



Enabled to eat more plant proteins? Capabilities, opportunities, and motivations related to increasing pulse and pulse-based product consumption across consumer groups

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ARTICLE INFO

Keywords:

Alternative protein
Plant-based diet
Legume
Socioeconomic differences
Gender
COM-B

ABSTRACT

Replacing even part of dietary red meat with plant proteins, such as pulses, is associated with better environmental and human health. Despite this, meat consumption is still popular while plant proteins are underconsumed in the Western world, especially among certain consumer groups. In this paper, our objective was to examine to what extent 15 different enablers would advance the consumption of pulses and pulse-based products (PBPs) across different genders, age groups, education levels, perceived financial situations, and red meat-eating frequencies. A survey was conducted among Finnish adults aged 18–75 years ($n = 1000$). The main analysis technique was multivariable linear regression. The Capability, Opportunity, Motivation, Behavior (COM—B) model was applied in discussing the results. The most important enablers for increasing pulse and PBP consumption were better taste, lower price, and having recipes and ideas for use provided, which represent motivation, opportunity, and capability in the COM-B model. In general, women, the young, and respondents with less frequent red meat consumption perceived the enablers could increase their pulse and PBP consumption more than men, older respondents, and those with frequent red meat consumption. Additionally, the effects of age, financial situation, and red meat consumption frequency on the perceived importance of some of the enablers varied between women and men. Taken together, consumer groups differed in the importance of all three COM-B elements. These results can be used to promote plant-based eating among different consumer groups and allow the design of increasingly targeted interventions.

1. Introduction

The impact of food production on environmental health and sustainability is indisputable. Food systems production amount to a third of global greenhouse gas (GHG) emissions (Crippa et al., 2021). GHG emissions from animal-based foods, of which beef's share is the largest, are almost double compared to plant-based foods (Xu et al., 2021). Furthermore, animal-based foods have overall more negative environmental impact than plant-based foods (e.g. Poore & Nemecek, 2018; Scarborough et al., 2023). In addition to threatening environmental health, excessive amounts of animal-based foods, and especially red meat, may contribute negatively to human health (e.g. Ferrari et al., 2022; Haghghatdoost et al., 2023; Lamberg-Allardt et al., 2023), but recent studies show that replacing even part of red and processed meat

with plant proteins (Päivärinta et al., 2020) and increased bean consumption (Papanikolaou et al., 2024) lead to better diet quality. Regardless of these notions, on average, meat consumption tends to be high while the consumption of plant proteins, such as pulses, remains low in the Western world (e.g. Niva et al., 2017), even though their role in the dietary transition is significant (Cusworth et al., 2021; Ferreira et al., 2021).

In the Western world, meat is the most consumed source of protein (FAO, 2024), and it is often considered to be the center of a meal (Fiddes, 1991). Furthermore, red meat has symbolized status and wealth throughout history (e.g. Chiles & Fitzgerald, 2018). At the same time, pulses and other plant proteins are often overlooked by consumers (e.g. FAO, 2024; Semba, Rahman, et al., 2021; Semba, Ramsing, et al., 2021; Valsta et al., 2018). The Finnish meat and plant protein consumption

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<https://doi.org/10.1016/j.foodqual.2024.105388>

Received 14 February 2024; Received in revised form 28 October 2024; Accepted 26 November 2024

Available online 4 December 2024

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trends are no exception to these notions (FAO, 2024; Kylli, 2021). However, in reality meat has not been a standard on our dinner tables for very long: it used to be scarce, expensive, and special to many. Before meat's emergence as an affordable protein source, main protein sources were in fact plants, such as peas and beans (i.e. pulses), and grains (Kylli, 2021). Unlike meat, pulses are not a major part of the contemporary Finnish food culture and are not promoted widely, even though faba bean and green pea cultivation on Finnish soil dates back hundreds of years (Stoddard et al., 2009), and the very traditional "pea soup Thursday" still exists in some capacity. In addition, the most recent Finnish nutrition recommendations from 2014 urge to increase the consumption of pulses (National Nutrition Council, 2018), and it is likely that this will be further highlighted in the upcoming new nutrition recommendations scheduled to be published in late 2024. Despite these efforts, pulses are currently underconsumed, averaging at only a few grams per day, while meat has firmly secured its place in the Finnish food culture up to the point where it is consumed in excess (Valsta et al., 2018), and many are quite attached to it (Sares-Jäske et al., 2022). Nevertheless, in order to accommodate the ever-growing global population's need for food within planetary boundaries, it is necessary to change the protein sources of global diets (Willett et al., 2019).

Certain trends in meat and plant protein food consumption can be observed across sociodemographic groups. For instance among gender, men typically prefer animal protein sources, while women tend to be more open to plant protein foods (Eckl et al., 2021; Graça et al., 2019). In addition to sociodemographic factors, personality traits and values, for instance, often have a major impact on food choices (Esposito et al., 2021; Lehto et al., 2022) and thus should not be overlooked. However, it is well-established that there are eating-related disparities (e.g. Konttinen et al., 2012; Pechey & Monsivais, 2016) as well as differences in food choice motives (Hentilä et al., 2023; Konttinen et al., 2021) among different sociodemographic groups. Thus, to advance pulse consumption, it is essential to understand consumers with different sociodemographic backgrounds and their perceptions of meat and plant-based proteins, and especially the factors barring or enabling the transition towards more plant-based diets. Research on barriers related to increasing the consumption of plant-based foods and plant-based eating is quite ample (i.a. Fehér et al., 2020; Figueira et al., 2019; Lea et al., 2006; Niva et al., 2017; Varela et al., 2022). In addition, an earlier paper by the authors (Kuosmanen et al., 2023) utilizing the same dataset as the present paper examined the perceived barriers in relation to sociodemographic factors, as did Pohjolainen et al. (2015). Moreover, prior studies have included both enablers (also called, i.a., drivers and facilitators) and barriers and focused on the present moment inquiring, for instance, "Why do you (not) eat pulses/other plant proteins?" (e.g. Eckl et al., 2021; Graça et al., 2019; Henn et al., 2022; Kerslake et al., 2022; Reipurth et al., 2019; van den Berg et al., 2022). More research on identifying which enablers can advance the transition towards more plant-based diets has been called for (Reipurth et al., 2019), and to our knowledge, there is very little research on which enablers, if any, would encourage consumers regardless of their plant protein eating status to consume more pulses and other plant proteins (see Jallinoja et al., 2016; Szczybyło et al., 2020). In addition, as Eckl et al. (2021), Graça et al. (2019), and Onwezen et al. (2021) note acknowledging different consumer groups is important when researching and planning future interventions aimed to increase the consumption of plant-based foods, but research on how sociodemographic factors are related to enablers is almost non-existent (see Knaapila et al., 2022; Szczybyło et al., 2020).

1.1. The COM-B model

In this paper, we apply the Capability, Opportunity, Motivation, Behavior (COM—B) model developed by Michie et al. (2011) to classify different enablers for consuming more pulses and pulse-based products (PBPs). The COM-B model provides an apt theoretical framework for studying increasing plant-based food and pulse consumption and the

related enablers (see Graça et al., 2019; Onwezen & Dagevos, 2024; van den Berg et al., 2022), as the enablers have dimensions of capability (e.g. cooking skills), opportunity (e.g. affordable products), and motivation (e.g. good taste). Capabilities represent the physical capability and mental capability to be able to do something. Opportunities refer to social opportunities, such as the surrounding culture and people, and to physical opportunities, such as the setup of an environment. Motivations describe automatic motivations, which are often basic wants and desires and may appear suddenly, and reflective motivations, which are more thought of reasons to act in a certain way. According to the COM—B, these factors affect behavior and thus for a behavior to occur, all of these factors need to be present (Michie et al., 2011). Additionally, capability and opportunity may influence motivation – if suitable capabilities and opportunities are not present or are insufficient, it is likely that the motivation suffers as well (West & Michie, 2020).

