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Sustainable diets: Links between knowledge, motivations and eating practices.

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Abstract

To preserve the planet's ecosystems and ensure the well-being of its inhabitants, the adoption of more sustainable diets is necessary. At present, however, consumer dietary practices often remain unsustainable. One main barrier to adopting sustainable diets is the lack of both knowledge and motivation. The primary objective of this study was to examine whether a link exists between knowledge about sustainable diets and sustainable eating practices, and whether this link is mediated by motivations. Additionally, we compared the respective roles of objective and subjective knowledge about sustainable diets. To this end, 273 participants aged 20 to 60 years responded to questionnaires about their motivations concerning sustainable food choices, as well as their objective and subjective knowledge about sustainable diets, and their self-reported sustainable eating practices. A PLS-SEM model was used to analyze the relationships among these variables, demonstrating good reliability of the indicators, internal consistency, convergent and discriminant validity, and no multicollinearity. The predictive power of this model was found to be satisfactory, with 18% of the variance explained for motivations and 34% for practices. Our results indicate a significant link between knowledge about sustainable diets and sustainable eating practices, with motivations acting as a crucial mediator in this relationship. This finding was confirmed for both objective and subjective knowledge. Subjective knowledge was thus also revealed to have a direct effect on sustainable eating practices. These findings suggest that the manner in which individuals perceive their own knowledge about sustainable diets may have a greater impact on their practices than their actual knowledge, and that motivations play a central role in shaping sustainable behaviors.

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Introduction

To safeguard ecosystems and protect human well-being, a transition towards sustainable diets is essential (Meybeck & Gitz, 2017; Willett et al., 2019; Springmann et al., 2021). Sustainable diets are characterized by their low environmental impact; they support food and nutrition security and promote healthy lives for present and future generations (FAO, 2010). Current eating practices do not align with dietary guidelines (Leme et al., 2021) and require natural resources that exceed planetary limitations (Willett et al., 2019; Lucas et al., 2021). The transition toward more sustainable diets thus requires a change in consumer dietary habits (Willett et al., 2019). To facilitate the transition toward more sustainable diets, it is essential to more fully understand the key drivers and barriers to more sustainable food practices, and the interconnections between them.

Recent reviews identify various factors that may impede the adoption of sustainable dietary practices (Muñoz-Martínez et al., 2024; Principato et al., 2025). These barriers include external influences, e.g. social norms, pricing, and supply-related factors, as well as internal factors, e.g. awareness, knowledge, skills, attitudes, motivations, emotions, and cognitive dissonance (Principato et al., 2025). At the level of the consumer, several studies have highlighted the limited understanding of the concept of sustainable diets on the part of consumers (van Bussel et al., 2022; Hazley & Kearney, 2024). However, a lack of knowledge is not the only barrier to sustainable food choices, which can also be impeded by lack of motivation. In a food choice situation, sustainability-related motivations, such as environmental and ethical concerns, tend to be secondary for consumers when compared with taste, food safety, and cost (European Commission, 2020). Despite extensive research on barriers and facilitators, research remains limited on how motivation and knowledge interact in shaping consumer practices.

To address this question, the Motivation-Ability-Opportunity-Behavior (MOA) model identifies three determinants of unsustainable behaviors: motivation (i.e. a goal-directed arousal to engage in desired behaviors); ability (i.e. the psychological and physical capacities required to act); and opportunity (i.e., external conditions facilitating or hindering action) (Ölander & Thøgersen, 1995). The MOA model has been applied to pro-environmental practices by Li et al. (2017), who subdivided ability into two types of knowledge: objective knowledge (what someone has stored in memory) and subjective knowledge (what someone believes they know) (Brucks, 1985). In a later study, they introduced the mediating role of motivation, emphasizing its influence on the relationship between ability, opportunity, and behavior (Li et al., 2019). This model has been partially extended to sustainable food consumption, but only in specific contexts, such as its application to a particular food item (Tong et al., 2023), consumption of organic food products (Zhu, 2016), and circular food consumption practices (Raimondo et al., 2023).

Building on these findings, we examined whether the extended MOA model could be applied to the more general study of sustainable eating practices.

Effect of objective and subjective knowledge on practices

The effects of both objective and subjective knowledge on the adoption of sustainable practices have been studied. For example, objective knowledge about climate change was positively associated with self-reported climate-conserving behavior (Mohamed Ali Khan et al., 2021), and French students with extensive objective knowledge of the environmental impact of food chose vegetarian dishes more often in a cafeteria and had more environmentally friendly diets (Arrazat et al., 2024, 2025). Subjective knowledge was also found to predict self-reported sustainable eating practices (Verain et al., 2015). Moreover, in a choice experiment, Hoek et al. (2017) found that consumers' subjective knowledge about healthy and environmentally-friendly foods was generally higher among those who selected healthy and sustainable alternatives.

Indeed, subjective knowledge often drives behavior more strongly than objective knowledge (Feick et al., 1992; Kwon et al., 2021). In the context of organic food choice, subjective knowledge correlated with higher consumption, whereas objective knowledge did not (Pieniak et al., 2010;

Aertsens et al., 2011). In a choice experiment, individuals with high subjective knowledge about climate-friendly production were more likely to choose food products with lower carbon and water footprints, which was not always the case in individuals with extensive objective knowledge (Peschel et al., 2016).

Based on these findings, our primary objective was to evaluate the influence of objective and subjective knowledge about sustainable diets on food practices. We therefore formulated the following hypothesis:

H1: Objective knowledge (a) and subjective knowledge (b) about sustainable diets both have a positive effect on sustainable eating practices, but the effect of objective knowledge is weaker than that of subjective knowledge.

Effect of motivation on practices

The literature indicates a strong link between sustainable dietary motivations and sustainable eating practices. Sustainability motivation, such as concerns for animal welfare, environmental protection, origin-based sourcing, local purchasing, and organic options, significantly predicted self-reported sustainable eating practices (Verain et al., 2015). Brunin et al. (2022) showed that participants with the most sustainable diets over time exhibited stronger sustainable food-purchase motives, including “ethics and environment,” “traditional and local production,” “health,” and “absence of contaminants.” Extending these findings, Marty et al. (2022) demonstrated a link with multiple dimensions of sustainable diets. Specifically, motives related to sustainability, such as health, natural content, and ethical concerns, were positively associated with various indicators in consumption: health outcomes (nutritional quality), environmental outcomes (organic food consumption), and sociocultural factors (local food consumption).

