to better understand the factors that lead Portuguese individuals actions towards seaweed products, and, above all, adding new knowledge to the literature in this field.

6.2.2. PRACTICAL IMPLICATIONS

The findings of this study provide significant practical implications for marketing strategies and policy formulations, both to companies that produce seaweed products and those that can incorporate seaweed into their existing product lines.

In fact, this pioneering research provides novel insights into consumer's intentions regarding seaweed as an alternative protein in the Portuguese context, offering valuable insights for companies, by identifying key factors that impact consumer acceptance of seaweed.

First, the strong influence of attitudes regarding consumption intention suggest that marketing professionals should prioritize strategies that aim to reinforce positive consumer attitudes towards seaweed. In fact, as positive attitudes represent a fundamental driver for purchase intention, marketing campaigns should highlight the intrinsic benefits of the product,

reinforce positive experiences, and use persuasive messaging to shape consumer perceptions and beliefs. Moreover, investing in educational content marketing and interacting with individuals in order to create perceived value could be more effective than solely focusing on accessibility or price. Following attitude, subjective norms also reported a positive effect on consumer intentions. Therefore, the collaboration with authority figures and the development of campaigns that show the seaweed consumption in social contexts could emphasise acceptance and popularity among consumer reference groups. Perceived behaviour control was the weakest predictor of intention – but is proved to be strong enough to affect it. For that reason, increasing the variety of formats in well-known Portuguese supermarkets could enhance its accessibility and, consequently, consumption. Furthermore, to increase consumer perceived capacity to eat seaweed, it could be useful to offer cooking workshops to show how seaweed can be easily incorporated into everyday dishes (not only in Asian contexts – the most consumed way of seaweed reported by the individuals – but also in soups, salads, or even as condiment). Finally, due to the strong influence of food disgust on consumption and consumer' attitudes, it would be helpful to gradually introduce seaweed in formats that minimize the initial sensory shock (visual or textural), or introducing them as a complementary ingredient on comforting Portuguese foods. Moreover, contextualizing the individuals about the health and environmental benefits of seaweed could lead to a greater level of familiarisation with this novel source, promoting their consumption. Highlighting the safety, origin, and the certification on an appellative packaging could also enhance the consumer purchase intention.

Such strategies could be more effective if they targeted the individuals who show remarkable intentions to consume seaweed products. Age, geographical distance to the sea, and level of income prove to be crucial sociodemographic factors. Therefore, the previously explained strategies should address older individuals (65+), with a high level of income (between 56.00€ and 60.000€), and who live far from the sea, as these were the individuals who demonstrated the highest level of consumption intention in studied population.

Collectively, these strategies could drive to the adoption of seaweed products, transforming them from a niche food to an integral part of the Portuguese diet. Concluding, the implementation of these marketing strategies based on the findings of Portuguese consumer behaviour are crucial to unlock the vast potential of seaweed for a more resilient, sustainable, and healthy food future.

6.3. LIMITATIONS AND FUTURE RESEARCH

Despite the contributions, this study is not without limitations, which open avenues for future research. Firstly, the author identified the limitations inherent to this study, and then the paths for future research were outlined, based on the trajectory taken in this dissertation.

6.3.1. LIMITATIONS OF THIS STUDY

The reliance of **self-reported data** introduces the possibility of bias, considering that respondents may overstate their attitudes towards seaweed, and under or overreport their negative feelings about seaweed characteristics. This is particularly relevant when considering the impact of food neophobia on intention to consume seaweed. While overall food neophobia did not directly impact purchase intention in the Portuguese context, it is important to acknowledge that the underlying fear of the unknown – a widely studied barrier in the literature on novel foods – can still directly influence the Portuguese population's seaweed consumption.

Furthermore, the **low sociodemographic diversity** of the sample was another encountered limitation. The sample size should be larger in order to achieve greater sociodemographic heterogeneity that influence consumer's food choices – particularity in terms of diet (almost 90% were omnivorous), distance from the sea (few people reported to live far away from the sea), and education level (the most common level was higher education).

This study applied **MLRM's** to analyse the relationship between the dependent, and the independent variables. Nonetheless, a Structural Equation Model (SEM) could have been carried out. This is a multivariate statistical test that makes possible to analyse complex relationships between multiple variables at the same time, without the need to make several models – as was the case in this dissertation (Mooi & Sarstedt, 2014).

In addition, **several motivations and barriers** that have been proved, in other studies, to be crucial in the formulation of consumer intentions **were not studied**. This study only investigated food neophobia, food disgust, and food-related lifestyle of the individuals. Therefore, other variables that could be crucial to understand the consumer's intentions in the Portuguese context were not explored, such as health consciousness, symbolic value of food, or subjective knowledge about seaweed (Al-Thawadi, 2018; Bahraseman et al., 2025; Rombach & Dean, 2024; Tunca et al., 2024; Weinrich & Elshiewy, 2023).

Finally, since the author identified the gaps in the literature based on 29 selected articles from an SLR, with previously determined inclusion and exclusion criteria, it was **not possible**

to analyse some articles that addressed the TPB on novel food context. In this regard, the contrast or agreement between the results obtained on this research, and those found in the literature could be more enriched.

6.3.2. FUTURE RESEARCH DIRECTIONS

The author suggests performing **cluster segmentation** (*K-means clustering technique*) of individuals by segmenting the food-related lifestyle dimensions. This technique enables the grouping of consumers with similar food-related behaviours, attitudes, and motivations, aiming to develop targeted strategies and communication to the specific needs and motivations of each cluster and to understand their respective differences in sociodemographic factors (Tunca et al., 2024; Weinrich & Elshiewy, 2023).

This study was only carried out over a short period of time. It is therefore suggested that future studies should carry out **longitudinal studies**, in order to track changes in consumer's preferences, reluctance, and disgust towards seaweed, and consequently their attitudes and behaviours over time (Brayden et al., 2018; Onwezen et al., 2022; Tunca et al., 2024).

Moreover, the quantitative design of this research could be complemented with **qualitative methods** – such as focus groups – to gain richer insights about preferences, motivations, and barriers to the seaweed consumption. Also, evaluating specific seaweed-based products (such as seaweed burgers, lollipops, chips, or juice) through direct testing could capture genuine participant reactions and comments, providing valuable insights to understand Portuguese consumer acceptance and preferences (Weinrich & Elshiewy, 2019; Palmieri et al., 2023; Rombach & Dean, 2024; Wassmann et al., 2024).

Finally, the author also suggests the **integration of other variables on the Theory of Planned Behaviour**, besides the selected variables (food-related lifestyle, food neophobia, food disgust, and sociodemographic factors). Thus, analysing the effect of motivation and barriers on seaweed consumption – such as health awareness, symbolic value of food, food safety concerns, subjective knowledge about seaweed, or marketing-mix variables – could enhance the predictive power of the model, and a better understanding of the consumer's intention to consume seaweed-based products (Bahraseman et al., 2025; Tunca et al., 2024).

7. BIBLIOGRAPHICAL REFERENCES

- Ajzen, I. (1991). The Theory of Planned Behavior. In *Organizational Behavior and Human Decision Processes*, 50(2), 179–211. [https://doi.org/10.1016/0749-5978\(91\)90020-T](https://doi.org/10.1016/0749-5978(91)90020-T)
- Albertsen, L., Wiedmann, K. P., & Schmidt, S. (2020). The impact of innovation-related perception on consumer acceptance of food innovations – Development of an integrated framework of the consumer acceptance process. *Food Quality and Preference*, 84, 103958. <https://doi.org/10.1016/J.FOODQUAL.2020.103958>
- Al-Thawadi, S. (2018). Public perception of algal consumption as an alternative food in the Kingdom of Bahrain. *Arab Journal of Basic and Applied Sciences*, 25(1), 1–12. <https://doi.org/10.1080/25765299.2018.1449344>
- Bahraseman, S. E., Dehghani Dashtabi, M., Karbasi, A., Firoozzare, A., Boccia, F., & Hosseinzadeh Nazeri, Z. (2025). Moving towards novel and sustainable foods: Investigating consumers' intention to consume algae-based foods in a developing country. *Appetite*, 206. <https://doi.org/10.1016/j.appet.2024.107801>
- Begho, T. (2024). Sentiments, barriers and predictors of acceptance for meat alternatives among UK meat consumers. *Food and Humanity*, 3. <https://doi.org/10.1016/j.foohum.2024.100461>
- Bell, E., Bryman, A., & Harley, B. (2018). *Business Research Methods* (5th ed.). <https://books.google.co.zm/books?id=J9J2DwAAQBAJ&printsec=frontcover#v=onepage&q&f=false>
- Birch, D., Skallerud, K., & Paul, N. (2019). Who Eats Seaweed? An Australian Perspective. *Journal of International Food and Agribusiness Marketing*, 31(4), 329–351. <https://doi.org/10.1080/08974438.2018.1520182>
- Boccia, F., & Tohidi, A. (2024). Analysis of green word-of-mouth advertising behavior of organic food consumers. *Appetite*, 198, 107324. <https://doi.org/10.1016/J.APPET.2024.107324>
- Brannen, J. (2017). Combining qualitative and quantitative approaches: an overview. *Mixing Methods: Qualitative and Quantitative Research*, 3–37. <https://doi.org/10.4324/9781315248813-1>
- Brayden, W. C., Noblet, C. L., Evans, K. S., & Rickard, L. (2018). Consumer preferences for seafood attributes of wild-harvested and farm-raised products. *Aquaculture Economics and Management*, 22(3), 362–382. <https://doi.org/10.1080/13657305.2018.1449270>
- Brunso, K., Birch, D., Memery, J., Temesi, Á., Lakner, Z., Lang, M., Dean, D., & Grunert, K. G. (2021). Core dimensions of food-related lifestyle: A new instrument for measuring food involvement, innovativeness and responsibility. *Food Quality and Preference*, 91, 104192. <https://doi.org/10.1016/J.FOODQUAL.2021.104192>
- Bryant, C., Szejda, K., Parekh, N., Desphande, V., & Tse, B. (2019). A Survey of Consumer Perceptions of Plant-Based and Clean Meat in the USA, India, and China. *Frontiers in Sustainable Food Systems*, 3. <https://doi.org/10.3389/FSUFS.2019.00011>
- Cardoso, M., & Lima, P. (2024, April 11). *Como estão as cadeias de supermercados a mexer com o setor?*. Expresso. <https://expresso.pt/economia/distribuicao/2024-04-11-Como-estao-as-cadeias-de-supermercados-a-mexer-com-o-setor--93ceae2c>