1.2. Sociodemographic factors and meat and plant protein consumption

Introducing pulses and other plant protein foods into diets is often related to a decrease in other protein consumption, mainly meat. Sares-Jäske et al. (2022) note that frequent meat consumption is strongly related to barriers associated with consuming plant-based foods. In addition, persons already consuming plant protein foods tend to have the most positive perceptions about them (Nevalainen et al., 2023), but may also experience more barriers (see Kuosmanen et al., 2023). Thus, in this section, we have also included studies on sociodemographic factors affecting meat consumption and reduction to better understand who are established meat eaters and which sociodemographic groups may be more open to plant-based meat alternatives.

Gender Traditionally, meat has symbolized masculinity (Kildal & Syse, 2017; Sobal, 2005). Even though there are signs that masculinity is changing especially among younger men and thus also the relationship between masculinity and meat (De Backer et al., 2020), old perceptions are hard to erase (see e.g. Knaapila et al., 2022). Earlier literature shows rather consistently that men do eat more meat (Sares-Jäske et al., 2022; Tschanz et al., 2022), are less willing to consume plant proteins (e.g. Graça et al., 2019), and experience more barriers towards plant-based eating (Pohjolainen et al., 2015) and in following meatless or low-meat diet (Hagmann et al., 2019) than women. However, as women consume and are more interested in plant proteins (e.g. Niva & Vainio, 2021), they may also experience more barriers related to plant-based eating: for example, not knowing how to cook meat alternatives is more of a barrier to women than men (Knaapila et al., 2022; Kuosmanen et al., 2023). This represents inadequate (*physical and psychological*) capability.

Age In their reviews, Eckl et al. (2021) and Graça et al. (2019) conclude that it is not clear if being certain age encourages or inhibits replacing meat with alternative proteins. Lemken et al. (2019) found their youngest participants to be very meat attached, but still willing to consider plant proteins as well, while the oldest participants were quite against plant-based meat alternatives. In addition, Kuosmanen et al. (2023) and Pohjolainen et al. (2015) discovered that it is in fact the young who experience more barriers towards plant-based eating. However, other studies have found the young to be more likely to try new protein alternatives (Clark & Bogdan, 2019) and to avoid beef and to have increased their plant protein food consumption (Nevalainen et al., 2023; Niva & Vainio, 2021). According to a study by Culliford and Bradbury (2020), the young perceived plant proteins important for environmental health, while older respondents rated their respective importance low. Valuing environmental health can translate into (*reflective*) motivation to consume plant-based foods.

Income and education level In their review, Graça et al. (2019) note that higher education and higher income level are enablers for following plant-based diets. Higher educated are more likely to reduce their meat consumption (Kemper et al., 2023) and to accept plant-based meat alternatives (Siegrist & Hartmann, 2019). In addition, lower education

level (Pohjolainen et al., 2015) and financial strain (Kuosmanen et al., 2023) is often associated with stronger barriers to plant-based eating. Financial struggles may translate into different (*physical*) opportunities in choosing what to eat.

1.3. The present study

As outlined above, in terms of adopting and following plant-based diets sociodemographics matter (Graça et al., 2019; Perez-Cueto et al., 2022). In addition to sociodemographic factors, this study included red meat-eating frequency as a background variable. High meat-eating frequency often affects the perception of plant-based foods negatively (e.g. Sares-Jáske et al., 2022), and strong meat attachment indicates lower probability to incorporate alternative proteins into one's diet (Abebe et al., 2024). However, to our knowledge meat-eating frequency has not had prominence in prior research on enablers associated with increasing plant protein consumption.

The COM-B model is usually applied in its entirety in research (e.g. Craveiro et al., 2021; Willmott et al., 2021). However, in the context of adopting more plant-based diets, opportunities are at the very core. Without physical opportunities, such as the offering of plant-based food items as well as their affordability, the behavior cannot be realized, no matter how capable or motivated an individual is. Consequently, in this study, the focus is more on opportunities than on capability and motivation.

Thus, to widen the understanding of how to advance the consumption of pulses and PBPs, in this paper we examine what kind of opportunity, capability and motivation-related enablers would promote their increased consumption across various consumer groups. Among these groups are gender, age, education level, perceived financial situation, and the consumption frequency of red meat. Furthermore, we examine whether the effect of age, education level, financial situation, and meat consumption frequency on perceived importance of different enablers varies between women and men.

2. Material and methods

The data for this study was collected in September–October 2020 through a Finnish-language online consumer survey, which was a part of the Leg4Life (Legumes for sustainable food system and healthy life) project funded by the Strategic Research Council at the Academy of Finland. A Finnish consumer and market research company Makery Oy conducted the survey via their existing consumer panel in Finland. The sample ($n = 1000$) consisted of 18–75-year-old women and men, and was stratified by gender, age group, education level and residential area (see Table 1 for the participants descriptive characteristics). The sample represents quite accurately the Finnish adult population (Lehto et al., 2023). No monetary compensation was provided, but the participants earned points, which could be either donated to charity or used to purchase goods from the panel's web shop.

2.1. Ethical issues

The survey and its protocol were reviewed by the University of Helsinki Ethical Review Board in Humanities and Social and Behavioral Sciences (Statement 40/2020) prior to data collection. The respondents were provided detailed information on the study prior to participation and gave their informed consent electronically.

2.2. Measures

The sociodemographic factors examined in this study were gender, age group, education level, and perceived financial situation. The options for gender were man, woman and other, but no one chose the last option. Age was recoded into three age groups (18–34, 35–54 and 55–75 years). Education level was also recoded into three groups:

Table 1

Descriptive characteristics of the participants, $n = 1000$.

	N	%		
Gender				
Man	500	50		
Woman	500	50		
Age group				
18-34 years	293	29.3		
35-54 years	352	35.2		
55-75 years	355	35.5		
Education level				
Tertiary	358	35.8		
Secondary	509	50.9		
Elementary	133	13.3		
Perceived financial situation				
No financial strain	442	44.2		
Ok when frugal	375	37.5		
Financial strain	183	18.3		
Red meat consumption				
At least 5 times a week	320	32		
Less than 5 times a week	680	68		
Enablers (COM-B element)				
			Mean	Std. Dev.
Better taste (M)	543	54	3.6	1.263
Lower price (O)	537	54	3.5	1.369
Recipes and ideas for use e.g. on packages, internet, ads, magazines (C)	463	46	3.27	1.303
Domesticity (M)	462	46	3.35	1.314
Better selection (O)	422	42	3.2	1.249
Better mouthfeel (M)	418	42	3.32	1.289
Locally produced (M)	413	41	3.2	1.345
Composition that does not cause stomach issues (C)	383	38	3.15	1.439
Marketing (e.g. tastings and ad campaigns) (O)	358	36	2.96	1.368
Better in-store availability/visibility (O)	354	35	3.03	1.282
Better selection at restaurants (O)	332	33	2.91	1.406
Organic (M)	292	29	2.78	1.349
Recommendations from friends/family (O)	275	28	2.72	1.315
Higher price of meat and meat products (O)	268	27	2.64	1.372
Public discussion on the health and environmental benefits related to pulses (O)	256	26	2.67	1.321

elementary, secondary, and tertiary education. The last group includes all higher education levels (bachelor, master, and post-graduate). The participants estimated their own financial situation on a 5-point scale with options for "I get by excellently", "I get by quite well", "I get by when I shop frugally", "I sometimes need to compromise" and "I need to compromise all the time". These were recoded into three categories: the first two options combined into "no financial strain" and last two options into "financial strain" and keeping the third option as it was.

In addition to the sociodemographic factors, the frequency of red meat consumption was also used as a background variable. The participants were asked to estimate how often they consume red meat including processed meats with response options never, less than once a month, 1–3 times a month, once a week, 2–4 times a week, 5–6 times a week and daily. These were recoded into a dichotomous variable by combining the last two options into 1 = "at least 5 times a week" and 0 = "all the others".