Based on these findings, our second objective was to evaluate the influence of motivations about sustainable diets on food practices.

H2: Sustainable dietary motivations have a positive effect on sustainable eating practices.

The central and mediating role of motivations

In addition to such direct links, knowledge may also influence practices indirectly through motivations. Individuals who reported strong sustainable dietary motivations tended to exhibit higher levels of both subjective and objective knowledge about sustainable foods (Piracci et al., 2023). Similarly, Aertsens et al. (2011) demonstrated that both types of knowledge positively influenced motivation for organic food consumption. Building on these findings and on the mediating role of motivation identified by Li et al. (2019) in the context of energy-saving behaviors, we aimed to analyze the interactions between these variables and to assess whether motivations mediate the relationship between knowledge and practices. We thus formulated the following hypotheses:

H3: Knowledge about sustainable diets, both objective (a) and subjective (b), has a positive effect on sustainable dietary motivations.

H4: Sustainable dietary motivations mediate the relationship between knowledge about sustainable diets, both objective (a) and subjective (b), and sustainable eating practices.

Methods

This study was conducted in accordance with the principles outlined in the Declaration of Helsinki and was approved by the Institutional Review Board of INSERM (CEEI/IRB) (IRB00003888, IORG0003254, FWA00005831) on January 10, 2023.

Sample and Procedure

Questionnaires were administered to 281 participants during supervised sessions conducted by an experimenter in a laboratory located in Dijon, France, between March and April 2023. Each participant completed the questionnaires individually using a computer via LimeSurvey

(LimeSurvey GmbH, Hamburg, Germany). The questionnaires, presented in French, required a maximum of 15 minutes to complete. Participants were recruited from PanelSens, the internal participant database of the CSGA laboratory, located in Dijon in a district with several universities, research institutions, and hospitals. This panel includes volunteers who have given prior consent to be contacted for studies related to food, sensory analysis, and consumer behavior. While the panel is fairly diverse, its geographical location means it includes a higher proportion of individuals living in urban areas and with higher education levels. Participants in our study were contacted by email for participation. Participants received ten euros in gift vouchers.

The initial sample size was determined using the inverse square root method developed by Kock and Hadaya (2018) for PLS-SEM (Partial Least Squares Structural Equation Modeling). Based on the guidelines outlined by Hair et al. (2021), 155 participants were required to achieve a statistical power of 80%, a significance level of 5%, and minimum path coefficients ranging between 0.11 and 0.2. Due to technical issues, eight participants did not complete the questionnaire, resulting in a final sample size of 273 participants, which was sufficient to satisfactorily meet the study conditions. The sample was balanced in terms of gender, educational level, and age (20 to 60 years old) in order to examine relationships within a diverse population (Table 1). Nevertheless, people with higher education were overrepresented (58.9% in our study vs. approximately 43% nationally in 2022 (INSEE, 2025), while individuals living in rural areas were underrepresented (17.2% in our study vs. 33% in France in 2017; INSEE, 2021).

Table 1 - Demographic characteristics of participants (n=273).

Characteristics	Number of participants	Percentage
Sex		
Female	142	52%
Male	131	48%
Age		
20-30	65	23.8%
31-40	70	25.6%
41-50	66	24.2%
51-60	72	26.4%
Educational level		
Without higher education	112	41.1%
With higher education	161	58.9%
Residence		
Countryside	47	17.2%
Periphery	58	21.2%
City	168	61.6%
Diet		
Omnivore	128	46.9%
Flexitarian	124	45.4%
Pescetarian	14	5.1%
Vegetarian	6	2.2%
Vegan	1	0.4%
Number of adults living in the household		
1	90	33%
2	138	50.5%
3 and more	45	16.5%
Number of children living in the household		
0	171	62.6%
1	49	17.9%
2	42	15.4%
3 and more	11	4.1%

Questionnaires

Participants completed a series of questionnaires assessing their objective and subjective knowledge about sustainable diets, their motivations concerning sustainable diets, their sustainable eating practices, and their socio-demographic characteristics (gender, age, educational level, place of residence, dietary habits, and household size). The questionnaire items are detailed in Table 5 for subjective knowledge about sustainable diets, sustainable dietary

motivations and sustainable eating practices, and in Appendix A for objective knowledge about sustainable diets.

Objective knowledge about sustainable diets

Participants evaluated a series of 24 statements to identify those they believed accurately described the concept of 'sustainable diets.' Among these, six statements corresponded to key features of sustainable diets as defined by the FAO (2010), six were the opposite statements and 12 were distractors. The six defining characteristics stated that a sustainable diet: "is composed of foods that are good for health;" "contributes to the preservation of the environment;" "is adapted to all food habits and cultures;" "is affordable;" "allows producers to receive adequate remuneration;" "must be easily accessible to all." The distractor statements were not related to the definition of a sustainable diet; they were drawn from the literature on consumers' beliefs and validated through pre-testing. For each ticked item, participants rated their level of certainty about the answer, using a 10-point scale (ranging from "I'm not at all certain of my answer" (1) to "I'm certain of my answer" (10). The objective knowledge score was calculated as the sum of points based on participants' ability to correctly identify or reject key features of sustainable diets, using the 6 items linked to the definition and their 6 opposites, i.e., 12 items, while responses to distractors were excluded. Participants' objective knowledge was scored on a scale of -6 to 6. One point was awarded for correctly identifying key features of sustainable diets with high confidence (self-rated 6–10), and half a point for correct answers with lower confidence (1–5). Conversely, one point was deducted for selecting incorrect (opposing) features with high confidence, and half a point for those with lower confidence.