- Chang, H. P., Ma, C. C., & Chen, H. S. (2019). Climate Change and Consumer's Attitude toward Insect Food. *International Journal of Environmental Research and Public Health* 2019, 16, 1606. <https://doi.org/10.3390/IJERPH16091606>
- Creswell, J. W. (2009). *Research Design: Qualitative, Quantitative and Mixed Methods Approaches* (3rd ed.). SAGE Publications.
- Creswell, J. W., & Creswell, J. D. (2018). *Research design: qualitative, quantitative, and mixed methods approaches* (5th ed.). SAGE Publications.
- Cudeck, R. (2000). Exploratory Factor Analysis. *Handbook of Applied Multivariate Statistics and Mathematical Modeling*, 265–296. <https://doi.org/10.1016/B978-012691360-6/50011-2>
- Dias, S. (2022). *A revolução das algas vai-se fazer à mesa - Ambiental - Jornal de Negócios*. <https://www.jornaldenegocios.pt/sustentabilidade/ambiental/detalhe/a-revolucao-das-algas-vai-se-fazer-a-mesa>
- Dubey, U. K. B., & Kothari, D. P. (2022). Research Methodology: Techniques and Trends. *Research Methodology*. <https://doi.org/10.1201/9781315167138>
- Dupont, J., & Fiebelkorn, F. (2020). Attitudes and acceptance of young people toward the consumption of insects and cultured meat in Germany. *Food Quality and Preference*, 85, 103983. <https://doi.org/10.1016/J.FOODQUAL.2020.103983>
- Embling, R., Neilson, L., Mellor, C., Durodola, M., Rouse, N., Haselgrove, A., Shipley, K., Tales, A., & Wilkinson, L. (2024). Exploring consumer beliefs about novel fortified foods: A focus group study with UK-based older and younger adult consumers. *Appetite*, 193. <https://doi.org/10.1016/j.appet.2023.107139>
- Embling, R., Neilson, L., Randall, T., Mellor, C., Lee, M. D., & Wilkinson, L. L. (2022). 'Edible seaweeds' as an alternative to animal-based proteins in the UK: Identifying product beliefs and consumer traits as drivers of consumer acceptability for macroalgae. *Food Quality and Preference*, 100. <https://doi.org/10.1016/j.foodqual.2022.104613>
- Epstein, S. (1994). Integration of the cognitive and the psychodynamic unconscious. *The American Psychologist*, 49(8), 709–724. <https://doi.org/10.1037//0003-066X.49.8.709>
- EuropeanCommission. (2024a). *More than 20 algae species can now be sold as food or food supplements in the EU*. Directorate General, for Maritime Affairs and Fisheries. https://oceans-and-fisheries.ec.europa.eu/news/more-20-algae-species-can-now-be-sold-food-or-food-supplements-eu-2024-02-26_en
- EuropeanCommission. (2024b). *Novel Food*. https://food.ec.europa.eu/food-safety/novel-food_en
- FAO. (2024). *The State of Food Security and Nutrition in the World*. <https://doi.org/10.4060/cd1254en>
- Fischer, A. R. H., & Reinders, M. J. (2022). Consumer acceptance of novel foods. *Innovation Strategies in the Food Industry: Tools for Implementation* (2nd ed., pp. 307–333). Elsevier. <https://doi.org/10.1016/B978-0-323-85203-6.00013-X>
- Franco, B. L., Costa, J. A. V., & Brunner, T. A. (2021). Superfoods: Drivers for Consumption. *Journal of Food Products Marketing*, 27(1), 1–9. <https://doi.org/10.1080/10454446.2020.1869133>
- Freire, I. (2025, May 8). *Continente e Pingo Doce são as marcas com maior referência no Estudo ao Consumidor. Imagens de Marca*.

<https://www.imagensdemarca.pt/artigo/continente-e-pingo-doce-sao-as-marcas-com-maior-referenciacao-no-estudo-ao-consumidor/>

- Giacalone, D., & Jaeger, S. R. (2023). Consumer acceptance of novel sustainable food technologies: A multi-country survey. *Journal of Cleaner Production*, 408. <https://doi.org/10.1016/j.jclepro.2023.137119>
- Govaerts, F., & Olsen, S. O. (2024). Environmental values and self-identity as a basis for identifying seaweed consumer segments in the UK. *British Food Journal*. <https://doi.org/https://doi.org/10.1108/BFJ-07-2023-0576>
- Govaerts, F., & Ottar Olsen, S. (2023). Consumers' values, attitudes and behaviours towards consuming seaweed food products: The effects of perceived naturalness, uniqueness, and behavioural control. *Food Research International*, 165. <https://doi.org/10.1016/j.foodres.2022.112417>
- Hunter, R., & Gibson, C. (2021). Narratives from within 'lockdown': A qualitative exploration of the impact of COVID-19 confinement on individuals with anorexia nervosa. *Appetite*, 166. <https://doi.org/10.1016/J.APPET.2021.105451>
- Jr., J. F. H., Black, W. C., Babin, B. J., & Anderson, R. E. (2014). *Multivariate Data Analysis* (7th ed.). Pearson.
- Kankam, K. P., Acheampong, L. D., & Dei, D. J. (2024). Dissemination of scientific information through open access by research scientists in a developing country. *Heliyon*. <https://doi.org/https://doi.org/10.1016/j.heliyon.2024.e28605>
- Kurek, M. A., Onopiuk, A., Pogorzelska-nowicka, E., Szpicer, A., Zalewska, M., & Póltorak, A. (2022). Novel Protein Sources for Applications in Meat-Alternative Products—Insight and Challenges. *Foods*, 11(7). <https://doi.org/10.3390/foods11070957>
- Li, T., Ahsanuzzaman, & Messer, K. D. (2019). *Is there a potential market for seaweed? A framed field experiment on consumer acceptance*. <https://udspace.udel.edu/server/api/core/bitstreams/64166b5e-d44c-4dbe-aeca-5cb6ff67396a/content>
- Liu, M. T., Liu, Y., & Mo, Z. (2020). Moral norm is the key: An extension of the theory of planned behaviour (TPB) on Chinese consumers' green purchase intention. *Asia Pacific Journal of Marketing and Logistics*, 32(8), 1823–1841. <https://doi.org/10.1108/APJML-05-2019-0285>
- Losada-Lopez, C., Dopico, D. C., & Faína-Medín, J. A. (2021). Neophobia and seaweed consumption: Effects on consumer attitude and willingness to consume seaweed. *International Journal of Gastronomy and Food Science*, 24. <https://doi.org/10.1016/j.ijgfs.2021.100338>
- Lucas, B., Costa, J., & Brunner, T. (2023). Attitudes of consumers toward Spirulina and açai and their use as a food ingredient. *LWT*, 178. <https://doi.org/10.1016/j.lwt.2023.114600>
- Lucas, S., Gouin, S., & Lesueur, M. (2019). Seaweed consumption and label preferences in France. *Marine Resource Economics*, 34(2), 143–162. <https://doi.org/10.1086/704078>
- Marôco, J. (2021). *Análise Estatística com o SPSS Statistics* (7th ed.). https://books.google.com/books/about/An%C3%A1lise_Estat%C3%ADstica_com_o_SPSS_Statist.html?hl=pt-BR&id=Ki5gDwAAQBAJ

