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One in Six English Children Eat Less Meat: The Role of Adults' Lack of
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One in Six English Children Eat Less Meat: The Role of Adults' Lack of Climate Action

Abstract

Plant-based diets are one of the most effective ways for individuals to drastically reduce their ecological footprint. Since dietary behaviors are established in childhood and more difficult to alter in adulthood, understanding the mechanisms that contribute to sustainable diet behaviors are crucial. In this study, we investigate the context in which minors decide for a meat-reduced diet (MRD) for environmental reasons, using a nationally representative cross-sectional dataset of 16104 English children aged 8-15. Primary focus was the role of environmental knowledge as the main effect and children's perceptions of adult environmental action (adult appraisals) as mediator and moderator. Age, family income, region, survey year and nature connectedness are taken into account. 17.5% of the sample reported on reducing their meat intake for the environment. Environmental knowledge was positively associated with self-reported meat-reduced diets. Partial support was found for a negative mediation via adult appraisals. Negative adult appraisals were associated with a higher likelihood of meat reduction, whereas higher environmental knowledge was associated with more positive adult appraisals. In addition, adult appraisals positively moderated the relationship between environmental knowledge and meat reduction, such that the positive association between knowledge and meat reduction was stronger among participants with more positive adult appraisals. These effects remained significant when controlling for relevant covariates. The findings underscore the complexity of intergenerational dynamics in shaping climate-related behaviors and provide insight into factors associated with meat reduction among minors.

Keywords: meat reduction, meat-reduced diet, environmental knowledge, intergenerational influence

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1. Introduction

1.1 Theoretical Background

The meat industry is responsible for approximately 14.5 % of global greenhouse gas emissions (Gerber et al., 2013). The main contributor to the carbon emissions in this industry is livestock-induced deforestation, particularly of the Amazon rainforest (Donoso et al., 2024). In total, the deforestation linked to the meat industry is responsible for up to 2.4 billion tonnes of CO₂ a year, or 7% of global gas house emissions (Garnett, 2009). Measured on an individual level, opting for a meat-reduced diet (MRD) is one of the most effective ways to lower one's own carbon footprint, with a reduction of as much as 61 to 73% in case of a vegan diet (Poore & Nemecek, 2018). A shift in diet choices among the general population is therefore a key target in climate mitigation.

It is a common belief that dietary behavior is a question of personal preference. However, empiricism suggests otherwise. In some countries such as the United States or France, meat is a main component of the national cuisine. In other nations like India, vegetarian diets are widely spread. Meat consumption is also connected to masculine identities in many societies (e.g. Rosenfeld & Tomiyama, 2021). Moreover, people may even conform to vegetarian and vegan diets due to social pressure (Hammami et al., 2023; Sparkman & Walton, 2017), furtherly suggesting that diet choices are not purely individualistic, but in fact shapeable by our surroundings.

The majority of dietary habits are established in childhood and then get carried into adulthood, where they are difficult to alter (Coulson et al., 1998; Hill et al., 1998). Therefore, tackling environmentally harmful dietary behaviors seems to be most effective if change is implemented early in life. However, children are often unaware of the implications of meat consumption or the origin of meat, as shown by Hahn et al. (2021). In their study, 41% of a sample of US-American children aged 4 to 7 claimed that bacon came from a plant. The authors further suggest that parents often feel uncomfortable talking to their children about the origins of meat, sometimes deliberately withholding information about animal slaughter in an attempt to safeguard children's innocence (Hahn et al., 2021).

Children and adults show different motivational factors when it comes to vegetarian diet choices. Most adults cite health concerns as their top reason to become vegetarian (48%), followed by the environment (29%), while animal welfare seems to be a more distant concern for adults, with 25% naming it as their reason for renouncing meat (Smart Protein, 2024).

Children, however, seem to have opposite priorities. In a study conducted by Hussar & Harris (2010), 48 independent vegetarian children aged 6-10, who chose to follow a vegetarian diet despite being raised in non-vegetarian households, were interviewed about their reasons for abstaining from meat. All participants (100%) named animal welfare as their reason to become vegetarian. 19% did not like the taste of meat, and 6% named health concerns as a reason. None of the children spontaneously brought up environmental reasons as a factor. As stated by the authors, a different result may have been obtained by asking the children about the environment directly, but the interview was consciously conducted in an open format. A partial explanation for this might be that global climate change is not a salient issue for younger children up until 8 years old (Carballo-Losada et al., 2025). Additionally, the results might differ if the study were replicated today, as climate change has become more salient and has received increased media coverage.