The participants were asked to evaluate on a 5-point Likert scale (1 = no increase at all – 5 = significant increase) to what extent 15 different factors (enablers) would possibly increase their consumption of pulses and PBPs (combined in the original variable). The response scale also included "I do not know" option, but these responses were coded as missing for the analysis (varying between 73 and 139 responses). In order to determine which factors were the most enabling, responses were recoded into a dichotomous variable: values 1–3 into 1 = others and 4–5 into 2 = would increase significantly (Table 1). These dichotomous variables were also analyzed among the sociodemographic and meat-eating frequency groups to determine which enablers were the most prevalent in every group (Tables A.1 and A.2).

The examined enablers were based on an earlier multinational

consumer survey conducted in the ScenoProt project (<https://projects.lu.fi/scenoprot/en/>). The ScenoProt project examined pathways to self-sufficiency and to a sustainable and healthy protein system. Prior to the present study, the ScenoProt consumer survey had been conducted in Finland for the first time in 2016 and again in 2019. Both years the survey included a question related to enablers increasing the consumption of plant proteins, the latter with a more extensive list of items (15 and 20, respectively). When the survey examined in this paper was planned, the focus was shifted from plant proteins in general to pulses and PBPs, and the items from the earlier surveys were used as a base and then refined into the 15 enablers by combining similar items. For instance, the 2019 survey had three items related to restaurants, which were combined into one in this survey. The 2016 survey had an item related to taste, but the 2019 survey did not; one was included in this survey as taste is one major factor in food selection (e.g. Steptoe et al., 1995). In addition, one new enabler (Composition that does not cause stomach issues) was added based on findings from prior research (e.g. Figueira et al., 2019; Niva et al., 2017). A justification based on earlier research for each of the enablers is provided in Appendix A.3. The survey items were mapped into the COM-B elements after conducting the survey (Table 1).

2.3. Statistical analyses

The unadjusted mean differences in each of the 15 enablers between the sociodemographic and meat-eating frequency groups were analyzed with One-Way ANOVA. We then performed 15 multivariable linear regression models with the sociodemographic factors and the frequency of meat consumption as the predictors and each of the 15 enablers as the outcomes. All predictors were entered simultaneously into the models. The results are reported as unstandardized regression coefficients (β) and 95 % confidence intervals (CIs). Multicollinearity of the predictor variables was examined with variance inflation factor (VIF). All VIF values were under 2 suggesting no multicollinearity between the variables (Kleinbaum et al., 1988). Based on earlier research on which sociodemographic groups are most likely consumers of plant proteins, the reference groups were women, respondents aged 18–34 years, tertiary education, no financial strain, and consuming red meat less than 5 times a week. Interactions between gender and each of the other predictors were tested by adding the respective interaction term(s) to the multivariable regression models. If R^2 change associated with the interaction term(s) was statistically significant, then the estimated marginal means (with 95 % CIs) of the enabler were graphically plotted across the subgroups to aid in the interpretation of the interaction. All analyses were performed using IBM SPSS Statistics version 29 (IBM Corp., Armonk, NY, USA). The threshold for statistical significance was set at $p < .05$.

3. Results

The most prevalent enablers among all respondents were better taste (54 %), lower price of pulses and PBPs (54 %) and recipes and ideas for use (46 %) (Table 1). The least common enablers for increasing pulse and PBP consumption were higher price of meat and meat products (27 %) and public discussion on the health and environmental benefits related to pulses (26 %). Among the examined consumer groups, better taste and lower price were the two most important enablers with the exception of the oldest age group (TOP2 enablers domesticity and better taste) (Tables A.1 and A.2). The importance of other enablers varied between the groups, but for instance having recipes and ideas for use provided was rated important in many subgroups.

The unadjusted means of the enablers by gender, age, education level, self-perceived financial situation, and meat consumption frequency groups ranged from 2.36 to 3.90 on a scale of 1 to 5 (1 = no increase at all – 5 = significant increase) (Tables A.4 and A.5). Generally, the means were higher among the groups that have been identified

earlier as more likely consumers of plant-based foods, though financial situation presented some exceptions. The effect sizes (η^2) ranged from 0.000 to 0.078, thus being very small, small, or moderate as proposed by Cohen (2013). The largest effect size was between age groups in the enabler “recommendations from friends/family” ($\eta^2 = 0.078$).

Results from 15 multivariable linear regression models are shown in Tables 2–4. Among the sociodemographic factors, gender was significantly associated with all but one enabler (higher price of meat and meat products) demonstrating that men experienced the enablers to increase their pulse and PBP consumption less than women did. Age was also related to most of the enablers. Respondents aged 55–75 years found eleven enablers and respondents aged 35–54 years six enablers to increase their consumption less than the reference group of 18–34-year-olds. Among these were better taste, lower price, recipes and ideas for use (55–75 years), better mouthfeel, better/wider selection (55–75 years), better selection at restaurants, marketing (55–75 years), better in-store availability/visibility (55–75 years), recommendations from friends and family, higher price of meat and meat products (55–75 years), and public discussion on the health and environmental benefits related to pulses. Perceived financial situation had associations with the enablers of lower price, higher price of meat and meat products and recommendations from friends and family. Lower price would enable respondents who shopped frugally or were financially strained to increase their pulse and PBP consumption more than well-off respondents, while higher price of meat and meat products would be more of an enabler for frugal shoppers. Financially strained respondents rated recommendations from friends and family to be a more important enabler than respondents with better financial situations. Education level had statistically non-significant associations with all of the enablers.

In addition to sociodemographic factors, the association between the frequency of meat consumption and the enablers was examined. Respondents consuming red meat at least 5 times a week experienced 10 of the enablers to advance their consumption of pulses and PBPs less than respondents consuming red meat less than 5 times a week. Among these enablers were lower price, domesticity, locally produced, better/wider selection, better selection at restaurants, marketing, better in-store availability/visibility, organic, higher price of meat and meat products, and public discussion on the health and environmental benefits related to pulses.

Adjusted R^2 values indicated that these multivariable models explained from 2 % to 10 % of the variance in the enablers. The enablers “better mouthfeel”, “locally produced”, and “organic” had the smallest R^2 values (0.018, 0.024, and 0.024 respectively). “Recommendations from friends/family”, “better selection at restaurants”, and “lower price” had the highest R^2 values (0.096, 0.070, and 0.060 respectively). Tables A.6 and A.7 provide more detailed information on the impact of each sociodemographic and meat consumption frequency variable on the explained variance in the enablers by showing R^2 change values.

Eleven statistically significant interactions between gender and age, financial situation, or red meat consumption frequency were detected in relation to the enablers (Tables 2–4). These interactions are visualized in Figs. 1 and 2, and in Fig. A.1. Among age groups, the enablers of having recipes and ideas for use provided, better in-store availability/visibility, and marketing were the most important to women aged 35–54 years, and least important for men of the same age or older (55–75 years) (Fig. 1). The in-store visibility/availability and higher price of meat and meat products were more important for men consuming meat and meat products less than 5 times a week than for men consuming meat more often, whereas for women the difference was negligible (Fig. 2). Among women, it was apparent that better taste and better mouthfeel were more important for daily or almost daily consumers of meat, while for men the difference was almost non-existent. Financially strained women perceived the enablers of having recipes and ideas for use provided, marketing, public discussion on the health and environmental benefits related to pulses, and domesticity more important than women with better financial status, while for men it was the opposite (Fig. A.1). All

Table 2
Multivariable linear models predicting the importance of the enablers.