- Mellor, C., Embling, R., Neilson, L., Randall, T., Wakeham, C., Lee, M. D., & Wilkinson, L. L. (2022). Consumer Knowledge and Acceptance of “Algae” as a Protein Alternative: A UK-Based Qualitative Study. *Foods*, 11(12). <https://doi.org/10.3390/foods11121703>
- Menozzi, D., Sogari, G., Veneziani, M., Simoni, E., & Mora, C. (2017). Eating novel foods: An application of the Theory of Planned Behaviour to predict the consumption of an insect-based product. *Food Quality and Preference*, 59, 27–34. <https://doi.org/10.1016/J.FOODQUAL.2017.02.001>
- Michel, F., Knaapila, A., Hartmann, C., & Siegrist, M. (2021). A multi-national comparison of meat eaters’ attitudes and expectations for burgers containing beef, pea or algae protein. *Food Quality and Preference*, 91. <https://doi.org/10.1016/j.foodqual.2021.104195>
- Moher, D., Liberati, A., Tetzlaff, J., Altman, D. G., Antes, G., Atkins, D., Barbour, V., Barrowman, N., Berlin, J. A., Clark, J., Clarke, M., Cook, D., D’Amico, R., Deeks, J. J., Devereaux, P. J., Dickersin, K., Egger, M., Ernst, E., Gøtzsche, P. C., ... Tugwell, P. (2009). Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. *PLoS Medicine*, 6(7). <https://doi.org/10.1371/journal.pmed.1000097>
- Mooi, E., & Sarstedt, M. (2014). *A Concise Guide To Market Research: The process, data, and methods using IBM SPSS Statistics*. (3rd ed.). Springer. <https://www.wook.pt/livro/a-concise-guide-to-market-research-erik-mooi/21743413?srsId=AfmBOoovfwmSblLNeCp5amfxT42NGThBL1LFwtXvKcccB6NXTzLKCC0U>
- Moons, I., Barbarossa, C., & De Pelsmacker, P. (2018). The Determinants of the Adoption Intention of Eco-friendly Functional Food in Different Market Segments. *Ecological Economics*, 151, 151–161. <https://doi.org/10.1016/j.ecolecon.2018.05.012>
- Mosikyan, S., Dolan, R., Corsi, A. M., & Bastian, S. (2024). A systematic literature review and future research agenda to study consumer acceptance of novel foods and beverages. *Appetite*, 203. <https://doi.org/10.1016/j.appet.2024.107655>
- Moss, R., Dabas, T., Stright, A., Caya, E., Baxter, L., Dolan, E., Gorman, M., & McSweeney, M. B. (2024). The use of sugar kelp (*Saccharina latissima*) as a seasoning for popcorn: An investigation of consumer acceptance, sensory perception and emotional response. *Food and Humanity*, 3. <https://doi.org/10.1016/j.foohum.2024.100382>
- Moss, R., & McSweeney, M. B. (2021). Do consumers want seaweed in their food? A study evaluating emotional responses to foods containing seaweed. *Foods*, 10(11). <https://doi.org/10.3390/foods10112737>
- Nature. (2020). *The Future of Food from the Sea - Ocean Panel*. <https://oceanpanel.org/future-food-sea/>
- Ong, W. L. K., Gauhar, V., Castellani, D., & Teoh, J. Y. C. (2023). Tips and Pitfalls in Using Social Media Platforms for Survey Dissemination. *Société Internationale d’Urologie Journal*, 4(2), 118–124. <https://doi.org/10.48083/perg3137>
- Onwezen, M. C., Bouwman, E. P., Reinders, M. J., & Dagevos, H. (2021). A systematic review on consumer acceptance of alternative proteins: Pulses, algae, insects, plant-based meat alternatives, and cultured meat. *Appetite*, 159. <https://doi.org/10.1016/j.appet.2020.105058>
- Onwezen, M. C., Verain, M. C. D., & Dagevos, H. (2022). Positive emotions explain increased intention to consume five types of alternative proteins. *Food Quality and Preference*, 96. <https://doi.org/10.1016/j.foodqual.2021.104446>

- Palmieri, N., & Forleo, M. B. (2020). The potential of edible seaweed within the western diet. A segmentation of Italian consumers. *International Journal of Gastronomy and Food Science*, 20. <https://doi.org/10.1016/j.ijgfs.2020.100202>
- Palmieri, N., & Forleo, M. B. (2022). An Explorative Study of Key Factors Driving Italian Consumers' Willingness to Eat Edible Seaweed. *Journal of International Food and Agribusiness Marketing*, 34(4), 433–455. <https://doi.org/10.1080/08974438.2021.1904082>
- Palmieri, N., Nervo, C., & Torri, L. (2023). Consumers' attitudes towards sustainable alternative protein sources: Comparing seaweed, insects and jellyfish in Italy. *Food Quality and Preference*, 104. <https://doi.org/10.1016/j.foodqual.2022.104735>
- Paul, J., Khatri, P., & Kaur Duggal, H. (2023). Frameworks for developing impactful systematic literature reviews and theory building: What, Why and How? *Journal of Decision Systems*. <https://doi.org/10.1080/12460125.2023.2197700>
- Paul, J., & Rosado-Serrano, A. (2019). Gradual Internationalization vs Born-Global/International new venture models: A review and research agenda. *International Marketing Review*, 36(6), 830–858. <https://doi.org/10.1108/IMR-10-2018-0280>
- Pestana, H., & Gageiro, J. (2014). *Análise de Dados para Ciências Sociais* (6th ed.). Edições Sílabo. <https://silabo.pt/catalogo/informatica/aplicativos-estatisticos/livro/analise-de-dados-para-ciencias-sociais/>
- Piowar, A., Wolańska, W., Orkusz, A., Kapelko, M., & Harasym, J. (2023). Modelling the Factors Influencing Polish Consumers' Approach towards New Food Products on the Market. *Sustainability (Switzerland)*, 15(3). <https://doi.org/10.3390/su15032818>
- Pliner, P., & Hobden, K. (1992). Development of a scale to measure the trait of food neophobia in humans. *Appetite*, 19(2), 105–120. [https://doi.org/10.1016/0195-6663\(92\)90014-W](https://doi.org/10.1016/0195-6663(92)90014-W)
- PortugalFoods. (2024). *Tendências de inovação e consumo no setor agroalimentar em 2024 - PortugalFoods*. <https://www.portugalfoods.org/noticias/tendencias-setor-agroalimentar-2024/>
- Robson, C., & McCartan, K. (2016). *Real World Research* (4th ed.). John Wiley & Sons.
- Rogers, E. M., Singhal, A., & Quinlan, M. M. (2014). Diffusion of Innovations. *An Integrated Approach to Communication Theory and Research*, 432–448. <https://doi.org/10.4324/9780203887011-36>
- Rombach, M., & Dean, D. L. (2024). Eating Macro-Algae (Seaweed): Understanding Factors Driving New Zealand Consumers' Willingness to Eat and Their Perceived Trust towards Country of Origin. *Foods*, 13(9). <https://doi.org/10.3390/foods13091300>
- Rotfeld, H. J. (2014). The pragmatic importance of theory for marketing practice. *Journal of Consumer Marketing*, 31(4), 322–327. <https://doi.org/10.1108/JCM-02-2014-0854/FULL/XML>
- Saunders, M., Lewis, P., & Thornhill, A. (2009). Research methods for business students . In *Research Methods for Business Students* (5th ed.). Pearson.
- Szakály, Z., Kovács, B., Soós, M., Kiss, M., & Balsa-Budai, N. (2021). Adaptation and validation of the food neophobia scale: The case of Hungary. *Foods*, 10(8). <https://doi.org/10.3390/foods10081766>

- Taherdoost, H. (2022). Designing a Questionnaire for a Research Paper: A Comprehensive Guide to Design and Develop an Effective Questionnaire. *Asian Journal of Managerial Science*, 11(1), 8–16. <https://doi.org/10.51983/ajms-2022.11.1.3087>
- Thu Thu Aung, M., Dürr, J., Klink-Lehmann, J., & Borgemeister, C. (2023). Predicting consumers' intention towards entomophagy using an extended theory of planned behavior: evidence from Myanmar. *International Journal of Tropical Insect Science*, 43(4), 1189–1206. <https://doi.org/10.1007/S42690-023-01016-4/METRICS>
- Tunca, S., Budhathoki, M., & Brunsø, K. (2024). European consumers' intention to buy sustainable aquaculture products: An exploratory study. *Sustainable Production and Consumption*, 50, 20–34. <https://doi.org/10.1016/j.spc.2024.07.021>
- Wahyuningtyas, A. S. H., Abidin, Z., Putri, W. D. R., Maligan, J. M., Berlian, G. O., & Ningrum, P. F. W. (2024). Consumer's willingness to try new microalgae-based food in Indonesia. *Journal of Agriculture and Food Research*, 18. <https://doi.org/10.1016/j.jafr.2024.101367>
- Wassmann, B., Hartmann, C., & Siegrist, M. (2024). Novel microalgae-based foods: What influences Singaporean consumers' acceptance? *Food Quality and Preference*, 113. <https://doi.org/10.1016/j.foodqual.2023.105068>
- Weinrich, R., & Elshiewy, O. (2019). Preference and willingness to pay for meat substitutes based on micro-algae. *Appetite*, 142. <https://doi.org/10.1016/j.appet.2019.104353>
- Weinrich, R., & Elshiewy, O. (2023). A cross-country analysis of how food-related lifestyles impact consumers' attitudes towards microalgae consumption. *Algal Research*, 70. <https://doi.org/10.1016/j.algal.2023.102999>
- Xiao, Y., & Watson, M. (2019). Guidance on Conducting a Systematic Literature Review. *Journal of Planning Education and Research*, 39(1), 93–112. <https://doi.org/10.1177/0739456X17723971>
- Yadav, R., & Pathak, G. S. (2016). Young consumers' intention towards buying green products in a developing nation: Extending the theory of planned behavior. *Journal of Cleaner Production*, 135, 732–739. <https://doi.org/10.1016/J.JCLEPRO.2016.06.120>
- Young, M., Paul, N., Birch, D., & Swanepoel, L. (2022). Factors Influencing the Consumption of Seaweed amongst Young Adults. *Foods*, 11(19). <https://doi.org/10.3390/foods11193052>
- Zheng, Q., Davis, C. V., Noll, A. L., Bernier, R., & Labbe, R. (2024). US consumer preferences and attitudes toward seaweed and value-added products. *Agribusiness*. <https://doi.org/10.1002/agr.21915>

8. APPENDIX

8.1. APPENDIX A | ARTICLES SELECTED

The articles presented on **Table 58** were the 29 articles mentioned throughout the SLR.

Table 58

Articles from the SLR.