Subjective knowledge about sustainable diets

A self-evaluation questionnaire, adapted to the subject of sustainable diets from Flynn & Goldsmith (1999), was used. Participants were asked to rate their agreement with various statements on a 5-point Likert scale, ranging from strongly disagree to strongly agree.

Sustainable dietary motivations

A subset of the "Single Item Food Choice Questionnaire" (SI-FCQ) was used (Onwezen et al., 2019). Participants evaluated the importance on a 7-point semantic differential scale of five sustainable motivations in their everyday food choices: health, natural content, environmental impact, animal welfare, and ethical concerns.

Sustainable eating practices

A self-reported questionnaire, adapted and translated into French from Van Loo et al. (2017), was used. This questionnaire was developed based on food-related environmentally friendly lifestyle behavior items from Vanhonacker et al. (2013) and Whitmarsh and O'Neill (2010), with two additional items related to food waste and plant-based alternatives to meat. Participants were asked to indicate the extent to which they engaged in various sustainable practices using a 5-point semantic differential scale. Practices included were: eating organic food, eating seasonal products, buying local products, limiting meat consumption, consuming plant-based alternatives to meat, reducing food waste, and composting food waste.

Analyses

This study is a secondary analysis based on the same dataset used in Chene et al. (2024). Partial Least Squares Structural Equation Modeling (PLS-SEM) was employed to test our hypotheses, as structural equation modeling (SEM) is a robust technique for evaluating complex theoretical relationships involving multiple variables (Hair & Alamer, 2022). The PLS-SEM approach is used to test a complex model from a predictive perspective, with moderately sized sample sizes and non-normally distributed data, which was the case in our study (Hair et al., 2018). This method prioritizes prediction accuracy by iteratively estimating both the measurement and structural models until convergence is achieved. Rather than relying on traditional goodness-of-fit

indices, PLS-SEM focuses on maximizing explained variance and minimizing prediction error. To assess the stability and significance of model estimates, bootstrapping was performed. This technique involves generating multiple subsamples by randomly drawing observations (with replacement) from the original dataset. Each subsample is used to estimate model parameters, and the variability of these estimates is analyzed to construct confidence intervals. Following best practices, 5,000 bootstrap iterations were conducted to ensure the robustness of the results (Hair et al., 2017). Data analysis was conducted in R (R and RStudio, version 4.4.1, RStudio Team, 2020) using the Seminr package (Ray et al., 2025), adhering to the sequential process outlined by Hair and colleagues (Hair et al., 2021). The R code is available at https://osf.io/js2t7/(Chene, 2025). This analysis involved two main steps: (1) estimation of the measurement model (outer model), specifically the relationships between latent variables and their observed indicators. Indicators are manifestations of the latent variable (reflective measurements). A latent variable is the measurable version of the construct estimated from the data. Constructs here are subjective knowledge about sustainable diets, sustainable dietary motivations, and sustainable eating practices. In contrast, objective knowledge of sustainable diets was not treated as a construct, as the corresponding items were not scales and were not interrelated, they were complementary and used collectively to compute an objective knowledge score. The second step (2) involved the estimation of the structural model (inner model) where relations between latent variables are analyzed.

Results

Description of knowledge, motivations, and sustainable eating practices

Among all participants (Table 2), the median score for objective knowledge about sustainable diets was 2.5 (range: –2 to 6; IQR = 3). The median of the average scores for subjective knowledge about sustainable diets was 2.5 (range: 1 to 4.75; IQR = 1.25). The median score for sustainable dietary motivations was 5.6 (range: 2.2 to 7; IQR = 1), and for sustainable eating practices, 3.2 (range: 1.2 to 5; IQR = 1).

Table 2 - Descriptive statistics for all participants.

	Mean	SD	Median	IQR	Min	Max
Mean score for objective knowledge about sustainable diets (score ranging from –6 to 6)	2.456	1.772	2.5	3	–2	6
Average of items for subjective knowledge about sustainable diets (items ranging from 1 to 5)	2.643	0.736	2.5	1.25	1	4.75
Average of items for sustainable dietary motivations (items ranging from 1 to 7)	5.563	0.873	5.6	1	2.2	7
Average of items for sustainable eating practices (items ranging from1 to 5)	3.318	0.812	3.2	1	1.2	5

Variables were not normally distributed. The average of items for subjective knowledge about sustainable diets and sustainable eating practices was calculated by including only items with factor loadings greater than 0.4.

More specifically regarding objective and subjective knowledge (Table 3), 56% of participants had a low score on objective knowledge (i.e., below 3 out of a maximum of 6), meaning they either correctly identified less than half of the six defining characteristics of sustainable diets with high confidence or selected incorrect statements (i.e., opposite statements). Among the 153 participants with low objective knowledge, 45.8% had a subjective knowledge score above the sample mean, while 54.2% were below. Conversely, among the 120 participants with high objective knowledge, 48.3% had high subjective knowledge, and 51.7% had scores below the mean.

Regarding the specific components of the objective knowledge score and participants' confidence levels (Table 4), the two items most frequently selected by participants, among the six characteristics from the established FAO (2010) definition of sustainable diets, were "Contributes to the preservation of the environment" (selected by 94.9% of participants, 92.3% of whom reported high confidence) and "Is composed of foods that are good for health" (selected by 78.4%, with 90.2% reporting high confidence). These were not only the most widely identified correct

statements, but also those with the highest proportions of confident responses among those who selected them. By contrast, the two correct items selected by the fewest participants were "Is suitable for all eating habits and cultures" (41.4% selected, with 77% of them confident) and "Is affordable" (23.1% selected, with 60.3% confident), also showing the lowest confidence rates among the correct responses. Overall, the items checked by the greatest number of participants were also those for which the highest proportions of respondents reported being confident, suggesting a strong link between how widely an item was selected and the level of certainty expressed.

Table 3 - Distribution of participants by level of objective and subjective knowledge about sustainable diets**.**

Subjective knowledge level	Low objective knowledge (< 3)	High objective knowledge (≥ 3)	Total
Below sample mean	83 (54.2%*)	62 (51.7%*)	145 (53.1%)
At or above sample mean	70 (45.8%*)	58 (48.3%*)	128 (46.9%)
Total	153 (56%)	120 (44%)	273 (100%)

Percentages in the "Total" column are calculated over the total sample (N = 273). Percentages within the "Low objective knowledge" and "High objective knowledge" columns (marked with *) are calculated relative to the number of participants in each respective group.