	Better taste			Lower price			Domesticity			Recipes and ideas for use e.g. on packages, internet, ads, magazines			Better mouthfeel		
	β	95% CI	Interaction p value ^a	β	95% CI	Interaction p value	β	95% CI	Interaction p value	β	95% CI	Interaction p value	β	95% CI	Interaction p value
Gender			-			-			-			-			-
Woman (ref. cat.)															
Man	-.251**	-.414; -.087		-.196*	-.368; -.023		-.379***	-.550; -.208		-.475***	-.642; -.308		-.303***	-.474; -.133	
Age			.144			.070			.327			.012*			.344
18-34 (ref. cat.)															
35-54	-.268*	-.472; -.064		-.306**	-.524; -.089		-.194	-.408; .021		-.072	-.281; .137		-.238*	-.451; -.026	
55-75	-.494***	-.699; -.290		-.567***	-.783; -.352		-.124	-.338; .090		-.263*	-.472; -.054		-.301**	-.514; -.088	
Education level			.215			.589			.812			.576			.214
Tertiary (ref. cat.)															
Secondary	-.091	-.268; .087		-.117	-.305; .071		-.110	-.296; .076		-.009	-.190; .173		-.061	-.245; .124	
Elementary	-.152	-.428; .125		-.270	-.564; .024		-.151	-.436; .135		-.112	-.395; .170		-.182	-.472; .109	
Perceived financial situation			.425			.734			.042			.022			.417
No financial strain (ref. cat.)															
Ok when frugal	-.007	-.191; .176		.281**	.087; .475		.014	-.176; .204		-.086	-.272; .101		.088	-.102; .278	
Financial strain	.141	-.89; .371		.553***	.308; .797		-.087	-.327; .153		-.081	-.317; .154		.193	-.048; .434	
Red meat consumption			.036*			.627			.296			.102			.007**
Less than 5 times a week (ref. cat.)															
At least 5 times a week	.168	-.011; .347		-.291***	-.480; -.101		-.253**	-.439; -.067		-.154	-.642; -.308		.117	-.070; .304	
Adjusted R ²	.029***	.060***	.031***	.037***	.018**										

*** $p < .001$, ** $p < .01$, * $p < .05$

^a p value for the R² change associated with the interaction term(s) between gender and each of the other predictors in relation to the enabler.

Table 3
Multivariable linear models predicting the importance of the enablers.

	Locally produced			Better/wider selection			Composition that does not cause stomach issues			Better selection at restaurants			Marketing (e.g. tastings, ad campaigns)		
	β	95% CI	Interaction <i>p</i> value ^a	β	95% CI	Interaction <i>p</i> value	β	95% CI	Interaction <i>p</i> value	β	95% CI	Interaction <i>p</i> value	β	95% CI	Interaction <i>p</i> value
Gender															
Woman (ref. cat.)															
Man	-.328***	-.504; -.152		-.305***	-.467; -.142		-.561***	-.752; -.370		-.375***	-.559; -.191		-.559***	-.734; -.383	
Age															
18-34 (ref. cat.)			.485			.292			.634		.424				.026*
35-54	-.141	-.363; .081		-.032	-.235; .171	-.085	-.325; .156	-.237*		-.466; -.008	-.103		-.324; .118		
55-75	-.091	-.311; .130		-.245*	-.449; -.041	-.158	-.398; .082	-.684***		-.914; -.455	-.229*		-.449; -.010		
Education level															
Tertiary (ref. cat.)			.996			.909			.200		.705				.800
Secondary	-.158	-.350; .033	-.100	-.276; .076	.071	-.136; .278	-.175	-.373; .024		.122	-.070; .313				
Elementary	-.148	-.446; .149	-.205	-.480; .070	-.201	-.525; .124	-.301	-.617; .014		.213	-.083; .508				
Perceived financial situation															
No financial strain (ref. cat.)			.320			.366			.891		.089				.050
Ok when frugal	.019	-.177; .216		-.027	-.209; .154	.168	-.046; .381	-.078		-.282; .125	-.044		-.240; .152		
Financial strain	-.234	-.482; .014		.071	-.158; .301	.142	-.129; .414	-.223		-.487; .041	.017		-.231; .265		
Red meat consumption															
Less than 5 times a week (ref. cat.)			.126			.116			.598		.165				.841
At least 5 times a week	-.202*	-.395; -.009		-.280**	-.458; -.102		-.043	-.252; .166		-.290**	-.492; -.089		-.288**	-.480; -.097	
Adjusted R ²	.024***	.030***	.039***	.070***	.053***										

^a *p* value for the R² change associated with the interaction term(s) between gender and each of the other predictors in relation to the enabler.

Table 4
Multivariable linear models predicting the importance of the enablers.

	Better in-store availability/visibility			Organic			Recommendations from friends/family			Higher price of meat and meat products			Public discussion on the health and environmental benefits related to pulses		
	β	95% CI	Interaction <i>p</i> value ^a	β	95% CI	Interaction <i>p</i> value	β	95% CI	Interaction <i>p</i> value	β	95% CI	Interaction <i>p</i> value	β	95% CI	Interaction <i>p</i> value
Gender			-			-			-			-			-
Woman															
Man	-.336***	-.502; -.171		-.305***	-.482; -.128		-.368***	-.534; -.201		-.007	-.187; .172		-.445***	-.614; -.276	
Age			.045*			.292			.330			.518			.383
18-34 (ref. cat.)															
35-54	-.051	-.259; .157		-.106	-.330; .117		-.335**	-.542; -.127		-.114	-.339; .111		-.283*	-.496; -.069	
55-75	-.209*	-.415; -.002		-.180	-.403; .043		-.927***	-.1.135; -.720		-.304**	-.530; -.078		-.356**	-.567; -.144	
Education level			.666			.903			.421			.199			.613
Tertiary (ref. cat.)															
Secondary	.025	-.155; .205		-.092	-.284; .100		.041	-.139; .222		-.107	-.302; .089		-.088	-.272; .096	
Elementary	-.219	-.501; .063		-.054	-.352; .245		.062	-.221; .345		-.219	-.526; .087		.058	-.228; .344	
Perceived financial situation			.110			.238			.919			.494			.031*
No financial strain (ref. cat.)															
Ok when frugal	-.026	-.211; .159		-.053	-.250; .145		-.134	-.320; .052		.261*	.060; .462		.032	-.157; .221	
Financial strain	.027	-.208; .262		-.250	-.501; .001		-.250*	-.485; -.015		.154	-.098; .407		-.117	-.355; .122	
Red meat consumption			.012*			.472			.374			.018*			.312
Less than 5 times a week (ref. cat.)															
At least 5 times a week	-.320***	-.502; -.139		-.267**	-.461; -.073		-.115	-.297; .067		-.419***	-.614; -.223		-.360***	-.545; -.175	
Adjusted R ²	.034***	.024***	.096***	.031***	.058***										

****p*<.001, ***p*<.01, **p*<.05

^a *p* value for the R² change associated with the interaction term(s) between gender and each of the other predictors in relation to the enabler.