#	Name	Year	Journal	Author	Doi
1	'Edible seaweeds' as an alternative to animal-based proteins in the UK: Identifying product beliefs and consumer traits as drivers of consumer acceptability for macroalgae	2022	Food Quality and Preference	Embling, Rochelle and Neilson, Louise and Randall, Tennessee and Mellor, Chloe and Lee, Michelle D. and Wilkinson, Laura L.	10.1016/j.foodqua.1.2022.104613
2	A cross-country analysis of how food-related lifestyles impact consumers' attitudes towards microalgae consumption	2023	Algal Research	Weinrich, Ramona and Elshiewy, Ossama	10.1016/j.algal.2023.102999
3	A multi-national comparison of meat eaters' attitudes and expectations for burgers containing beef, pea or algae protein	2021	Food Quality and Preference	Michel, Fabienne and Knaapila, Antti and Hartmann, Christina and Siegrist, Michael	10.1016/j.foodqua.1.2021.104195
4	An Explorative Study of Key Factors Driving Italian Consumers' Willingness to Eat Edible Seaweed	2022	Journal of International Food and Agribusiness Marketing	Palmieri, Nadia and Forleo, Maria Bonaventura	10.1080/08974438.2021.1904082
5	Attitudes of consumers towards Spirulina and açai and their use as a food ingredient	2023	LWT	Lucas, Bárbara Franco and Alberto Vieira Costa, Jorge and Brunner, Thomas A.	10.1016/j.lwt.2023.114600
6	Consumer Knowledge and Acceptance of "Algae" as a Protein Alternative: A UK-Based Qualitative Study	2022	Foods	Mellor, Chloe and Embling, Rochelle and Neilson, Louise and Randall, Tennessee and Wakeham, Chloe and Lee, Michelle D. and Wilkinson, Laura L.	10.3390/foods11121703
7	Consumer preferences for seafood attributes of wild-harvested and farm-raised products	2018	Aquaculture Economics and Management	Brayden, W. Christian and Noblet, Caroline L. and Evans, Keith S. and Rickard, Laura	10.1080/13657305.2018.1449270

8	Consumer's willingness to try new microalgae-based food in Indonesia	2024	Journal of Agriculture and Food Research	Wahyuningtyas, A.S.H. and Abidin, Z. and Putri, W.D.R. and Maligan, Jaya Mahar and Berlian, Gladys Oryz and Ningrum, Priskilah Febi Widya	10.1016/j.jafr.2024.101367
9	Consumers' attitudes towards sustainable alternative protein sources: Comparing seaweed, insects and jellyfish in Italy	2023	Food Quality and Preference	Palmieri, Nadia and Nervo, Chiara and Torri, Luisa	10.1016/j.foodqua.1.2022.104735
10	Consumers' values, attitudes and behaviours towards consuming seaweed food products: The effects of perceived naturalness, uniqueness, and behavioural control	2023	Food Research International	Govaerts, Florent and Ottar Olsen, Svein	10.1016/j.foodres.2022.112417
11	Eating Macro-Algae (Seaweed): Understanding Factors Driving New Zealand Consumers' Willingness to Eat and Their Perceived Trust towards Country of Origin	2024	Foods	Rombach, Meike and Dean, David L.	10.3390/foods13091300
12	Environmental values and self-identity as a basis for identifying seaweed consumer segments in the UK	2024	British Food Journal	Govaerts, Florent and Olsen, Svein Ottar	10.1108/BFJ-07-2023-0576
13	European consumers' intention to buy sustainable aquaculture products: An exploratory study	2024	Sustainable Production and Consumption	Tunca, Sezgin and Budhathoki, Mausam and Brunsø, Karen	10.1016/j.spc.2024.07.021
14	Exploring consumer beliefs about novel fortified foods: A focus group study with UK-based older and younger adult consumers	2024	Appetite	Embling, Rochelle and Neilson, Louise and Mellor, Chloe and Durodola, Mercy and Rouse, Natalie and Haselgrove, Alison and Shipley, Katharine and Tales, Andrea and Wilkinson, Laura	10.1016/j.appet.2023.107139
15	Factors Influencing the Consumption of Seaweed amongst Young Adults	2022	Foods	Young, Mikaela and Paul, Nicholas and Birch, Dawn and Swanepoel, Libby	10.3390/foods11193052
16	Finding Nori—Understanding Key Factors Driving US Consumers' Commitment for Sea-Vegetable Products	2024	Sustainability	Rombach, Meike and Botero, Julio and Dean, David L.	10.3390/su16052107
17	Is there a potential us market for seaweed-based products? A framed field experiment on consumer acceptance	2021	Marine Resource Economics	Li, Tongzhe and Ahsanuzzaman and Messer, Kent D.	10.1086/714422
18	Modelling the Factors Influencing Polish Consumers' Approach towards New Food Products on the Market	2023	Sustainability	Piowar, Arkadiusz and Wolańska, Wioletta and Orkus, Agnieszka and Kapelko, Magdalena and Harasym, Joanna	10.3390/su15032818

19	Moving Towards Novel and Sustainable Foods: Investigating Consumers' Intention to Consume Algae-Based Foods in a Developing Country	2025	Appetite	Bahraseman, Sasan Esfandiari and {Dehghani Dashtabi}, Maryam and Karbasi, Alireza and Firoozzare, Ali and Boccia, Flavio and Hosseinzadeh Nazeri, Zahra	10.1016/j.appet.2024.107801
20	Neophobia and seaweed consumption: Effects on consumer attitude and willingness to consume seaweed	2021	International Journal of Gastronomy and Food Science	Losada-Lopez, Chema and Dopico, Domingo Calvo and Faína-Medín, José Andrés	10.1016/j.ijgfs.2021.100338
21	Novel microalgae-based foods: What influences Singaporean consumers' acceptance?	2024	Food Quality and Preference	Wassmann, Bianca and Hartmann, Christina and Siegrist, Michael	10.1016/j.foodqua.2023.105068
22	Positive emotions explain increased intention to consume five types of alternative proteins	2022	Food Quality and Preference	Onwezen, Marleen C. and Verain, Muriel C.D. and Dagevos, Hans	10.1016/j.foodqua.2021.104446
23	Preference and willingness to pay for meat substitutes based on micro-algae	2019	Appetite	Weinrich, Ramona and Elshiewy, Ossama	10.1016/j.appet.2019.104353
24	Public perception of algal consumption as an alternative food in the Kingdom of Bahrain	2018	Arab Journal of Basic and Applied Sciences	Al-Thawadi, Salwa	10.1080/25765299.2018.1449344
25	Seaweed consumption and label preferences in France	2019	Marine Resource Economics	Lucas, Sterenn and Gouin, Stéphane and Lesueur, Marie	10.1086/704078
26	Sentiments, barriers and predictors of acceptance for meat alternatives among UK meat consumers	2024	Food and Humanity	Begho, Toritseju	10.1016/j.foohum.2024.100461
27	The Determinants of the Adoption Intention of Eco-friendly Functional Food in Different Market Segments	2018	Ecological Economics	Moons, Ingrid and Barbarossa, Camilla and De Pelsmacker, Patrick	10.1016/j.ecolecon.2018.05.012
28	The potential of edible seaweed within the western diet. A segmentation of Italian consumers	2020	International Journal of Gastronomy and Food Science	Palmieri, Nadia and Forleo, Maria Bonaventura	10.1016/j.ijgfs.2020.100202
29	Who Eats Seaweed? An Australian Perspective	2019	Journal of International Food and Agribusiness Marketing	Birch, Dawn and Skallerud, Kåre and Paul, Nicholas	10.1080/08974438.2018.1520182

8.2. APPENDIX B | PRODUCTS UNDER STUDY

Table 59 aims to resume the seaweed products detected in the selected articles.

Table 59

Seaweed products detected in the selected articles.

Seaweed Products		
Seaweed as general (16)		
Seaweed in the natural form (14)	• Wakame (3)	• Sea grapes
	• Kombu (2)	• Natural seaweed
	• Nori (2)	• Dulse
	• Baby sugar kelp	• Furikake
Seaweed-based drink (9)	• Smoothy or shake (3)	• Tea (2)
	• Juice drink (3)	• Seaweed drink
Seaweed-based food (64)	• Crackers or cookies (8)	• Kelp noodles (2)
	• Salad (6)	• Sausage
	• Meat substitute (6) - based on soy, quinoa, peas, lupines, milk and egg	• Steamed bun
	• Sushi or sushi rolls (4)	• Vegetarian abalone
	• Snacks (4)	• Chocolate ice cream with pea protein
	• Soup (4)	• Tartare curry
	• Supplements (4)	• Bread
	• Cereal/energy/protein bar (3)	• Seasoning
	• Jelly or candy/lolly (3)	• Flakes/sprinkles
	• Chips (3)	• Vegetarian satay
	• Burger (3)	• Vegetarian tuna
	• Pasta (3)	• Vegetarian fish balls

Table 60 aims to resume the non-seaweed products detected in the selected articles.

Table 60

Non-Seaweed products detected in the selected articles.

Non-Seaweed Products		
Aquaculture foods (11)	• Oysters (2)	• Sea urchin
	• Clams (2)	• Sea cucumber
	• Mussels (2)	• Abalone
	• Scallops	• Jellyfish
Technology-based foods (3)	• Cultured meat (2)	• 3D printed food
Açaí, pulses, and grains meat alternatives	• Plant-based meat (2)	• Açaí yogurt
	• Pea burger	• Açaí juice
	• Dumpling pea protein	• Açaí cereal bars
	• Tofu	• Açaí breakfast cereals
	• Vegetables	• Açaí cookies
Insects (4)		
Animal-based proteins (7)	• Beef burger (2)	• Chicken
	• Fish	• Beef
	• Egg	• Pork
Others (3)	• Almond, cranberry and flaxseed topping	
	• Mango and passionfruit yogurt drink	
	• Cashew butter, apricot and lemon dark chocolate cup	

8.3. APPENDIX C | VARIABLES OF THE QUANTITATIVE STUDIES

Table 61

Overview of the variables found in the 25 quantitative selected studies.