Table 4 - Number and proportion of participants selecting each statement considered in the definition of "sustainable diet" with associated confidence levels.

Statement	Not selected (n, % of total)	Selected (n, % of total)	"Not sure" (Confidence 1–5) (n, % of checked)	"Sure" (Confidence 6–10) (n, % of checked)
Six characteristics from the established definition of sustainable diets (FAO, 2010)				
Contributes to the preservation of the environment	14 (5.1%)	259 (94.9%)	20 (7.7%)	239 (92.3%)
Is composed of foods that are good for health	59 (21.6%)	214 (78.4%)	21 (9.8%)	193 (90.2%)
Is suitable for all eating habits and cultures	160 (58.6%)	113 (41.4%)	26 (23%)	87 (77%)
Allows producers to receive adequate remuneration	87 (31.9%)	186 (68.1%)	36 (19.4%)	150 (80.6%)
Must be easily accessible to all	71 (26%)	202 (74%)	32 (15.8%)	170 (84.2%)
Is affordable	210 (76.9%)	63 (23.1%)	25 (39.7%)	38 (60.3%)
Six opposites statements				
Doesn't help preserve the environment	263 (96.3%)	10 (3.7%)	8 (80%)	2 (20%)
Does not allow the inclusion of healthy foods	264 (96.7%)	9 (3.3%)	4 (44.4%)	5 (55.6%)
Is unsuitable for all eating habits and cultures	203 (74.4%)	70 (25.6%)	21 (30%)	49 (70%)
Does not allow producers to be properly remunerated	256 (93.8%)	17 (6.2%)	12 (70.6%)	5 (29.4%)
Not necessarily accessible to all	133 (48.7%)	140 (51.3%)	23 (16.4%)	117 (83.6%)
Is too expensive	189 (69.2%)	84 (30.8%)	19 (22.6%)	65 (77.4%)

Estimation of reflective measurement models (Outer Model)

We assessed the quality of the reflective measurement models estimated using PLS-SEM in terms of both reliability and validity.

Four criteria were calculated. The first one was the reliability of indicators based on the loadings on the constructs (Table 5). An indicator was considered reliable if the loading was greater than 0.4 (i.e., good correlation between the indicator and its latent variable). This is a measure of the association between the indicator and the construct: the square of the loading (R^2 of the indicator) indicates the variance explained by an indicator in the latent variable. If the factor loading is 0.7, then the variance explained is 49% (0.7^2). Loadings below 0.4 are considered unacceptable (Bagozzi et al., 1991; Hair et al., 2011), leading to the exclusion of the indicators SUBJ5 (0.392), PRACT6 (0.367), and PRACT7 (0.4) from the measurement model. Additionally, since the sustainable eating practices construct focused on consumption behaviors, it was deemed

appropriate to exclude PRACT6 and PRACT7, which pertained to post-consumption activities such as waste management and recycling. After these exclusions, the loadings for the subjective knowledge about sustainable diets indicators ranged from 0.703 to 0.839. The sustainable dietary motivations construct included indicators with loadings between 0.64 and 0.848, while the sustainable eating practices construct exhibited loadings ranging from 0.553 to 0.77. Indicators with a loading between 0.4 and 0.7 are not ideal but may be retained under certain conditions. A weakly loaded indicator may be retained if the internal reliability of the construct is adequate and if the convergent validity is acceptable, as was the case for sustainable dietary motivations (Hair et al., 2017). This indicates that the indicator does not compromise the overall quality of the construct's measurement. Additionally, an indicator may be retained if it is theoretically important in representing the construct and if its removal could reduce the construct's validity, as was the case for sustainable eating practices (Hair et al., 2017). All constructs thus exhibited acceptable indicator reliability.

The second criterion was internal consistency reliability, measured by Cronbach's alpha (α) (Trizano-Hermosilla & Alvarado, 2016) and composite reliability ρ_C (CR) (Jöreskog, 1971). Internal consistency reliability reflects the degree to which indicators measuring the same construct are correlated. All constructs achieved reliability values within the recommended range of 0.7 to 0.9. Cronbach's alpha (α) was 0.762 for subjective knowledge about sustainable diets, 0.783 for sustainable dietary motivations, and 0.714 for sustainable eating practices. CR was 0.846 for subjective knowledge about sustainable diets, 0.851 for sustainable dietary motivations, and 0.811 for sustainable eating practices (Table 5).

Table 5 - Results of the measurement model.

Constructs	Indicators	Scale items	Loadings
Subjective knowledge about sustainable diets α: 0.762 CR: 0.846 AVE: 0.58	SUBJ1	I know pretty much about sustainable diets.	0.839
	SUBJ2	I do not feel very knowledgeable about sustainable diets. (Reverse scored)	0.703
	SUBJ3	Among my circle of friends, I'm one of the "experts" on sustainable diets.	0.783
	SUBJ4	Compared to most other people, I know less about sustainable diets. (Reverse scored)	0.713
	SUBJ5	When it comes to sustainable diets, I really don't know a lot. (Reverse scored)*	0.392
Sustainable dietary motivations α: 0.783 CR: 0.851 AVE: 0.537	MOTIV1	It is important to me that the food I eat on a typical day is healthy.	0.661
	MOTIV2	It is important to me that the food I eat on a typical day is natural.	0.748
	MOTIV3	It is important to me that the food I eat on a typical day is environmentally friendly.	0.848
	MOTIV4	It is important to me that the food I eat on a typical day is fairly traded.	0.748
	MOTIV5	It is important to me that the food I eat on a typical day is animal friendly.	0.64
Sustainable eating practices α: 0.714 CR: 0.811 AVE: 0.465	PRACT1	I regularly eat organic food products.	0.77
	PRACT2	I eat seasonal products.	0.609
	PRACT3	I eat local products whenever possible.	0.553
	PRACT4	I limit my meat consumption.	0.692
	PRACT5	I regularly eat plant-based foods as an alternative to meat.	0.759
	PRACT6	I limit the amount of food I waste.*	0.367
	PRACT7	I compost food waste at home.*	0.4

*Items with loadings ≤ 0.4 were excluded from the model. For these items (marked with *), loadings are reported from the full model (with all items). For all other items, loadings are reported from the reduced model (after exclusion of low-loading items <0.4). α: Cronbach's Alpha. CR: Composite Reliability Dillon-Goldstein's ρ_C. AVE: Average Variance Extracted. SUBJ refers to the items corresponding to Subjective knowledge about sustainable diets, MOTIV to Sustainable dietary motivations, and PRACT to Sustainable eating practices.