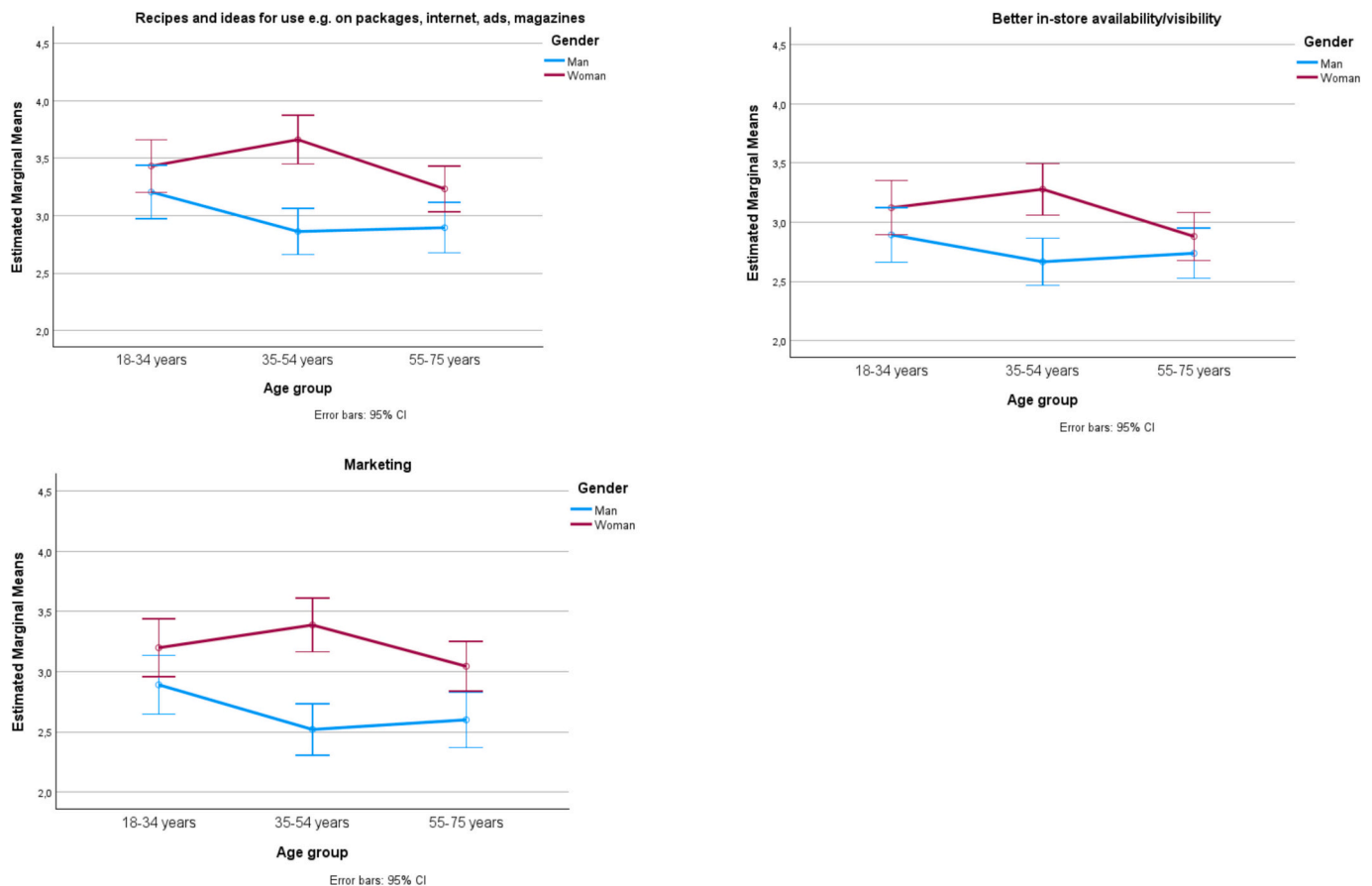


Fig. 1. Estimated marginal means (95 % CIs) of the enablers Recipes and ideas for use, Marketing, and Better in-store availability/visibility by gender and age group. The models include gender, age group, education level, perceived financial situation, meat consumption frequency, and the interaction between gender and age group as independent variables.

other interactions for age groups, financial situation, and red meat consumption frequency were statistically non-significant. None of the interactions were statistically significant for the education level.

Fig. 3 presents all of the studied enablers in their best corresponding COM-B elements. The enablers having more prominence in Fig. 3 derive from their importance in all respondents, the strength of the associations (R^2 change values) with sociodemographic and red meat consumption frequency factors and the interactions between gender and the other predictors.

4. Discussion

The objective and novel aspect of this study was to focus on a diverse set of enablers that could increase the consumption of pulses and PBPs across sociodemographic groups and consumers with different red meat-eating habits. By applying the COM-B model to analyze the capabilities, opportunities and motivations related to increasing pulse and PBP consumption we respond to the calls made in previous studies in the field (e.g. Graça et al., 2019; Onwezen & Dagevos, 2024).

The addition of red meat consumption frequency as a background variable alongside the more traditional sociodemographic factors allowed us to examine what kind of enablers could encourage consumers with different meat-eating habits to add more pulses and PBPs into their diets. According to our results, the respondents who consumed red meat daily or almost daily perceived most of the enablers to increase their pulse and PBP consumption less than those consuming red meat less often. We argue that red meat consumption frequency combined with sociodemographic factors provides valuable information for advancing a dietary shift. However, it is quintessential to include both in the analysis,

as red meat consumption is often intertwined with sociodemographic factors, especially gender, and thus carries with it complex, intangible, and deep-rooted connotations (e.g. Johnston et al., 2021; Rothgerber, 2013). Moreover, although the results related to sociodemographic factors echoed the findings from previous studies (e.g. Graça et al., 2019; Nevalainen et al., 2023; Niva & Vainio, 2021), i.e. women and the young perceived most of the enablers more relevant and men and older consumers found them less relevant, by using interactions we were able to identify some subgroups who might benefit from targeted food behavior interventions to increase their pulse and PBP consumption.

4.1. Capability: Providing recipes

Learning new skills to cook and having recipes to follow can boost one's *psychological* capability to consume pulses (Szczybyło et al., 2020) and other plant-based meat alternatives (White et al., 2022). Recipes and ideas for use provided was among the five most important enablers for all examined consumer groups, but it was especially important for women. As men are less likely consumers of plant proteins than women (e.g. Culliford & Bradbury, 2020; Niva & Vainio, 2021), they may not be interested in cooking them either, hence having recipes is not so much an enabler for men.

In addition, having recipes and ideas for use was particularly relevant for 35–54-year-old women and for women with financial strain. These findings may have to do with the notion that it is still often women who shop for groceries and prepare meals for the family (Holm et al., 2015). The group of 35–54-year-old women are those who are most likely to have families with children of different ages to feed at home and may experience time constraints, which is why easily accessible recipes