DEPENDENT	MEDIATOR	MODERATOR
Attitudinal (45%) Consumer Attitude (6) Consumer Acceptability (3) Consumer Perception (3) Consumer Preferences (3) Perceived Trust (2) Consumer Expectations	Consumer-Related (68%) Consumer Traits Health Consciousness (2) Food Neophobia (2) Symbolic Value Responsibility with food Food Safety Consumer Attitudes Attitudes (2) Subjective Norms (2) Perceived Behavioural Control Moral Norms Subjective Knowledge Snacking behaviour	Consumer-Related (92%) Sociodemographic and cultural Factors Sex/Gender (4) Age (3) Education (2) Country (2) Household income Shopper status Purchasing role International trips per year Consumer Traits Food Neophobia (3) Food Technology Neophobia Consumer Attitudes Perceived Behavioural Control
Behavioural (55%) Consumption Intention (6) Willingness to Pay (6) Seaweed Consumption (5) Willingness to Eat (3) Willingness to Try (2) Willingness to Consume (2) Willingness to Recommend Willingness to Buy Consumer Satisfaction	Product-Related (32%) Naturalness expectation Taste/edibility expectation Familiarity expectation Healthiness expectation Calories expectation Processing expectation Sustainability expectation	Product-Related (8%) Perceived Naturalness Perceived Uniqueness
INDEPENDENT		
Consumer-Related (70%)		
Sociodemographic Factors (38%) Age (9) Sex/Gender (8) Education (5) Household Income (5) Country (4) Diet (3) Food Habits (3) Peer influence (2) Household income spent on food Distance from sea Employment status Purchase location Children at home Body weight Diseases Household members Social events Social relationships Woman's task Whole family task Travel Abroad	Consumer Attitudes (20%) Attitudes towards Meat (5) Attitude (3) Subjective Norms (3) Price criteria (2) Attitude to advertising Enjoyment from shopping Desirable responding Health interest for foods Convenience orientation Speciality shop Shopping list Interest in Cooking Looking for new ways to cook Planning the meal Snacks vs Meals Access to information Vegetarian Attitude Cooking habits Personal Norms Perceived Behaviour Control Moral Norms	Consumer Traits (42%) Food Neophobia (10) Sustainability Consciousness (6) Safety Concern (6) Health Concern (5) Familiarity and knowledge (5) Consumer Perception (5) Food Related Lifestyle (4) Sustainability Concern (4) Food Technology Neophobia (3) Hedonic Values (2) Biospheric Values (2) Self-fulfilment in food Animal welfare Concern Environmental motivations Curiosity about food Emotions towards seaweed Symbolic Value Food fussiness Social Image eating motivations Egoistic Values Food Disgust

Polish cuisine preference	Subjective Knowledge	Credibility of chefs Domain-specific innovativeness
Product-Related (30%)		
Health and environmental aspects (19) Price level (8) Sensory properties and appeal (6) Perceived Naturalness, Uniqueness and quality (4) Taste (4) Convenience (3) Production source (2) Certification (2) Food Product Information and Labelling (2) Novelty (2) Origin (2)		Type of secondary ingredient and quantity of seaweed (2) Versatility Appearance Freshness Affordability Variety of alternatives Perceived risk and uncertainty Weigh control Mood Familiarity

8.4. APPENDIX D | HYPOTHESES TO BE TESTED

Table 62 aims to summarise all the hypotheses to be tested with the statistical tests.

Table 62

Resume of all hypotheses to be tested.

Hypotheses to be tested	
H1	Positive consumer's attitude (Att) significantly influences their intention to consume (ItC) seaweed products.
H2	Positive consumer's subjective norms (SN) significantly influence their intention to consume (ItC) seaweed products.
H3	Positive consumer's perceived behavioural control (PBC) significantly influences their intention to consume (ItC) seaweed products.
H4	Consumer's food neophobia (FN) negative and significantly influences their intention to consume (ItC) seaweed products.
H5	Consumer's food disgust (FD) negative and significantly influences their attitude (Att) towards seaweed products.
H6	Consumer's food neophobia (FN) negative and significantly influences their attitude (Att) towards seaweed products.
H7	Consumer's food disgust (FN) negative and significantly influences their attitude (Att) towards seaweed products.
H8a	Consumer's involvement (Inv) with foods and drinks significantly influence their food neophobia (FN) level.
H8b	Consumer's innovativeness (Inn) with foods and drinks significantly influence their food neophobia (FN) level.
H8c	Consumer's responsibility (Res) with foods and drinks significantly influence their food neophobia (FN) level.
H8d	There are age differences in consumer's food neophobia (FN) towards seaweed products.
H8e	There are gender differences in consumer's food neophobia (FN) towards seaweed products.
H8f	There are education differences in consumer's food neophobia (FN) towards seaweed products.
H8g	There are income differences in consumer's food neophobia (FN) towards seaweed products.
H8h	There is distance from sea differences in consumer's food neophobia (FN) towards seaweed products.
H9a	Consumer's involvement (Inv) with foods and drinks significantly influence their attitudes (Att) towards seaweed products.
H9b	Consumer's innovativeness (Inn) and responsibility (Res) with foods and drinks significantly influence their attitudes (Att) towards seaweed products.
H9c	Consumer's responsibility (Res) with foods and drinks significantly influence their attitudes (Att) towards seaweed products.
H9d	There are age differences in consumer's attitude (Att) towards seaweed products.
H9e	There are gender differences in consumer's attitude (Att) towards seaweed products.

H9f	There are education differences in consumer's attitude (Att) towards seaweed products.
H9g	There are income differences in consumer's attitude (Att) towards seaweed products.
H9h	There is distance from sea differences in consumer's attitude (Att) towards seaweed products.
H10a	Consumer's involvement (Inv) with foods and drinks significantly influence their subjective norms (SN) towards seaweed products.
H10b	Consumer's innovativeness (Inn) with foods and drinks significantly influence their subjective norms (SN) towards seaweed products.
H10c	Consumer's responsibility (Res) with foods and drinks significantly influence their subjective norms (SN) towards seaweed products.
H10d	There are age differences in consumer's subjective norms (SN) towards seaweed products.
H10e	There are gender differences in consumer's subjective norms (SN) towards seaweed products.
H10f	There are education differences in consumer's subjective norms (SN) towards seaweed products.
H10g	There are income differences in consumer's subjective norms (SN) towards seaweed products.
H10h	There is distance from sea differences in consumer's subjective norms (SN) towards seaweed products.
H11a	Consumer's involvement (Inv) with foods and drinks significantly influence their perceived behavioural control (PBC) towards seaweed products.
H11b	Consumer's innovativeness (Inn) with foods and drinks significantly influence their perceived behavioural control (PBC) towards seaweed products.
H11c	Consumer's responsibility (Res) with foods and drinks significantly influence their perceived behavioural control (PBC) towards seaweed products.
H11d	There are age differences in consumer's perceived behavioural control (PBC) towards seaweed products.
H11e	There are gender differences in consumer's perceived behavioural control (PBC) towards seaweed products.
H11f	There are education differences in consumer's perceived behavioural control (PBC) towards seaweed products.
H11g	There are income differences in consumer's perceived behavioural control (PBC) towards seaweed products.
H11h	There is distance from sea differences in consumer's perceived behavioural control (PBC) towards seaweed products.
H12d	There are age differences in consumer's food disgust (FD) towards seaweed products.
H12e	There are gender differences in consumer's food disgust (FD) towards seaweed products.
H12f	There are education differences in consumer's food disgust (FD) towards seaweed products.
H12g	There are income differences in consumer's food disgust (FD) towards seaweed products.
H12h	There is distance from sea differences in consumer's food disgust (FD) towards seaweed products.
H13a	Consumer's involvement (Inv) with foods and drinks significantly influence intention to consume seaweed products.
H13b	Consumer's innovativeness (Inn) with foods and drinks significantly influence intention to consume seaweed products.
H13c	Consumer's responsibility (Res) with foods and drinks significantly influence intention to consume seaweed products.
H13d	There are age differences in consumer's intention to consume towards seaweed products.
H13e	There are gender differences in consumer's intention to consume towards seaweed products.
H13f	There are education differences in consumer's intention to consume towards seaweed products.
H13g	There are income differences in consumer's intention to consume towards seaweed products.
H13h	There is distance from sea differences in consumer's intention to consume towards seaweed products.

8.5. APPENDIX E | QUESTIONNAIRE

A sample of the questionnaire is presented below.

Questionnaire 1

Sample of the questionnaire



Consumo de Algas em Portugal

Car@ participante,

O presente inquérito por questionário tem como objetivo recolher dados sobre a **intenção de consumo dos inquiridos portugueses face a algas e produtos à base de algas**, com vista a melhor compreender as suas atitudes e comportamentos. Deverá demorar cerca de 8 minutos a responder. Responda com sinceridade - todas as respostas são válidas e não existem respostas erradas.

A participação neste estudo é voluntária e todas as informações serão recolhidas de forma anónima e confidencial, conforme o Regulamento Geral sobre a Proteção de Dados (RGPD). Os dados recolhidos serão utilizados unicamente para fins de investigação científica (dissertação de mestrado em Gestão de Marketing, IPAM Porto).

Agradecemos, desde já, a sua participação e interesse neste estudo!

Se desejar obter mais informações, contacte:

Mariana Rodrigues | **Linkedin:** [mariana-rodrigues-2108](#)

***Indica uma pergunta obrigatória**

1. Pedido de Consentimento*

Marcar apenas uma oval.

- ☐ Aceito participar neste estudo.
- ☐ Não aceito participar neste estudo.

Inquiridos do Estudo

Este estudo é dirigido exclusivamente para pessoas com 18 anos ou mais e que tenham nacionalidade portuguesa.

2. Selecione a opção que se enquadra consigo: *

Marcar apenas uma oval.

- ☐ Sou português e tenho 18 anos ou mais.
- ☐ Sou português, mas tenho menos de 18 anos.
- ☐ Não sou português.