The third criterion was the convergent validity for each construct, or the degree to which a construct explains the variance of its indicators. Convergent validity was evaluated using the average variance extracted (AVE), with an acceptable threshold of 0.5 (Hair et al., 2017). AVE values for subjective knowledge about sustainable diets (0.58) and sustainable dietary motivations

(0.537) exceeded this threshold. However, the AVE for sustainable eating practices was slightly below the threshold at 0.465. Since AVE is considered a stringent measure of convergent validity, and given that all items were essential in describing sustainable eating practices, the construct was retained but interpreted with caution (Pahlevan Sharif et al., 2021).The fourth criterion was discriminant validity, which evaluates whether a construct is empirically distinct from other constructs in the structural model. Discriminant validity was measured using the heterotrait–monotrait (HTMT) values for all pairs of constructs. The constructs demonstrated adequate discriminant validity, with HTMT values ranging from 0.128 to 0.706 (Table 6), which were significantly different from the conservative threshold of 0.85 (Henseler et al., 2015).

Table 6 - Evaluation of discriminant validity of the constructs and collinearity in the model.

	HTMT value (2.5%-97.5% CI)		
	Objective knowledge about sustainable diets	Subjective knowledge about sustainable diets	Sustainable dietary motivations
Subjective knowledge about sustainable diets	0.128* (0.051-0.234)		
Sustainable dietary motivations	0.293* (0.191-0.393)	0.428* (0.324-0.539)	
Sustainable eating practices	0.265* (0.172-0.385)	0.440* (0.32- 0.556)	0.706* (0.608-0.797)
	VIF		
Sustainable dietary motivations	1.013	1.013	
Sustainable eating practices	1.076	1.149	1.219

HTMT: Heterotrait–monotrait ratio; VIF: variance inflation factor ; *Indicates that the value is significantly different from the threshold of 0.85, as shown by the confidence interval (CI), which does not include this value.

Estimation of the Structural Model (Inner Model)

After confirming the reliability and validity of the construct measurements, we evaluated the structural model by analyzing the relationships between the latent variables.

First, we checked whether the (exogenous) predictor variables were highly correlated with each other. If present, multicollinearity could bias the path coefficients, potentially compromising the validity of the relationships between the latent variables (Sarstedt & Mooi, 2019). The variance inflation factor (VIF) was used to detect collinearity, with values between 3 and 5 suggesting potential collinearity issues among the predictors (Mason & Perreault, 1991; Becker et al., 2015) and values above 5 indicating serious collinearity issues (Hair et al., 2018). Among our constructs, the VIF values ranged from 1.013 to 1.219 (Table 6), suggesting that collinearity was not a concern.

Secondly, we examined the model's explanatory power, the quality of the predictive model, with the coefficient of determination (R^2), which reveals the amount of variance in the endogenous constructs explained by all of the exogenous constructs linked to them. R^2 values range from 0 to 1, with higher values reflecting greater explanatory power. Given that R^2 values are context-dependent, they should be interpreted within the specific research area. To guide our interpretation, we referenced similar studies, which categorize R^2 values as follows: 0 to 0.1, 0.11 to 0.3, 0.31 to 0.5, and greater than 0.5 are considered to reflect weak, modest, medium, and strong explanatory power, respectively (Hair & Alamer, 2022). In the present study, the R^2 value was 0.18 for sustainable dietary motivations, indicating that 18 % of the variance in this construct was explained, and 0.335 for sustainable eating practices, indicating that 33.5 % of the variance in this construct was explained. These values indicate modest explanatory power for sustainable dietary motivations and medium explanatory power for sustainable eating practices.

Finally, the model's predictive power was assessed, a crucial step in evaluating its external validity in similar research contexts. To achieve this assessment, we compared the accuracy of the PLS predictions with those of a naive linear regression model (Shmueli et al., 2016). The aim was to check whether the PLS-SEM model provided better predictive capability than a basic model (LM). If PLS-SEM yields better predictions, the Root Mean Square Error (RMSE), a measure of the average prediction error, should be lower, thereby validating its usefulness. Conversely, if PLS-

SEM does not outperform the naïve model, its complexity may be unwarranted. Following the recommendations of Shmueli et al. (2019), the present model was found to exhibit moderate to high predictive power, as only one indicator (PRACT1) showed a higher RMSE for the PLS-SEM compared to the LM model (Table 7).

Table 7 - The predictive power of the model.

Indicators	RMSE		PLS-SEM results show lower errors than LM
	PLS-SEM	LM	
MOTIV1	0.955	0.968	Yes
MOTIV2	1.066	1.071	Yes
MOTIV3	0.996	1.006	Yes
MOTIV4	1.316	1.319	Yes
MOTIV5	1.401	1.408	Yes
PRACT1	1.137	1.135	No
PRACT2	0.93	0.94	Yes
PRACT3	0.974	0.978	Yes
PRACT4	1.305	1.318	Yes
PRACT5	1.342	1.355	Yes

Results of the path model

After analyzing the relationships between the latent variables, it was necessary to determine whether the assumed relationships between the latent variables were statistically significant and consistent with the theory. To test the hypotheses, the significance and relevance of the path coefficients were assessed, as detailed in Table 8 and illustrated in Figure 1. Bootstrapping was used to test the significance of relationships between latent variables. If the p-value < 0.05, the relationship is significant. Path coefficients (β) typically range from −1 to +1, with values closer to −1 indicating strong negative relationships and those closer to +1 indicating strong positive relationships. According to Hair and Alamer (2022), path coefficients in the structural model were categorized as follows: between 0 and 0.1 for weak effects, between 0.11 and 0.3 for modest effects, between 0.31 and 0.5 for medium effects, and greater than 0.5 for strong effects.