Minors take up a unique role in the climate crisis. Often labeled the “problem-solvers” of the mistakes of past generations, a general frustration due to the insufficiency of adult action is a common sentiment across youth (Thomas et al., 2022). When minors perceive greater insufficiency in adult action, this may increase the salience of environmental problems and strengthen a sense of personal responsibility or urgency to take compensatory action, thereby exhibiting higher rates of MRDs compared with children who perceive adult climate action as sufficient (hereafter: “adult appraisals”). At the point of pre-registration, the authors are unaware of a comparative study in this matter. Furthermore, it could be predicted that higher environmental knowledge may be associated with more negative adult appraisals, as many global reports highlight the insufficiency of adult climate action (e.g., Burck et al., 2025). These considerations suggest a possible negative mediation, in which environmental knowledge is associated with meat reduction through adult appraisals.

At the same time, adult appraisals may shape the context in which environmental knowledge predicts MRDs. If a child with high environmental knowledge perceives low environmental action by the adults in their surroundings, they may feel more inclined to rely on their own knowledge about environmental action as a guide for behaviour, which may in turn strengthen the association between environmental knowledge and MRDs. Conversely, high adult appraisals may convey the impression that sufficient climate action is being taken, thereby weakening the association between knowledge and MRDs. Taken together, adult appraisals may not only have a direct influence on MRDs but may also moderate the relationship between environmental knowledge and MRDs.

Moreover, research shows that children who feel more connected to the environment judge actions that harm the environment more harshly (Collado & Sorrell, 2019). Nature connectedness may therefore act as a motivator for sustainable dietary choices. At the same time, socioeconomic factors, such as educational background and family income, need to be considered when examining pro-environmental behaviors, as socioeconomic background is often associated with greater engagement in such behaviors (Piao & Managi, 2024).

Considering the recent trend in MRDs in the western world, capturing representative descriptives of the population is a challenge. Data as old as five years could already be considered outdated. Minors are often overlooked in these statistics, and the majority of research about MRDs in minors focuses on health risks and benefits. A German study from 2019 has found a prevalence of 1.5% vegetarians among 6- to 11-year-olds and 5.1% among 12- to 17-year-olds (Patelakis et al.).

1.2. The Comprehensive Action Determination Model (Klöckner & Blöbaum, 2010)

The present study conceptually draws on the Comprehensive Action Determination Model (CADM; Klöckner & Blöbaum, 2010), an approach to predict ecological behavior. It is an attempt in uniting the two most common theories around pro-environmental behaviors, which is the theory of planned behavior (Ajzen, 1991) and the norm-activation model (Schwartz, 1977, Schwartz and Howard, 1981). It has so far explained the greatest degree of variation (65%) in comparison to other models (Klöckner & Blöbaum, 2010). The CADM proposes that ecological behavior is formed through habitual, normative, and intentional processes, as well as situational influences. To our knowledge, only one study has used the model to explain pro-environmental behaviors among adolescents specifically (Truskauskaitė-Kunevičienė et al., 2021).

The current analysis does not constitute a formal test of the CADM, but rather draws on selected components as a heuristic framework. Within this orientation, environmental knowledge is conceptualized as action-relevant awareness of consequences and thus located within the normative processes of the model. Adult appraisals, as a comparatively underresearched construct, are not explicitly represented within the CADM. They can, however, be interpreted as reflecting perceived normative climate, insofar as they capture children's evaluation of a relevant reference group and its environmental responsibility. At the same time, adult appraisals represent a distinct form of intergenerational norm perception that is not formally integrated into the original model and therefore extend its application to

developmental and intergenerational contexts.

1.3 Scope of the study

This study examines meat reduction solely from an environmental perspective. Ethical and health-related implications of meat consumption are outside the scope of the present analysis and are not considered. This narrowed focus was chosen to facilitate a clear examination of environmental knowledge and appraisals in relation to environmentally motivated dietary behavior.