Comportamento e Preferências Alimentares

As questões que se seguem dizem respeito ao seu comportamento e preferências alimentares, incluindo hábitos de consumo, escolhas nutricionais e fatores que influenciam a sua alimentação. Em todas as questões é pedido ao inquirido para **selecionar o seu grau de concordância** em relação às afirmações apresentadas. A escala que deve utilizar é:

1 - discordo totalmente | 2 - discordo | 3 - nem concordo nem discordo | 4 - concordo | 5 - concordo totalmente

3. Q1 | Considera que está envolvido quando o tema é comida? Selecione o seu grau de concordância em relação às seguintes afirmações. *

Escala a utilizar:

1 - discordo totalmente | 2 - discordo | 3 - nem concordo nem discordo | 4- concordo | 5 - concordo totalmente

Marcar apenas uma oval por linha.

	1	2	3	4	5
Eu adoro boa comida.	☐	☐	☐	☐	☐
Comer e beber são uma fonte constante de prazer para mim.	☐	☐	☐	☐	☐
As decisões sobre o que comer e beber são muito importantes para mim.	☐	☐	☐	☐	☐
A alimentação (comida e bebida) são uma parte importante da minha vida.	☐	☐	☐	☐	☐
A alimentação (comida e bebida) é uma parte essencial da minha vida social.	☐	☐	☐	☐	☐

4. Q2 | Considera-se inovador em relação a alimentos? Selecione o seu grau de concordância em relação às seguintes afirmações. *

Escala a utilizar:

1 - discordo totalmente | 2 - discordo | 3 - nem concordo nem discordo | 4- concordo | 5 - concordo totalmente

Marcar apenas uma oval por linha.

	1	2	3	4	5
Gosto de experimentar novos alimentos que nunca provei antes.	☐	☐	☐	☐	☐
Adoro experimentar receitas de diferentes países.	☐	☐	☐	☐	☐
Receitas e artigos sobre comida de outras tradições culinárias incentivam-me a experimentar na cozinha.	☐	☐	☐	☐	☐
Gosto de experimentar novas receitas.	☐	☐	☐	☐	☐
Procuro por maneiras diferente de preparar refeições.	☐	☐	☐	☐	☐

5. Q3 | Considera-se um consumidor preocupado com o ambiente quando o tema é alimentação? Selecione o seu grau de concordância em relação às seguintes afirmações. *

Escala a utilizar:

1 - discordo totalmente | 2 - discordo | 3 - nem concordo nem discordo | 4- concordo | 5 - concordo totalmente

Marcar apenas uma oval por linha.

	1	2	3	4	5
Tento escolher alimentos produzidos com impacto mínimo no ambiente.	☐	☐	☐	☐	☐
Preocupo-me com as condições em que os alimentos que compro são produzidos.	☐	☐	☐	☐	☐
É importante compreender o impacto ambiental dos nossos hábitos alimentares.	☐	☐	☐	☐	☐
Tento escolher alimentos que são produzidos de forma sustentável.	☐	☐	☐	☐	☐
Tento comprar alimentos produzidos organicamente, se possível.	☐	☐	☐	☐	☐

6. Q4 | Será que tem neofobia alimentar?! Selecione o seu grau de concordância em relação às seguintes afirmações. *

Escala a utilizar:

1 - discordo totalmente | 2 - discordo | 3 - nem concordo nem discordo | 4- concordo | 5 - concordo totalmente

Marcar apenas uma oval por linha.

	1	2	3	4	5
Estou constantemente a experimentar alimentos novos e diferentes.	☐	☐	☐	☐	☐
Não confio em alimentos novos.	☐	☐	☐	☐	☐
Se não souber o que contém numa comida, não a provo.	☐	☐	☐	☐	☐
Gosto de comidas de diferentes países.	☐	☐	☐	☐	☐
A comida de diferentes países/gastronomias parece demasiado estranha para comer.	☐	☐	☐	☐	☐
Em jantares/festas, experimento novas comidas.	☐	☐	☐	☐	☐
Tenho receio de comer coisas que nunca provei antes.	☐	☐	☐	☐	☐
Sou muito seletivo em relação aos alimentos que como.	☐	☐	☐	☐	☐
Como quase tudo.	☐	☐	☐	☐	☐
Gosto de experimentar novos restaurantes de diferentes países/gastronomias.	☐	☐	☐	☐	☐

Algas ou Produtos à Base de Algas

As questões que se seguem dizem respeito ao seu comportamento e preferências face a algas ou produtos derivados destas, incluindo hábitos de consumo, percepções e fatores que influenciam a sua escolha. Em todas as questões é pedido ao inquirido para **selecionar o seu grau de concordância** em relação às afirmações apresentadas. A escala que deve utilizar é:

1 - discordo totalmente | 2 - discordo | 3 - nem concordo nem discordo | 4 - concordo | 5 - concordo totalmente

Exceto na questão Q8, que deve utilizar:

1 - nada nojento | 2 - pouco nojento | 3 - moderadamente nojento | 4 - bastante nojento | 5 - extremamente nojento

7. Q5 | Qual o seu grau de concordância em relação às seguintes afirmações? *

Escala a utilizar:

1 - discordo totalmente | 2 - discordo | 3 - nem concordo nem discordo | 4- concordo | 5 - concordo totalmente

Marcar apenas uma oval por linha.

	1	2	3	4	5
Acredito que consumir algas ou alimentos à base de algas é uma boa ideia.	☐	☐	☐	☐	☐
Acredito que consumir algas ou alimentos à base de algas é benéfico.	☐	☐	☐	☐	☐
Tenho interesse em consumir algas ou alimentos à base de algas.	☐	☐	☐	☐	☐
Na minha opinião, consumir algas ou alimentos à base de algas é razoável.	☐	☐	☐	☐	☐

8. Q6 | As nossas escolhas alimentares são frequentemente influenciadas por quem nos rodeia - como familiares, amigos ou especialistas. As seguintes afirmações visam compreender se a opinião de pessoas que respeita e considera importantes impacta a sua percepção e o consumo de algas ou alimentos à base de algas. Qual o seu grau de concordância em relação às seguintes afirmações? *

Escala a utilizar:

1 - discordo totalmente | 2 - discordo | 3 - nem concordo nem discordo | 4- concordo | 5 - concordo totalmente

Marcar apenas uma oval por linha.

	1	2	3	4	5
Pessoas cujas opiniões são importantes para mim apoiam o consumo de algas ou alimentos à base de algas.	☐	☐	☐	☐	☐
Os meus amigos e familiares apoiam o consumo de algas ou alimentos à base de algas.	☐	☐	☐	☐	☐
Pessoas que respeito apoiam o consumo de algas ou alimentos à base de algas.	☐	☐	☐	☐	☐
A maioria das pessoas que são importantes para mim incentiva-me a consumir algas ou alimentos à base de algas.	☐	☐	☐	☐	☐

9. Q7 | Qual o seu grau de concordância em relação às seguintes afirmações? *

Escala a utilizar:

1 - discordo totalmente | 2 - discordo | 3 - nem concordo nem discordo | 4- concordo | 5 - concordo totalmente

Marcar apenas uma oval por linha.

	1	2	3	4	5
Tenho confiança de que consigo consumir algas ou alimentos à base de algas, se assim o decidir.	☐	☐	☐	☐	☐
Consumir ou não algas ou alimentos à base de algas depende inteiramente de mim.	☐	☐	☐	☐	☐
Consumir algas ou alimentos à base de algas é fácil para mim.	☐	☐	☐	☐	☐

10. Q8 | Qual o seu grau de concordância em relação às seguintes afirmações? *

Escala a utilizar:

1 - discordo totalmente | 2 - discordo | 3 - nem concordo nem discordo | 4- concordo | 5 - concordo totalmente

Marcar apenas uma oval por linha

	1	2	3	4	5
A ideia de consumir algas ou alimentos à base de algas é repulsiva para mim.	☐	☐	☐	☐	☐
As algas ou os alimentos à base de algas têm um odor desagradável que me impede de os experimentar.	☐	☐	☐	☐	☐
A aparência das algas ou dos alimentos à base de algas causa-me uma sensação negativa.	☐	☐	☐	☐	☐
Evito algas ou alimentos à base de algas que tenham um sabor forte e desconhecido.	☐	☐	☐	☐	☐
A ideia de consumir algas ou alimentos à base de algas é desagradável para mim e causa-me náuseas.	☐	☐	☐	☐	☐
A textura viscosa e escorregadia das algas ou dos alimentos à base de algas é extremamente indesejável para mim, e sinto que não consigo engoli-los.	☐	☐	☐	☐	☐
Considero as algas ou os alimentos à base de algas nojentos e pouco apetitosos.	☐	☐	☐	☐	☐

11. Q9 | Qual o seu grau de concordância em relação às seguintes afirmações? *

Escala a utilizar:

1 - discordo totalmente | 2 - discordo | 3 - nem concordo nem discordo | 4- concordo | 5 - concordo totalmente

Marcar apenas uma oval por linha.

	1	2	3	4	5
Vou consumir algas ou alimentos à base de algas.	☐	☐	☐	☐	☐
Vou esforçar-me para consumir algas ou alimentos à base de algas.	☐	☐	☐	☐	☐
Recomendo a outras pessoas o consumo de algas ou alimentos à base de algas.	☐	☐	☐	☐	☐

As Preferências do Inquirido em relação a Produtos à Base de Algas

12. Q10 | Dos produtos apresentados, selecione os que já consumiu: *

Marcar tudo o que for aplicável.