In our findings (Table 8), the link between knowledge and sustainable eating practices was significantly positive for both types of knowledge, though it was modest for subjective knowledge (H1b) and weak for objective knowledge (H1a). The path between sustainable dietary motivations and sustainable eating practices was also significantly positive, with a medium effect size (H2). Hypotheses H1 and H2 were thus validated. There was a substantial positive link between subjective knowledge and practices, as well as between motivations and practices.

Turning now to the mediating role of motivations, the paths between both types of knowledge and sustainable dietary motivations were positive and significant, with effect sizes of modest strength for objective knowledge (H3a) and medium strength for subjective knowledge (H3b). Hypotheses H3a and H3b were thus validated. Regarding indirect effects, sustainable dietary motivations significantly mediated the link between both objective (H4a) and subjective knowledge (H4b) and sustainable eating practices. Hypotheses H4a and H4b were thus validated. For objective knowledge about sustainable diets, the positive effect on sustainable eating practices was primarily mediated through sustainable dietary motivations. In contrast, for subjective knowledge, the positive effect was mediated not only through sustainable dietary motivations but also through a direct link to sustainable eating practices.

Table 8 - Path-coefficients and effect sizes of the individual predictors.

Paths	Coefficient (β)	P-values	Effect sizes
Direct effects			
H1a: Objective knowledge about sustainable diets → Sustainable eating practices	0.102	0.021	Weak
H1b: Subjective knowledge about sustainable diets → Sustainable eating practices	0.172	0.001	Modest
H2: Sustainable dietary motivations → Sustainable eating practices	0.458	<0.001	Medium
H3a: Objective knowledge about sustainable diets → Sustainable dietary motivations	0.226	<0.001	Modest
H3b: Subjective knowledge about sustainable diets → Sustainable dietary motivations	0.334	<0.001	Medium
Indirect effects (mediation)			Mediation
H4a: Objective knowledge about sustainable diets → Sustainable dietary motivations → Sustainable eating practices	0.103	<0.001	Yes
H4b: Subjective knowledge about sustainable diets → Sustainable dietary motivations → Sustainable eating practices	0.153	<0.001	Yes

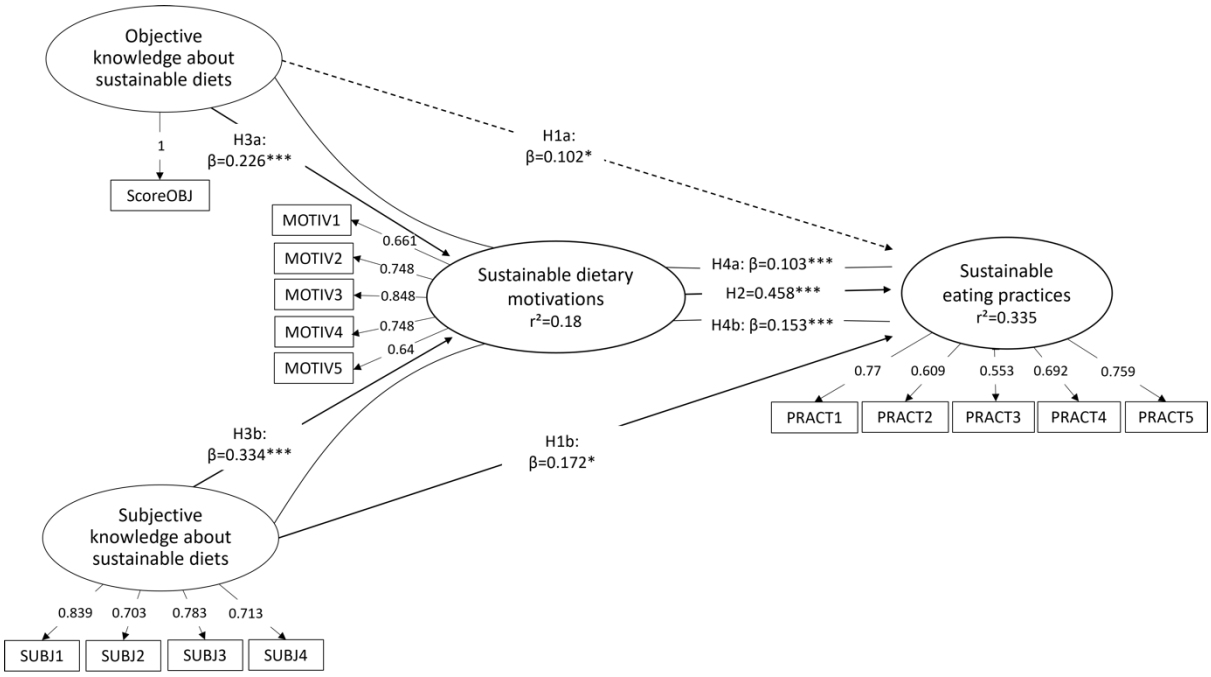

Figure 1 - The structural model. Dashed line indicates weak path. *p-value < 0.05, **p-value < 0.01, ***p-value < 0.001. SUBJ refers to the items corresponding to Subjective knowledge about sustainable diets, MOTIV to Sustainable dietary motivations, and PRACT to Sustainable eating practices. ScoreOBJ refers to the objective knowledge score computed.

Discussion

The primary aim of this study was to examine the influence of knowledge and motivation on sustainable eating practices, with a particular focus on the mediating role of motivations and the distinct effects of two types of knowledge: objective and subjective.