1.4 Hypotheses

In the present study, we investigated whether environmental knowledge predicts children's self-reported meat-reduced diets (see Fig.1). Furthermore, we investigated whether this relationship is mediated or moderated by adult appraisals. Given the limited prior research on this construct, both mechanisms were considered plausible. Conceptualizing adult appraisals as a mediator allows for examining whether they represent a process through which environmental knowledge is translated into behavior. In contrast, treating adult appraisals as a moderator provides insight into the contextual conditions under which environmental knowledge is more or less strongly associated with meat-reduced diets. When the role of a variable is theoretically ambiguous, environmental psychology commonly tests both mediating and moderating mechanisms, as also illustrated by Wells (2021).

To account for potential confounding variables, we incorporated age, region, gender, family income, nature connectedness and survey year into our research concept. Based on the theoretical considerations outlined above, three hypotheses were formulated:

1. Children with more knowledge about pro-environmental action will be more likely to self-reportedly follow a MRD.
2. A (mediation hypothesis): The relationship between knowledge about pro-environmental action and self-reported MRDs is negatively mediated by adult appraisals, such that lower adult appraisals are associated with a greater likelihood of a child practicing a MRD.

B (moderation hypothesis): The relationship between knowledge about pro-environmental action and self-reported MRDs is negatively moderated by adult appraisals, such that low adult appraisals strengthen the association between environmental knowledge and MRDs.

3. The direct and indirect effect of environmental knowledge on MRDs remains significant after controlling for gender, income, age group, and nature connectedness.

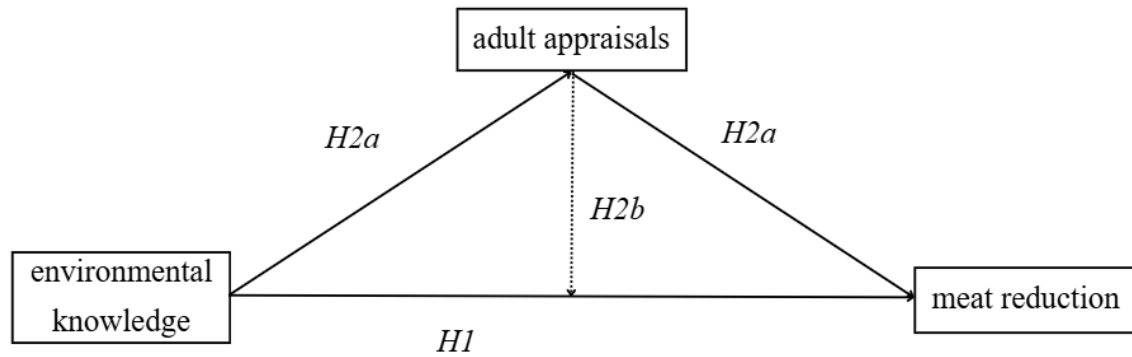


Fig. 1. Proposed model of the predictors for meat reduction in children and adolescents (solid lines = mediation, dotted lines = moderation)

2. Method

2.1 Data set

This analysis draws on data from the Children’s People and Nature Survey for England (C-PaNS), a comprehensive cross-sectional dataset monitoring children’s engagement with nature and its contribution to wellbeing. All information regarding the dataset, including sampling, recruitment, weighting, and procedures, is based on Natural England (2020). The survey collects data in two waves per year, with one wave conducted during the school term and one during the holidays. In total, approximately 4,000 children aged 8 to 15 years participate each year. This resulted in a total sample of 16,104 participants between 2021 and 2024, up to the date of pre-registration. The questionnaire has been developed by Natural England, the Department of Environment of the United Kingdom, UK Youth and various other stakeholders. As we were primarily interested in children’s pro-environmental behaviors and attitudes, we focused on the questions related to pro-environmental behaviors. In this section, respondents were asked about their knowledge of and attitudes towards the environment, as well as their own pro-environmental behaviors. For this analysis, we exclusively focused on meat reduction as a pro-environmental behavior.

2.2 Participants

The final, nationally representative analytical sample consisted of 16,102 children, aged 8 to 15 years from all regions of England. Of these, 27.6% were from the North, 30.9% from the Midlands, and 41.5% from the South. Details regarding the specific recruitment procedures and the context in which children completed the survey were not disclosed. Natural England commissioned an independent third-party research agency, Verian (formerly Kantar Public until November 2023), to conduct recruitment and data collection. The agency did not release further information on these procedures due to proprietary considerations. Nevertheless, Natural England specified that they worked closely with the agency to ensure sampling quality and the representativeness of the English population. Due to data safeguarding regulations, access to specific data points, such as the exact age of each child, was not possible. Consequently, analyses were conducted using two age bands: 8–11 years and 12–15 years. 50.1% of participants were between 8 and 11 years old, while 49.9% were between 12 and 15.