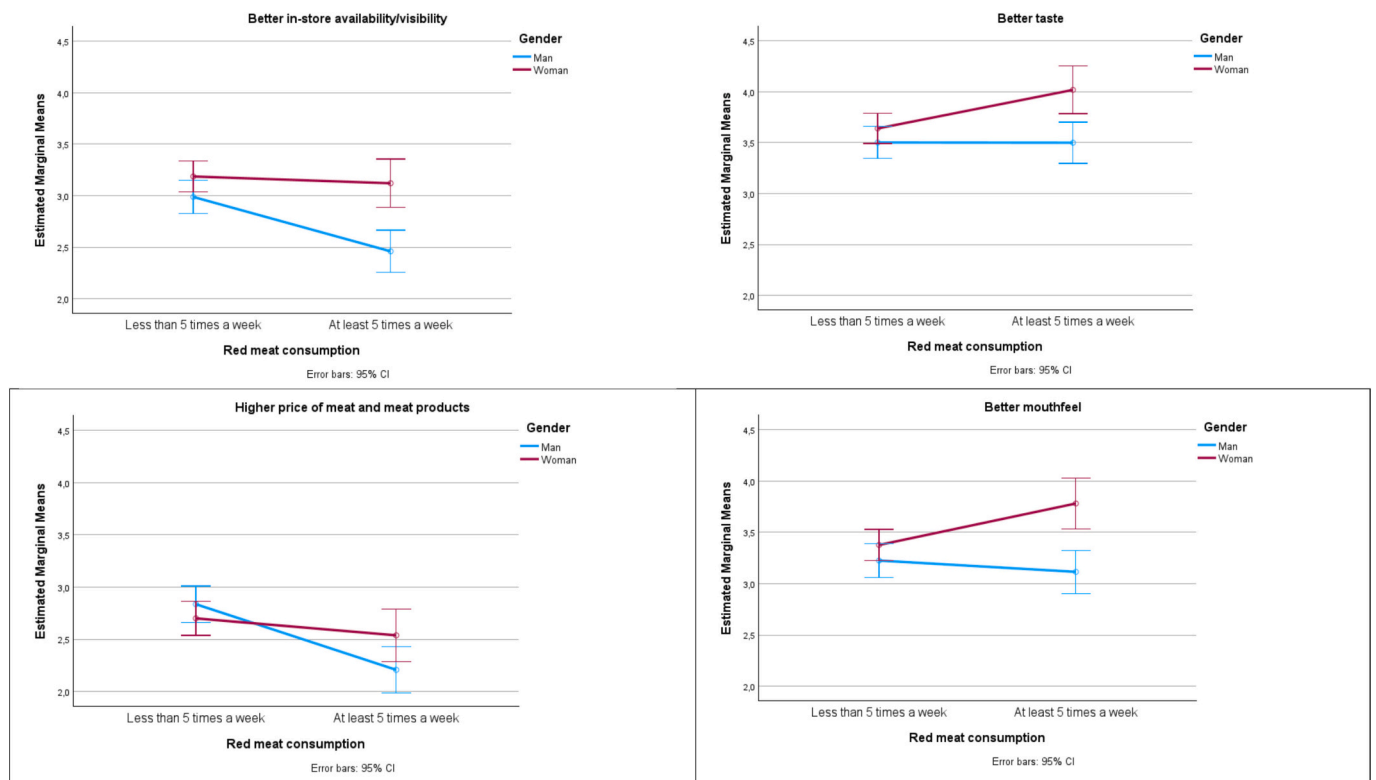


Fig. 2. Estimated marginal means (95 % CIs) of the enablers Better in-store availability/visibility, Higher price of meat and meat products, Better taste and Better mouthfeel by gender and red meat consumption frequency. The models include gender, age group, education level, perceived financial situation, meat consumption frequency, and the interaction between gender and age group as independent variables. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

and ideas are appreciated. Moreover, struggling financially has been associated with unfamiliarity with pulses and PBPs (Kuosmanen et al., 2023) and thus recipes ready to go with the food ingredient are welcome and may lower the barrier to buy and prepare these kinds of food products. Prior studies have concluded that providing recipes ease introducing new foods into (familiar) meals (Gravely & Fraser, 2018), and that especially women perceive having recipes for pulse dishes to increase their use (Szczybyło et al., 2020). In addition, social media can affect eating habits (Sokolova et al., 2024), especially among women (Alwafi et al., 2022). It can be argued that in many cases, women at least in some capacity make food choices for the whole family by grocery shopping and cooking. Thus, easy availability of recipes, be it on the packages or in social media cooking videos, for instance, might advance plant protein consumption among men and children as well.

4.2. Physical and social opportunities

In general, price is one of the most significant factors in food selection (e.g. Renner et al., 2012; Steptoe et al., 1995). Furthermore, being able to afford whatever food one desires may be seen as a privilege (Greenebaum, 2017; Steptoe et al., 1995). Thus, price represents physical opportunity. Earlier research has varied on the meaning of price in consuming plant-based foods: it has been found to be a major barrier (Knaapila et al., 2022), not a barrier (Niva et al., 2017), and both a barrier and non-barrier (van den Berg et al., 2022). In our study, the lower price of pulses and PBPs was found to be either the most important or second most important enabler among all subgroups, except for the 55–75-year-olds, for whom lower price was the third most important enabler. According to Lappalainen et al. (1998), among the 15 European Union countries of that time, the price of food was the most important for the Finns. In the Finnish context this emphasis on price is understandable: in Finland, the ethos of thrift has prevailed for decades

(Heinonen, 2013), and the price-quality ratio is highly appreciated when making food choices (Konttinen et al., 2021).

In a study by Knaapila et al. (2022) millennial Finns perceived plant-based meat alternatives too expensive. The same trend can be observed from our results: for 18–34-year-olds, who are also more likely plant protein consumers (e.g. Nevalainen et al., 2023), lower price was more important than to older respondents. We suggest that the price of PBPs may be more irrelevant for older consumers, as they tend to consume plant-based meat alternatives less and pulses more than younger consumers (Kuosmanen et al., 2023), and pulses per se are rather affordable. Furthermore, cheapness of food is important especially for those with lower incomes (Konttinen et al., 2021), which is demonstrated in our results as well. However, the results from the lower price enabler are somewhat complicated to interpret, as pulses per se and PBPs were lumped together in the original question. Pulses are quite budget-friendly, as is canned pea soup, but PBPs resembling meat and acting as meat alternatives are often more expensive. The consensus among the studied consumer groups that lower price is an important enabler leads us to believe that the majority of the respondents most likely thought of PBPs rather than pulses per se. Other supporting factor for this line of thought is that at the time of the survey, some PBPs (mostly pea and faba bean-based) had entered the Finnish market rather recently and had quite conspicuous ad campaigns, and their prices were (are) more expensive compared to pulses per se.

The other enabler regarding the price of food was the higher price of meat and meat products. Raising meat prices or employing a meat tax to advance plant-based eating is a measure suggested in earlier research (Graça et al., 2019; Kwasny et al., 2022), but steering consumers towards healthier foods through pricing policies or taxation does not always hit the target (e.g. Bødker et al., 2015). Even though carefully planned financial interventions may lead to a desired change in food consumption (e.g. Sacks et al., 2021), according to our results, higher

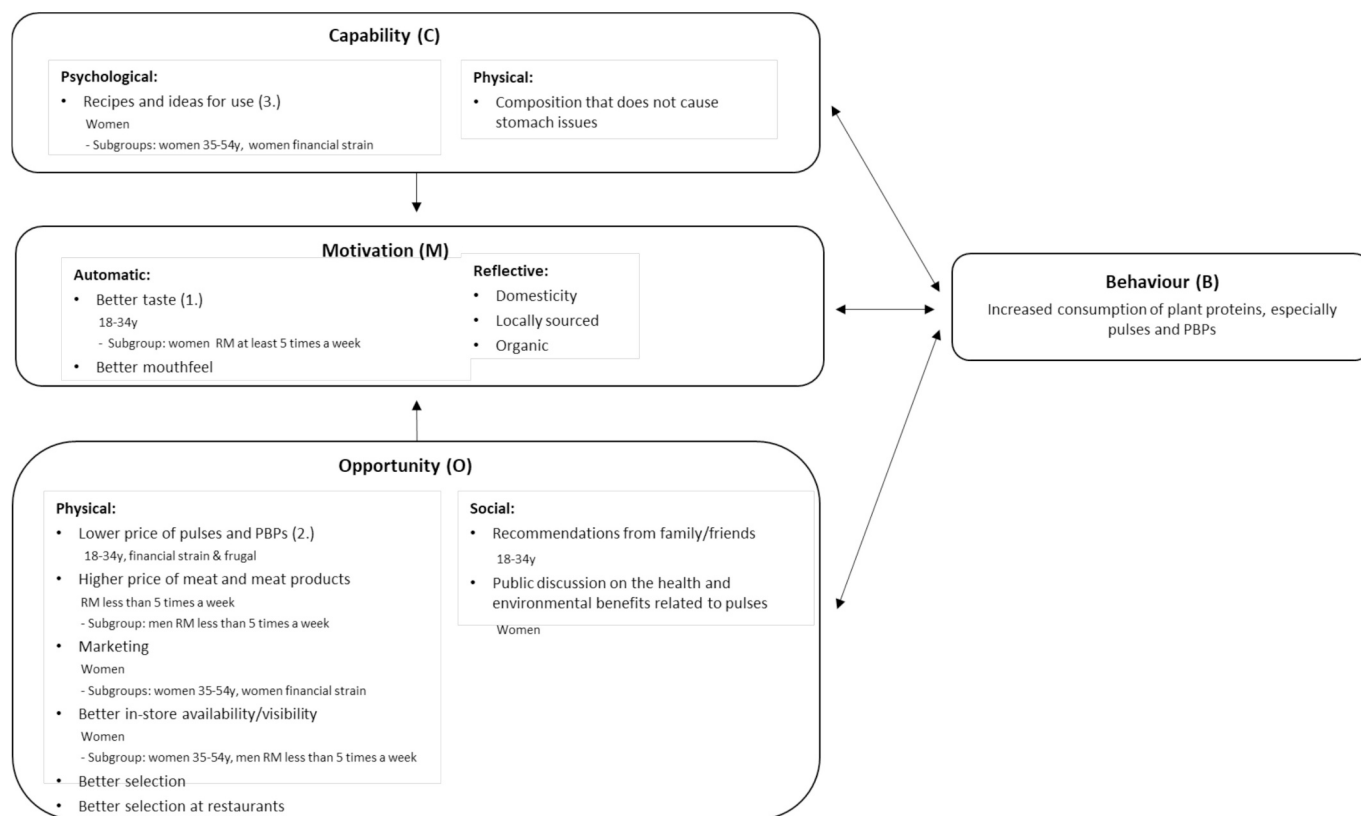


Fig. 3. The studied enablers classified into the COM-B elements and main outcomes of the study derived from the enablers' overall importance, the strength of their associations (R^2 change values) with the sociodemographic and red meat consumption frequency factors and the interactions between gender and other predictors. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