Levels of Objective Knowledge

Our results showed that 56% of participants exhibited a low level of objective knowledge regarding sustainable diets, indicating a widespread lack of awareness of key components outlined in the FAO (2010) definition. While participants tended to associate sustainable diets primarily with

environmental preservation and health benefits, fewer correctly identified dimensions related to affordability and cultural appropriateness. This pattern aligns with previous findings in the French context, which highlight strong recognition of environmental and health aspects but weaker awareness of socio-cultural and socio-economic factors (Mathe, 2009; Chene et al., 2024). Moreover, participants frequently endorsed incorrect statements such as “Is too expensive” or “Not necessarily accessible to all,” reflecting persistent misconceptions also reported in the systematic review by van Bussel et al. (2022) on consumers’ perceptions of food-related sustainability.

The differential impacts of subjective and objective knowledge about sustainable eating practices

Our results indicate that subjective knowledge has a direct positive effect on sustainable eating practices, whereas objective knowledge shows only a very weak association. This finding reinforces previous research demonstrating a stronger link between subjective knowledge and practices compared to objective knowledge in the contexts of organic food consumption (Pieniak et al., 2010; Aertsens et al., 2011) and the selection of food products with lower carbon and water footprints (Peschel et al., 2016).

Furthermore, our results show that these two forms of knowledge are not strongly aligned: 45.8% of participants had low objective knowledge but high subjective knowledge, suggesting overconfidence, while 51.7% had high objective knowledge but low subjective knowledge, indicating under confidence. These findings are consistent with previous studies showing that subjective and objective knowledge often display low or inconsistent correlations (Pieniak et al., 2010; Han, 2019), as self-assessments may not reflect actual knowledge levels (Alba & Hutchinson, 2000). Subjective knowledge tends to boost confidence, thereby reducing information-seeking and encouraging reliance on existing information. In contrast, high objective knowledge alone may not suffice if individuals feel uncertain and fail to act (Rudell, 1980; Brucks, 1985).

Although objective knowledge has displayed a limited direct effect, it indirectly influences practices through motivations. Moreover, objective knowledge may also affect individuals’ perceptions of barriers and facilitators, an aspect not necessarily influenced by subjective knowledge (Kwon et al., 2021). This analysis underscores the importance of interventions that effectively integrate both types of knowledge to promote sustainable eating practices. While fostering confidence through subjective knowledge can enhance decision-making, such knowledge must be grounded in accurate information to prevent inappropriate practice driven by overconfidence, as seen in our sample. Excessive confidence is undesirable, as it discourages the search for new information and can lead to decisions based on misconceptions (Alba & Hutchinson, 2000), which may in turn lead to suboptimal sustainable food choices (Cadario et al., 2025). Previous research has shown that knowledge of practical actions remains insufficient, with effective practices like reduction in meat consumption rarely linked to the notion of sustainable diets in consumers’ minds (European Commission, 2020; Chene et al., 2024). Educational efforts must therefore provide clear, actionable steps for consumers, thereby ensuring they acquire both accurate information (raising objective knowledge) and sufficient confidence (enhancing subjective knowledge).

Central role of motivations

Our results highlight that sustainable dietary motivations have a positive effect on sustainable eating practices, aligning with findings reported by Marty et al. (2022), who observed that health, natural content, and ethical concerns predict various dimensions of sustainability (e.g., the choice of organic or locally-sourced products, and less meat consumption). Additionally, our study extends this research by incorporating motivations related to environmental concerns, animal welfare, and sustainable eating practices such as seasonal food consumption, thereby broadening the scope of sustainability and reinforcing the generalizability of these findings. Beyond their direct effect, motivations mediate the relationship between knowledge (of both types) and practices. This finding echoes that of Li et al. (2019) who emphasized motivation’s central role in energy-saving

behaviors. Conceptually, the central role of motivations may be explained by their involvement in the different phases required for behavioral change, as described by the Transtheoretical Model (Prochaska & Norcross, 2018). The Transtheoretical Model conceptualizes behavior change as a progression through five distinct stages: (a) precontemplation, at which point individuals are not yet considering change and may be unaware of the issue; (b) contemplation, when they begin to recognize the problem and evaluate the pros and cons of modifying their behavior; (c) preparation, when they intend to take action soon and may initiate small steps toward change; (d) action, when they actively modify their behavior; and (e) maintenance, during which time they sustain long-term changes. Previous studies showed that sustainable dietary motivations appear to play a central role in advancing individuals from intention to action and maintenance stages in adopting sustainable eating practices. For example, identifying the environment as a motive in food choice significantly predicts an individual's being in the action or maintenance stages rather than in the precontemplation or contemplation steps for a variety of sustainable eating practices, such as avoiding excess packaging, buying locally-grown produce, consuming seasonal fruits and vegetables, limiting red and processed meat, prioritizing plant proteins, reducing air-freighted foods, choosing sustainable fish, reducing food waste, and selecting organic products (Culliford & Bradbury, 2020). Regarding seasonal fruit and vegetable consumption, Tobler et al. (2011) similarly found that individuals motivated by health and environmental concerns were more likely to be in the contemplation and preparation stages rather than the precontemplation stage. Additionally, motivation related to natural foods was associated with a higher likelihood of being in the action phase compared to remaining in precontemplation. In the study of reduction in meat consumption, motivations related to health and nutrition emerged as the primary motivators for participants transitioning from the contemplation stage to the maintenance stage (Reuzé et al., 2023). These findings highlight the central role of motivation for sustainability in driving shifts toward sustainable eating practices. In this sense, the Transtheoretical Model provides a useful theoretical lens to understand how motivation facilitates movement toward more sustainable dietary behavior. Hence, targeting motivation should be central to interventions aiming to encourage sustainable eating practices.