- ☐ Algas em rolos de Sushi
- ☐ Algas em confeção de saladas, massas, sopas (ex. Miso), caldos, etc.
- ☐ Algas aromáticas ("ervas aromáticas" vindas do mar)
- ☐ Snacks de algas Hambúrguer de algas e cenoura
- ☐ Não consumi nenhum produto
- ☐ Outro: _____

13. Q11 | Selecione o seu grau de concordância em relação à seguinte afirmação:

"Estou disposto a consumir este produto." *

Escala a utilizar:

1 - discordo totalmente | 2 - discordo | 3 - nem concordo nem discordo | 4- concordo | 5 - concordo totalmente

Marcar apenas uma oval por linha.

	1	2	3	4	5
Algas em rolos de sushi	☐	☐	☐	☐	☐
Algas em confeção de saladas, massas, sopa (ex. Miso), etc.	☐	☐	☐	☐	☐
Algas aromáticas ("ervas aromáticas" vindas do mar)	☐	☐	☐	☐	☐
Snacks de algas	☐	☐	☐	☐	☐
Hambúrguer de algas e cenoura	☐	☐	☐	☐	☐

14. Q12 | Selecione o intervalo de preços (em €) que estaria disposto a pagar pelos seguintes produtos: *

Marcar apenas uma oval por linha.

	Menos que 2,50€	2,50€ - 3,50€	3,50€ - 4,50€	Mais que 4,50€
Algas em rolos de sushi – 5 peças	☐	☐	☐	☐
Algas em confeção de saladas, massas, sopa (ex. Miso), etc. – 1 embalagem de 35 gr	☐	☐	☐	☐

Algas aromáticas ("ervas aromáticas" vindas do mar) – 1 frasco de 25 gr	☐	☐	☐	☐
Snacks de algas – 1 pacote de 55 gr	☐	☐	☐	☐
Hambúrguer de algas e cenoura – 1 hambúrguer de 75 gr	☐	☐	☐	☐

15. Q13 | Selecione a **opção** que completa a seguinte afirmação:
"Estou disposto a pagar mais por este tipo de produto, se o produto for: *
Marcar apenas uma oval.

- ☐ Produto Português (as algas foram colhidas e processadas em território português)"
- ☐ Produto Importado (as algas foram colhidas e processadas em territórios de outros países)"

Dados Sociodemográficos

16. Indique a sua **idade:** *

17. Selecione o seu **género:** *
Marcar apenas uma oval.

- ☐ Feminino
- ☐ Masculino
- ☐ Outro: _____

18. Selecione o seu **grau de escolaridade concluído:** *
Marcar apenas uma oval.

- ☐ Ensino Básico
- ☐ Ensino Secundário
- ☐ Ensino Superior

19. Selecione o **tamanho do seu agregado familiar:** *
Marcar apenas uma oval.

- ☐ 1
- ☐ 2
- ☐ 3
- ☐ 4 ou mais

20. Selecione a que **distância vive do mar:** *
Marcar apenas uma oval.

- ☐ Perto (consigo ir a pé)
- ☐ Relativamente perto (de carro)
- ☐ Relativamente longe

21. Selecione o termo que melhor descreve a sua **dieta:** *
Marcar apenas uma oval.

- ☐ Omnívoro (a minha dieta inclui carne e peixe)
- ☐ Flexitariano (tento reduzir o consumo de carne e peixe)
- ☐ Pescetariano (a minha dieta exclui carne, mas não peixe)
- ☐ Vegetariano (a minha dieta exclui carne e peixe)
- ☐ Vegano (a minha dieta exclui todos os produtos de origem animal)

22. Selecione o seu rendimento líquido anual individual: *

Marcar apenas uma oval.

- ☐ Menos de €24.000
- ☐ €24.001 - €36.000
- ☐ €36.001 - €60.000
- ☐ €60.001 ou mais
- ☐ Não tenho
- ☐ Prefiro não divulgar

8.6. APPENDIX F | PRICE OF THE SELECTED PRODUCTS

The following explanation is referred to the products and prices mentioned in **Section 5** of the questionnaire. **Table 63** summarises the products available on the 2 Portuguese supermarkets selected and respective prices on 03 March of 2025.

Table 63

Seaweed products available on two Portuguese supermarkets.

Supermarket	Seaweed Products available	Price
Continente	Folhas algas sushi nori Blue Dragon	3,79€/11g
	Alga Sushi Nori	2,25€/14g
	Algas Kombu biológicas	3,99€/30g
	Folhas Algas Sushi Nori Saitaku	2,19€/14gr
	Algas alface do mar biológicas	3,99€/30g
	Algas aromáticas em folhas biológicas	2,99€/10g
	Algas esparguete do mar biológicas	3,99€/30gr
	Algas aromáticas mix biológicas	3,69€/40gr
	Snacks de alga marinha recheada com amêndoa e sésamo	2,33€/35gr
	Hambúrguer cenoura e algas	3,49€/150gr
	Snack algas, amêndoa e arandos biológicos	2,99€/60gr
	Snack algas, noz e maçã biológicos	2,99€/60gr
	Snack algas, amendoim e figo biológicos	2,99€/60gr
	Snack algas, amendoim, alperce e figo biológicos	2,99€/60gr
Pingo Doce	Sushi Nori Saitaku	2,19€/14gr
	Hambúrguer cenoura e algas	3,49€/150gr
	Alga Kombu Japonesa Provida	4,59€/50gr

The products were organized by type, and it was discovered that in that 2 Portuguese supermarkets there are 5 varieties of products. Their average price was calculated.

- Seaweed in sushi rolls | Average price: 2,66€/13gr
- Seaweed for salads, or soups | Average price: 4,31€/35gr
- Aromatic seaweed | Average price: 5€/25gr
- Hamburger of carrot and seaweed | Average price: 3,49€/150gr

The amplitude of the seaweed prices was 2,34€ (5,00€-2,66€). As the author pretended one scale with 4 interval, the size of each interval was 0,78€. Thus, the price' ranges were:

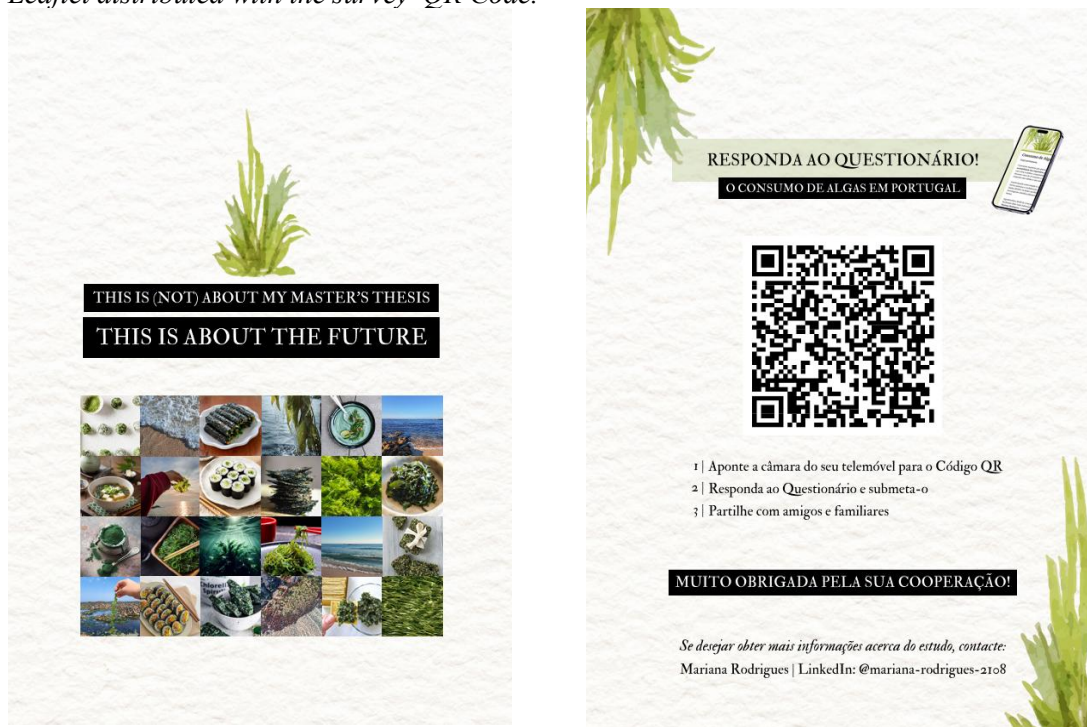
- 2,66€ → converted in less than 2,50€
- 2,66€ - 3,44€ → converted in 2,50€ - 3,50€
- 3,45€ - 4,22€ → converted in 3,51€ - 4,50€
- 4,23€ - 5,00€ → converted in more than 4,50€

8.7. APPENDIX G | LEAFLET

A leaflet with the survey's QR Code was distributed in physical locations such as coffee shops, herbalist shops, libraries, universities and other public spaces (**Figure 3**).

Figure 3

Leaflet distributed with the survey' QR Code.



8.8. APPENDIX H | STATISTICAL TESTS

The next **Table 65** aims to summarise all the statistical tests developed in this study.

Table 64
Statistical Tests developed in this research.