2.3 Procedure

The survey was developed in 2020 by Verian in collaboration with 5 key stakeholders, namely *Natural England, Defra, Groundwork, UK Youth and Step Up to Serve*. This collaboration aimed to determine which data were most needed from the children's survey. In a second development step, twelve face-to-face qualitative interviews were conducted with children, three at a time. These interviews ensured that the survey used child-appropriate language and provided insight into how children think and talk about nature.

The final survey incorporates information from both the stakeholder interviews and the qualitative interviews with children. It uses simplified language and icons to facilitate completion. The survey was approved by Natural England's Ethics Committee, on the condition that Verian obtains explicit consent from both the child and their parent before participation.

The final product is an online questionnaire completed by both children and their parents. Parents report on demographic variables such as family income and the child's age and gender, while the remaining items are answered by the children themselves. The questionnaire consists of two sections: one on the use of green spaces and national parks, and the other on attitudes and behaviors toward the environment. The present study focuses on the section related to pro-environmental behaviors.

2.4 Measures

Meat reduction

The dependent variable of interest in this study was meat reduction, assessed via a multiple-choice item asking, “Which of the following things do you do to look after the environment?” Participants were presented with 17 response options in randomized order, one of which was “Eat less meat (including vegetarian or vegan).” Additional options included “prefer not to say,” “none of the above,” and “something else,” the latter accompanied by an open text field. See Appendix A for details on all used questionnaire items. For the purposes of the present study, only whether a participant selected the “eat less meat” option was considered, resulting in a binary outcome variable.

Environmental knowledge

Self-reported environmental knowledge was measured using a single-item Likert scale assessing agreement with the statement, “I know what I can do to look after the environment,” rated from -3 (completely disagree) to 3 (completely agree). Separate “Don’t know” and “prefer not to say” options were coded as missing data.

Adult appraisals

Adult appraisals were operationalized as participants’ agreement with the statement, “I think adults are doing enough to look after the environment,” measured on the same 7-point Likert scale as environmental knowledge. Separate “Don’t know” and “prefer not to say” options were coded as missing data.

Covariates

Several covariates known to be associated with dietary or pro-environmental behaviour were controlled for. Because nature connectedness has been linked to how children evaluate environmentally harmful actions (Collado & Sorrell, 2019), a measure of nature connectedness was included. Children were asked, “How connected do you feel to nature? Please choose the picture that best describes your relationship to nature,” using the pictogram-based scale developed by Kleespies et al. (2021).

Additional single-choice items assessed region and demographic characteristics reported by parents, including age, gender, and annual household income. Income was provided in ten categorical brackets and further collapsed into six categories for analysis, likely for data

protection and to ensure sufficient cell sizes in higher income groups. Although prior research suggests that educational background is a stronger predictor of vegetarian diet choices than household income (Klink et al., 2022), participants in the present sample were still completing formal education. Family income was therefore used as an indicator of socioeconomic status. Region and survey year were not pre-registered but were included to account for potential regional and temporal trends, as dietary behaviours may differ between rural and more cosmopolitan areas (Morris & Northstone, 2015). Age was also included, as previous research indicates that motivations for plant-based diets differ between children and adults (Smart Protein, 2024). Although age was originally collected continuously, access to the data was limited to two age categories; analyses were therefore conducted using these bands. Gender was included because meat consumption is often associated with masculine identities across societies (e.g., Rosenfeld & Tomiyama, 2021). Parents were asked, “Is this child ... ? Please select one answer only,” with response options including male, female, other, prefer not to say, and I don’t know. The item did not specify whether parents were reporting the child’s gender or sex. For simplicity, the term *gender* is used throughout this study, although this distinction cannot be inferred from the item wording.

2.5 Analytic approach

To test the first hypothesis that higher environmental knowledge predicts self-reported meat reduction, a logistic regression was conducted. A mediation analysis (Hayes PROCESS Model 4) was performed to examine whether the relationship between environmental knowledge and self-reported meat reduction is negatively mediated by adult appraisals. A moderation analysis (Hayes PROCESS Model 1) was performed to test whether adult appraisals negatively moderate the relationship between environmental knowledge and self-reported meat reduction. All analyses included gender, income, age group, nature connectedness, region, and year as covariates.