Application of the MOA model to sustainable eating practices

Our findings, which reveal the positive influence of both Ability (proxied by subjective and objective knowledge) and Motivation (sustainable dietary motivations) on sustainable eating practices, support the applicability of the Motivation–Opportunity–Ability (MOA) framework to the domain of sustainable food consumption. The model demonstrated moderate predictive power, suggesting that internal drivers, ability and motivations, play a key role in promoting more sustainable eating practices. These results are consistent with and extend previous applications of the MOA model, which have focused on specific consumption contexts such as particular food items (Tong et al., 2023), organic food products (Zhu, 2016), and circular food practices (Raimondo et al., 2023). The moderate level of explained variance in our model underscores the potential added value of integrating the Opportunity dimension, a key element of the MOA framework not accounted for in this study. Indeed, opportunity factors, such as social norms, food accessibility, and affordability, also play a crucial role in shaping sustainable eating behaviors (Li et al., 2019). Recent UK-based evidence (The Food Foundation, 2025) suggests that sustainable diets remain out of reach for the least affluent consumers. Incorporating such contextual constraints in future research could provide a more comprehensive understanding of the multifactorial nature of sustainable food choices. These findings related resonate with results obtained using the COM-B model (Capability–Opportunity–Motivation–Behaviour; (Michie et al., 2011). The COM-B framework has been successfully applied to understand specific sustainable eating practices such as alternative proteins consumption (Jiang & Farag, 2023; Ford et al., 2023; Anant et al., 2025), as it is a model similar to MOA but oriented towards intervention design. COM-B offers a broader conceptualization of capability, emphasizing actionable components by distinguishing between physical and psychological factors, including knowledge as well as skills, planning, and cognitive

functions. These results are thus complementary, providing concrete ideas for interventions targeting specific practices linked to these factors (Ford et al., 2023).

Limitations and future research

While this study offers significant insights into the relationships between knowledge, motivations, and sustainable eating practices, it has certain limitations. First, eating practices were measured using self-reported questionnaires, which are vulnerable to social desirability bias and demonstrated only limited convergent validity. As such, the findings should be interpreted with caution. However, all widely used dietary assessment methods (food frequency questionnaires, food records, and 24-hour recalls) are subject to similar limitations, notably social desirability and recall bias (Bailey, 2021). Objectively measuring actual consumption, without relying on self-reports, remains logistically complex and financially demanding in large-scale studies, making self-report tools the most practical option despite their known biases. Secondly, our sample, though balanced in terms of age, education level, and gender, was not representative of French consumers. Participants were recruited from an urban laboratory panel in Dijon, and the sample was skewed toward individuals with higher education and urban residency, which may limit the generalizability of our results. A larger, more diverse sample might further clarify how these factors interrelate across varying cultural and demographic contexts.

Conclusion

In conclusion, understanding how knowledge and motivation jointly shape sustainable eating practices is essential in promoting effective dietary transitions. Our findings demonstrate a significant relationship between both objective and subjective knowledge about sustainable diets and sustainable eating practices, with motivations serving as a crucial mediator in this connection. Furthermore, subjective knowledge has a direct impact on sustainable eating practices, suggesting that individuals' perceptions of their knowledge may influence their behaviors more than their actual knowledge levels. Taken together, these insights suggest that interventions designed to foster sustainable dietary choices must address both knowledge dimensions while placing strong emphasis on motivating factors. Providing accessible, concrete solutions, along with confidence-building strategies, may be an effective way to encourage the adoption of more sustainable eating practices.

Appendices

Appendix A - Overview of the questionnaire on objective knowledge. The list of 24 statements included six characteristics from the established definition of sustainable diets (FAO, 2010), six opposite statements, and 12 distractors. The distractor statements were selected from the literature and refined following a pretest. The questionnaire was administered in French; English translations are provided in parentheses for reference only. Statements were presented in a randomized order. Participants could select as many statements as they believed were correct. Upon selecting an item, they were asked to indicate their level of certainty regarding their answer on a scale from 1 (I am not at all certain about my answer) to 10 (I am completely certain about my answer). Question : Quels éléments sont pris en compte dans la définition de l'« alimentation durable»? Cochez autant de cases que vous le souhaitez. L'alimentation durable… (What elements are considered in the definition of « sustainable diet »? Tick as many boxes as you like. Sustainable diet…)

Dimension	6 characteristics from the established definition of sustainable diets (FAO, 2010)	6 opposite statements
Environmental	Aide à préserver l'environnement (contributes to the preservation of the environment)	Ne permet pas de préserver l'environnement (Doesn't help preserve the environment)
Nutritional-Healthy	Est composée d'aliments bons pour la santé (Is composed of foods that are good for health)	Ne permet pas d'inclure des aliments bons pour la santé (Does not allow the inclusion of healthy foods)
Socioeconomic	A un prix abordable (Is affordable)	Est trop chère (Is too expensive)
	Permet de rémunérer correctement les producteurs (Allows producers to receive adequate remuneration)	Ne permet pas de rémunérer correctement les producteurs (Does not allow producers to be properly remunerated)
	Doit être facilement accessible à tous (Must be easily accessible to all)	N'est pas forcément accessible à tous (Not necessarily accessible to all)
Sociocultural	Est adaptée à toutes les habitudes et cultures alimentaires (Is suitable for all eating habits and cultures)	N'est pas adaptée à certaines habitudes et cultures alimentaires (Is unsuitable for all eating habits and cultures)
Distractors		
Est composée d'aliments avec des dates d'expiration longues (Is made up of foods with long expiry dates)		Est composée d'aliments avec des dates d'expiration courtes
Inclut tous les types d'aliments (Includes all food types)		Ne peut pas inclure tous les types d'aliments (Cannot include all food types)
Renvoie à des marques bien identifiées (Refers to well-identified brands)		Ne renvoie pas à des marques bien identifiées (Does not refer to clearly identified brands)
Est compatible avec le progrès technologique (Is compatible with technological progress)		N'est pas compatible avec le progrès technologique (Is not compatible with technological progress)
Est composée d'aliments qui existent depuis longtemps (Is made up of foods that have been around for a long time)		Est composée d'aliments apparus récemment (Is made up of foods that have only recently appeared)
Est adaptée en temps de crise (Is suitable in times of crisis)		Est peu adaptée en temps de crise (Is unsuitable in times of crisis)

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Data, scripts, code and supplementary information availability

Available at https://doi.org/10.17605/OSF.IO/JS2T7 (Chene, 2025).

Conflict of interest disclosure

The authors declare that they comply with the PCI rule of having no financial conflicts of interest in relation to the content of the article. Oriane Chene is a recommender for PCI Nutrition.

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