Type of Model	Model Name	Dependent Variable	Independent Variable	Tested Hypotheses
Multiple Linear Regression Model	A	ItC	Att; SN; PBC; FN-WT; FN-RP; FD; Inv; Inn; Res	H1, H2, H3, H4a, H4b; H5; H13a; H13b; H13c
	B	Att	Inv; Inn; Res; FN-WT; FN-RP; FD	H9a; H9b; H9c; H6a; H6b; H7
	C	SN	Inv; Inn; Res	H10a; H10b; H10c
	D	PBC	Inv; Inn; Res	H11a; H11b; H11c
	E	FN WT	Inv; Inn; Res	H8a-WT; H8b-WT; H8c WT
	F	FN RP	Inv; Inn; Res	H8a-RP; H8b-RP; H8c-RP
Type of Model	Model Name	Grouping Variable	Test Variable	Tested Hypotheses
Independent T-Test	A	Gender	Att; SN; PBC; FN_WT; FN_RP; FD; ItC	H9e; H10e; H11e; H8e_WT; H8e_RP; H12e; H13e
Type of Model	Model Name	Factor	Dependent List	Tested Hypotheses
One-Way ANOVA	A	Age	Att; SN; PBC; FN-WT; FN_RP; FD; ItC	H9d; H10d; H11d; H8d-WT; H8d_RP; H12d; H13d
	B	Education	Att; SN; PBC; FN-WT; FN-RP; FD; ItC	H9f; H10f; H11f; H8f_WT; H8f_RP; H12f; H13f
	C	Income	Att; SN; PBC; FN-WT; FN-RP; FD; ItC	H9g; H10g; H11g; H8g_WT; H8g_RP; H12g; H13g
	D	Distance from Sea	Att; SN; PBC; FN-WT; FN-RP; FD; ItC	H9h; H10h; H11h; H8h_WT; H8h_RP; H12h; H13h

8.9. APPENDIX I | COMPONENT MATRIX

Table 65 contains the values of the component matrix of this research.

Table 65

Component Matrix.

<i>Component Matrix*</i>											
Item	Communality	Inv	Inn	Res	Att	SN	PBC	ItC	FN-WT**	FN-RP**	FD
Inv1	0,646	0,804									
Inv2	0,705	0,839									
Inv3	0,705	0,840									
Inv4	0,706	0,840									
Inv5	0,517	0,719									
Inn1	0,692		0,832								
Inn2	0,718		0,847								
Inn3	0,777		0,882								
Inn4	0,771		0,878								
Inn5	0,638		0,799								
Res1	0,729			0,854							
Res2	0,767			0,876							
Res3	0,527			0,726							
Res4	0,850			0,922							
Res5	0,713			0,844							
Att1	0,861				0,928						
Att2	0,839				0,916						
Att3	0,807				0,899						
Att4	0,775				0,88						
SN1	0,844					0,919					
SN2	0,880					0,938					
SN3	0,851					0,922					
SN4	0,767					0,876					
PBC1	0,771						0,878				
PBC2	0,585						0,765				

PBC3	0,773						0,879				
ItC1	0,866							0,931			
ItC2	0,855							0,925			
ItC3	0,821							0,906			
FN1	0,601								0,856		
FN4	0,711								0,828		
FN6	0,707								0,814		
FN9	0,529								0,775		
FN10	0,768								0,707		
FN3	0,578									0,827	
FN5	0,705									0,805	
FN7	0,709									0,760	
FD1	0,760										0,872
FD2	0,781										0,884
FD3	0,827										0,91
FD4	0,710										0,843
FD5	0,834										0,913
FD6	0,751										0,867
FD7	0,836										0,914

* Extraction method: Principal Component Analysis

** Extraction method: Principal Component Analysis

Rotation method: Varimax with Kaiser Normalisation

Rotation converged in 3 iterations.

8.10. APPENDIX J | T-TEST & ANOVA RESULTS

Table 66 summarises the results of T-Test for equality of means on **gender** variable.

Table 66

Results of T-Test for equality of means.

T-TEST Grouping Variable: Gender	T-Test for Equality of Means					Cohen's d-point estimate
	Sig. sided	two- sided	T	Df	Difference of means	IC 95%
Att	,305		-1,028	287,815	-,102	[,291; ,086]
SN	,516		-,651	389	-,066	[-,265; ,133]
PBC	,121		-1,555	389	-,150	[-,339; ,040]
FN_WT	<,001		3,533	389	,331	[,147; ,515]
FN_RP	,056		1,919	389	,183	[,004; ,371]
FD	,008		2,650	389	,280	[,072; ,488]
ItC	,148		-1,451	282,029	-,159	[-,375; ,057]

Table 67 summarises the results of ANOVA Test for **age classes** as a factor.

Table 67

Results of One-Way ANOVA Test for age classes as a factor.

ANOVA Factor: Age by Classes	ANOVA		
	Homogeneity of Variance Test Sig. mean-based	ANOVA Sig.	Effect size Point estimate (eta squared)
Att	<,001	,015	,036
SN	,011	,031	,031
PBC	,096	,006	,041
FN_WT	<,001	,286	,016
FN_RP	,324	,344	,014
FD	,786	<,001	,057
ItC	<,001	<,001	,066

Table 68 aims to resume the hypotheses confirmation regarding the results found on One-Way ANOVA Test for age classes as a factor.

Table 68

Confirmation of the hypotheses tested.

Hypotheses		Confirmation
H9f	There are education differences in consumer's attitude (Att) towards seaweed products.	Confirmed
H10f	There are education differences in consumer's subjective norms (SN) towards seaweed products.	Confirmed
H11f	There are education differences in consumer's perceived behavioural control (PBC) towards seaweed products.	Confirmed
H8f-WT	There are educational differences in consumer's food neophobia – willingness and trust (FN_WT) towards seaweed products.	Rejected
H8f-RP	There are educational differences in consumer's food neophobia – rejection and particularity (FN_RP) towards seaweed products.	Rejected
H12f	There are education differences in consumer's food disgust (FD) towards seaweed products.	Confirmed

H13f	There are education differences in consumer's intention to consume towards seaweed products.	Confirmed
-------------	--	------------------

Table 69 summarises the results of ANOVA Test for **education level** as a factor.

Table 69

Results of One-Way ANOVA Test for education level as a factor.

ANOVA Factor: Education	One-Way ANOVA		
	Homogeneity of Variance Test Sig. mean-based	ANOVA Sig.	Effect size Point estimate (eta squared)
Att	,448	,270	,007
SN	,022	,031	,018
PBC	,198	,153	,010
FN_WT	,060	,018	,020
FN_RP	,313	,018	,020
FD	,008	,136	,010
ItC	,362	,166	,009

Table 70 aims to resume the hypotheses confirmation regarding the results found on One-Way ANOVA Test for education level as a factor.

Table 70

Confirmation of the hypotheses tested.

	Hypotheses	Confirmation
H9h	There are education differences in consumer's attitude (Att) towards seaweed products.	Rejected
H10h	There are education differences in consumer's subjective norms (SN) towards seaweed products.	Confirmed
H11h	There are education differences in consumer's perceived behavioural control (PBC) towards seaweed products.	Rejected
H8h-WT	There are educational differences in consumer's food neophobia – willingness and trust (FN_WT) towards seaweed products.	Confirmed
H8h-RP	There are educational differences in consumer's food neophobia – rejection and particularity (FN_RP) towards seaweed products.	Confirmed
H12h	There are education differences in consumer's food disgust (FD) towards seaweed products.	Rejected
H13h	There are education differences in consumer's intention to consume towards seaweed products.	Rejected

Table 71 summarises the results of ANOVA Test for **income level** as a factor.

Table 71

Results of One-Way ANOVA Test for income as a factor.

ANOVA Factor: Income	One-Way ANOVA		
	Homogeneity of Variance Test Sig. mean-based	ANOVA Sig.	Effect size Point estimate (eta squared)
Att	,366	,001	,050
SN	,769	,003	,045
PBC	,209	,018	,035
FN_WT	,309	,642	
FN_RP	,796	,004	,044
FD	,215	,005	,042
ItC	,017	<,001	,073

Table 72 aims to resume the hypotheses confirmation regarding the results found on One-Way ANOVA Test for income as a factor.

Table 72
Confirmation of the hypotheses tested.

	Hypotheses	Confirmation
H9g	There are income differences in consumer's attitude (Att) towards seaweed products	Confirmed
H10g	There are income differences in consumer's subjective norms (SN) towards seaweed.	Confirmed
H11g	There are income differences in consumer's perceived behavioural control (PBC) towards seaweed.	Confirmed
H8g-WT	There are income differences in consumer's food neophobia – willingness and trust (FN WT) towards seaweed.	Rejected
H8g-RP	There are income differences in consumer's food neophobia – rejection and particularity (FN RP) towards seaweed products.	Confirmed
H12g	There are income differences in consumer's food disgust (FD) towards seaweed.	Confirmed
H13g	There are income differences in consumer's intention to consume towards seaweed.	Rejected

Table 73 summarises the results of ANOVA Test for **distance from sea** as a factor.

Table 73
Results of One-Way ANOVA Test for distance from sea as a factor

ANOVA Factor: Distance from Sea	One-Way ANOVA		
	Homogeneity of Variance Test Sig. mean-based	ANOVA Sig.	Effect size Point estimate (eta squared)
Att	1,072	,004	,029
SN	1,714	,599	
PBC	0,223	,021	,020
FN_WT	2,484	,162	
FN_RP	0,328	,347	
FD	1,190	,034	,017
ItC	3,814	,003	,029

Table 74 aims to resume the hypotheses confirmation regarding the results found on One-Way ANOVA Test for distance from sea as a factor.

Table 74
Confirmation of the hypotheses tested.

	Hypotheses	Confirmation
H9d	There are age differences in consumer's attitude (Att) towards seaweed products.	Confirmed
H10d	There are age differences in consumer's subjective norms (SN) towards seaweed.	Rejected
H11d	There are age differences in consumer's perceived behavioural control (PBC) towards seaweed products.	Confirmed
H8d-WT	There are age differences in consumer's food neophobia – willingness and trust (FN_WT) towards seaweed products.	Rejected
H8d-RP	There are age differences in consumer's food neophobia – rejection and particularity (FN_RP) towards seaweed products.	Rejected
H12d	There are age differences in consumer's food disgust (FD) towards seaweed products.	Confirmed
H13d	There are age differences in consumer's intention to consume towards seaweed products.	Confirmed