meat prices would not act as an enabler to increase pulse and PBP consumption for the majority of the respondents, particularly among daily or almost daily red meat consumers, likely due to the importance placed on meat. However, we noted that there was a difference among men: men consuming red meat less than 5 times a week perceived higher meat prices to be a more likely enabler for increased pulse and PBP consumption. These men may be less attached to meat and thus more willing to reduce their meat consumption through price prompts than men who consume red meat more often.

Furthermore, our results indicate that more effective marketing strategies would be a beneficial *physical* opportunity for women, particularly for women aged 35–54 years and financially strained women. As discussed above, these subgroups of women may experience more pressure in providing tasty dishes for other family members. The original enabler claim had sampling and ad campaigns given as marketing examples. Being able to sample plant protein foods in a grocery store could advance their consumption, as shoppers (and their children) could familiarize themselves with these products pre-purchase (Gravelly & Fraser, 2018). In addition, the sampled plant proteins would likely be prepared as parts of a meal at the sampling station, such as a curry or a sample size burger, further giving ideas how to utilize them at home.

In general, pulses and PBPs' better availability or visibility in grocery stores can contribute to their increased consumption. Our results show this to be the most enabling for women, and particularly for women aged 35–54 years, but also for men consuming red meat less than 5 times a week. The shelf space allocated for plant-based proteins is significantly smaller than for animal proteins and their placement often varies between stores (Gravelly & Fraser, 2018): rather frequently meat alternative proteins are placed away from animal proteins (Brooker et al., 2021). As meat purchasing and consumption are rather habitual behavior (Kwasny et al., 2022), these measures can affect negatively the *physical* opportunity to purchase and consume plant-based foods,

especially among time-constrained shoppers. In Finland, refrigerated plant-based meat alternatives are often placed in their own section labeled as “vege” (short for vegetarian), but the placement of this section varies. It may be in the same aisle as meat and meat products, or in the convenience food aisle. Placing the “vege” section in the meat aisle may signal that they are alternatives to meat, while convenience food aisle may have more negative connotations. Additionally, more traditional tofu is often placed on the cheese shelf, and Vaskelainen et al. (2022) note that tofu did not benefit from the new plant-based meat alternative “hype”, maybe partly because of its separate location. We argue that placing refrigerated plant-based meat alternatives, including PBPs, next to meat equivalents would make them more accessible among various consumer groups and send a signal that they do provide a viable alternative to meat while also challenging routinized meat buying.

In addition to the physical opportunities described above, social opportunities can have a considerable effect on what is eaten and which kinds of diets are acceptable (e.g. Sijtsma et al., 2021). In this study, social opportunity is represented by the enablers of recommendations from friends and family and public discussion on the health and environmental benefits related to pulses. Neither of these enablers were perceived as particularly important among the respondents. However, the youngest age group did find recommendations from friends and family to be a rather significant enabler, while public discussion on the merits of pulses appealed particularly to women. This further strengthens the notion that these two groups often are the most interested in plant-based foods, and thus may discuss them with their social contacts as well as be more inclined to take notice of how they are presented publicly, and these actions can then encourage increased consumption.

4.3. Motivation: Taste

In addition to suitable price, sensory appeal including good taste is often another significant factor in choosing food (e.g. Steptoe et al., 1995). Liking the sensory aspects of food brings pleasure and thus may translate into *automatic* motivation to consume pleasure-inducing foods again. The unsavory taste of pulses has been identified to be a major barrier to their consumption (Kuosmanen et al., 2023; Niva et al., 2017; Vainio et al., 2016), and there is evidence that plant-based meat alternatives need to taste good for consumers to want to eat them (Kerlake et al., 2022; Siegrist & Hartmann, 2019). In our study, better taste of pulses and PBPs was particularly important for the youngest age group, but was also in TOP2 enablers in all examined groups, further showcasing the importance of good taste across all sociodemographic and meat-eating frequency groups. Hoek et al. (2011) suggested that improving the sensory qualities of plant-based meat alternatives could attract meat consumers.

However, our findings suggest that it is particularly women with high red meat consumption frequency who could potentially increase their consumption of pulses and PBPs if their sensory aspects were more appealing. This difference between genders might be explained at least partly with the finding that men with the highest red meat consumption find meat more important than women consuming large amounts of red meat, thus these men may find it (emotionally) harder to reduce high meat consumption than women, for whom it may be more a habit than a crucial element of their diet (Sares-Jäske et al., 2022). In addition, if women with high meat-eating frequency found palatable plant-based options, they might influence their families' meat-eating habits as well.

Furthermore, as good taste is such a significant enabler across all studied groups, it would be essential to introduce palatable pulse and PBP dishes to all consumer groups to gain good taste experiences, and to challenge the belief that plant-based foods taste bad (Reipurth et al., 2019), albeit how to successfully carry out these kinds of taste experiments is a rather complex matter. For instance, if there is a choice between a plant-based (meat alternative) meal and a meat meal, it is likely that the meal containing meat is chosen. Hartmann and Siegrist (2017) proposed that one way to reduce meat consumption among those with positive attitudes towards meat could be to offer dishes such as pizza or pasta which do not necessarily need meat to be perceived as complete meals. This could be one way to approach introducing plant-based meat alternatives as well, especially if no meat option is available. In addition, hybrid meat that includes both meat and plant-based ingredients may also be a stepping stone towards more plant-based diets, but at present, they are quite unfamiliar to consumers (Van Dijk et al., 2023). Yet another way could be nutrition interventions in which the participants are provided with plant-based options and thus get to taste several different products over a longer period of time, as in Ikonen et al.'s (2023) study with only male participants. However, if there is no interest towards nutrition or experimenting with one's diet this will not be a viable option, but for those who are interested in and have thought about plant proteins as an option participating in a nutrition intervention could be a good starting point.

In addition to the automatic motivation of taste, domesticity as a *reflective* motivation was rated overall as an important enabler among all the respondents. In general, Finns appreciate domestic food (e.g. Niva & Jallinoja, 2018), and consuming Finnish food is frequently associated with supporting domestic food producers as well as being environmentally friendly (Kumpulainen et al., 2018). Thus, it is plausible that the domesticity of pulses and PBPs is no exception to this.

4.4. Theoretical reflections

Even though the main focus of this paper on opportunities, our intention is not to diminish the motivations and capabilities required for plant-based eating to materialize as a behavior. First, there are multiple measures to enhance the capabilities related to increasing plant-based

eating, and at least some of them can also affect opportunity and motivation (Isbanner et al., 2024; Willmott et al., 2021). A focal capability factor, or enabler as called in this paper, is providing consumers with suitable recipes. We have suggested that social media influencers sharing cooking videos and recipes is one way to increase capability. Besides boosting capability, this measure can also reinforce social opportunity, as sharing plant-based recipes on social media creates an atmosphere where these kinds of foods are acceptable. This in turn can affect motivation positively and finally result in the consumption of more plant-based foods. Second, even if all kinds of physical opportunities were provided, such as a broad range of plant proteins catering to every need, but there is no motivation to consume such foods, the behavior of plant-based eating will not materialize (see Isbanner et al., 2024). Sometimes other motivation overrides another, i.e., there are competing motivations (West & Michie, 2020). In the context of plant-based eating the competing motivation is often to eat meat, which is why exploring meat-eaters' perspective is a valuable aspect when aiming to advance plant-based eating. In some cases the competing motivations can be addressed by modifying another COM-B element. For instance, price is an opportunity which can both increase and decrease a motivation to eat in a certain way – lower pulse and PBP and/or higher meat prices may shift the motivation to consume more plant-based foods and less meat, at least among some consumers.

The impact and importance of the enablers, and thus COM-B elements, often varies among different consumer groups. This study along with earlier research has established that certain groups of consumers are more positive towards plant-based eating (Graça et al., 2019; Nevalainen et al., 2023; Niva & Vainio, 2021). In addition, our results indicate that inside these groups are often smaller, more specific clusters of people who have potential to (further) alter their eating habits. However, to strengthen their motivation to do so, this requires enhancing opportunities and capabilities relevant to these individuals (Isbanner et al., 2024). Our study demonstrates some examples of this: women of certain age and financial situation would benefit from specific enhanced opportunities (e.g. better marketing) and capabilities (recipes), while improved taste of pulses and PBPs could affect the motivation of women consuming red meat daily or almost daily. Conversely, men consuming red meat less frequently found that adjusting some opportunities, such as higher meat prices, would be somewhat relevant to them.

These notions indicate how the relevance of the COM-B elements and the enablers varies among consumer groups, and the importance of enhancing the elements most relevant among each group to achieve a behavioral change. Moreover, our findings demonstrate the deep interrelatedness of the COM-B elements and thus echo the results by Isbanner et al. (2024) and Willmott et al. (2021). The COM-B model has been previously applied successfully in researching plant protein consumption in general (e.g. Graça et al., 2019; Onwezen & Dagevos, 2024). However, our study shows that not only is it a suitable framework for researching a more specific cluster of plant proteins, i.e. pulses and pulse-based products, but that it is valuable in studying plant-based eating habits among different consumer groups.

4.5. Consistent results with earlier study on barriers

Given that the same dataset has been used previously for examining ten barriers related to plant protein consumption across sociodemographic groups (Kuosmanen et al., 2023), it is plausible that the findings in these two studies are consistent even though the current study is more extensive due to a broader range of enablers and the inclusion of red meat-eating frequency. The sociodemographic groups perceiving both more barriers and enablers in the two studies were women and the young respondents, further solidifying the notion that they are the most invested consumer groups in plant-based eating. The main barriers identified were unpleasant taste, perceived high price, and unfamiliarity with pulses (Kuosmanen et al., 2023), while the most important enablers

were better taste, lower price, and having easy access to recipes and ideas for use. Thus, if the perceived barriers were overcome and the enablers reinforced, particularly women and the young would have real potential to (further) increase their consumption of plant proteins and also possibly influence the eating habits of at least their immediate families.

4.6. Strengths and limitations

The main strength of this paper is the detailed analysis of a diverse range of enablers related to increasing pulse and PBP consumption and their association with sociodemographic factors and meat-eating frequency. Further analysis with interaction terms uncovered some subgroups who might be rather receptive to certain incentives, and these findings can be employed when planning targeted interventions to advance plant-based eating. Another strength is the broad survey data, which is representative of the Finnish adult population in terms of gender, age, living area and education level.

One limitation of this study is that as the group of respondents is diverse, not everyone is interested in food choices or plant-based eating. Thus, they may not have thought of these matters before and can easily respond “I do not know”. Although the “I do not know” responses were excluded from the analysis, there may still be some variation between the respondents in the fruitfulness of this rather direct approach of inquiring about the enablers. In addition, lumping pulses per se and PBPs together in the original question has likely resulted in ambiguous responses with some enablers, such as price. Another limitation with the survey was that enablers related to more intangible factors, such as cultural and habitual behavior were largely omitted, as the examined enablers were partly based on an earlier consumer survey related to the same themes. Further, the data were collected already some years ago in the midst of the COVID-19 pandemic, so it is possible that eating motives have changed from that time. However, in general, changes in eating habits are slow to materialize (e.g. Niva et al., 2017), and it seems that European meat and plant-based eating habits have not changed drastically during or after the pandemic (SmartProtein Project, 2023). Thus, we believe that the data are still relevant.

5. Conclusions

This study demonstrates that currently the consumer groups, namely women, the young, and those consuming red meat less frequently, who have already been identified as more likely users and to have an interest in plant-based foods also perceived many of the enablers examined to possibly increase their consumption of pulses and PBPs more than groups less interested in plant-based eating. However, the enablers of lower price and better taste of pulses and PBPs were prominent among all studied consumer groups. The enablers were analyzed in accordance with the COM-B model to better understand what kind of measures could be most effective if pulse and PBP consumption is to be advanced. For this kind of dietary change to materialize, it is essential to have *motivation* to do so. According to our results the major motivational enabler is better taste of pulses and PBPs, which indicates that currently they are not tasty enough and thus motivation to consume them may be lacking. In addition to the food industry's efforts to improve the taste, consumer *capability* has a role here. The capability to cook tasty pulse and PBP dishes could be enhanced with easily available recipes and ideas for these kinds of products. Furthermore, affordable price is the most prominent *opportunity* to make pulses and PBPs more accessible. In addition, improved grocery store settings, better marketing, and increased price of meat are relevant opportunities for increasing pulse and PBP consumption among certain consumer groups. Thus, for the targeted behavior of increasing pulse and PBP consumption to be realized all elements of COM-B are needed with special attention paid to opportunities. However, our results suggest that the transition towards diets with more pulses and PBPs could, at present, be best achieved

through women. Tailored interventions for men and older people have been called for (Niva & Vainio, 2021), and we propose adding daily or almost daily meat consumers to the targeted groups. We also suggest that further, possibly qualitative, studies on enablers especially among the aforementioned groups are needed. Moreover, as the plant protein environment, i.e. opportunities, can change relatively fast, it is crucial to continue monitoring it to receive up to date information how the importance of different enablers evolves among different consumer groups to advance the consumption of pulses and PBPs.

Funding

This research was funded by the Strategic Research Council within the Research Council of Finland (grants 327698 and 327700), the Research Council of Finland (grants 309157 and 314135 to HK), and Raisio Plc's Research Foundation (personal grant to SK). The funding sources had no involvement in study design, data collection, analysis or interpretation, writing the article, or in the decision to submit the article for publication.

Data statement

The data included in this study are available upon reasonable request.

Ethical statement for the manuscript “Enabled to eat more plant proteins? Capabilities, opportunities, and motivations related to increasing pulse and pulse-based product consumption across consumer groups” written by S. Kuosmanen, K. Korhonen, A.-M. Pajari, and H. Konttinen.

The survey and its protocol were reviewed by the University of Helsinki Ethical Review Board in Humanities and Social and Behavioral Sciences (Statement 40/2020) prior to data collection. The respondents were provided detailed information on the study prior to participation and gave their informed consent electronically.

CRediT authorship contribution statement

Sini Kuosmanen: Writing – original draft, Visualization, Formal analysis, Conceptualization. **Kirsi Korhonen:** Writing – review & editing, Investigation. **Anne-Maria Pajari:** Writing – review & editing, Supervision, Investigation, Funding acquisition. **Hanna Konttinen:** Writing – review & editing, Supervision, Investigation, Funding acquisition, Formal analysis, Conceptualization.

Declaration of competing interest

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

Data availability

Data will be made available on request.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.foodqual.2024.105388>.

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