2.6 Data treatment

Weights provided by Natural England (2020) were applied to ensure that the sample was representative of the population of England. To account for only one child per household being surveyed, Verian calculated a design weight. Households with a single eligible child were assigned a design weight of 1, whereas children from households with multiple eligible children received a design weight of 2. The design weight was derived as the inverse of the probability of selection. It was subsequently incorporated into an algorithm to match population

margins for age, gender, region, ethnicity (White vs. non-White), long-term health conditions, number of cars per household, urban versus rural residence, and dog ownership. Representativeness quotas are based on the most recent Office for National Statistics (ONS; 2023) Mid-Year Population Estimates (or Census), as well as the Labour Force Survey. Updated population statistics are incorporated annually. Detailed target quotas for the core sample of 1500 children are publicly available on the Natural England website.

Additionally, Verian calculated non-response weights to account for differences in the probability of survey completion. These weights were computed using iterative proportional fitting (rim weighting). Starting with the design weight, the algorithm iteratively adjusted weights until all target population distributions were matched. Weighting reduces the amount of information contributed by each observation, resulting in less information than a simple random sample of the same size. The design effect quantifies this difference in information.

In each wave, the survey gathers responses from approximately 2000 children aged 8 to 15 years. Of these, 1,500 participants constitute the core sample designed to be representative of the English child population, while an additional 500 participants are recruited as a targeted boost sample to increase the representation of ethnic minority groups.

Verian conducts several steps of pre-processing and cleaning the data, including verifying the structure of the data, questionnaire routing, and back-coding ‘other specify’ answers. After data collection, the dataset undergoes quality checks conducted by Natural England using automated scripts. The scripts, along with the data dictionary, are updated quarterly. Natural England also verifies whether target demographic quotas are met in this step and checks the data for systematic bias, such as non-completion or individual questions. The statistics from C-PaNS have been published as accredited official statistics. Further methodological details are available in the Technical Report published by Natural England (2020).

Participants were given the option to respond with “Don’t know” or “Prefer not to say”, and these responses were treated as missing data. Only participants with complete data on all variables relevant to the analyses were included in the final analytical sample. Missing data affected only two participants.

No outliers were defined or excluded in this study. Given the large sample size, the influence of individual extreme values is expected to be minimal. Furthermore, as the variables were measured using Likert scales, which often do not follow a normal distribution, the identification

of statistical outliers is less meaningful in this context. The mediation model was bootstrapped using 5,000 resamples to estimate confidence intervals for indirect, direct, and total effects. All Likert-scale variables were recoded so that negative values indicate lower levels or less favorable responses, to facilitate interpretation.

2.7 Transparency Statement

This analysis was conducted as part of a master's thesis supervised by Dr. Mathew White and Prof. Dr. Sabine Pahl, both of whom have extensive expertise with the Children's People and Nature Survey (C-PaNS) dataset and actively use it in their own research. Prior access to the dataset was used solely to estimate the number of participants reporting meat-reduced diets and to assess data suitability and sample characteristics. No model testing was conducted prior to preregistration.

3. Results

3.1. Descriptives

The study was conducted on a total sample of $N = 16,104$ (48.7% female; 0.1% labeled "other"). After removing participants with missing data, the analytical sample consisted of $N = 16,102$. Overall, 17.5% of participants reported reducing their meat consumption. Among these meat-reducing participants, the majority were female (53.6%), aged 12–15 years (53.8%), residents of London (20.5%), and had a family income of £50,000 or more per year (42.0%). Of the meat-reducing participants, most (50.7%) also agreed that they have the knowledge to help the environment, most frequently selected the highest level of nature connectedness (23.2%), and most frequently disagreed that adults are doing enough to protect the environment (25.9%). Table 1 shows means and standard deviations for each variable.

Table 1*Descriptive Statistics for study variables*

	n	%	M	SD
Meat reduction	2825	17.5		
Environmental knowledge			1.18	1.079
Adult appraisals			0.22	1.538
Family Income			4.12	2.042
Nature Connectedness			4.52	1.668
Age				
8-11	8185	50.8		
12-15	7919	49.2		
Gender				
Female	7842	48.7		
Male	8237	51.1		
Other	18	0.1		
Region				
North East	724	4.5		
North West	2118	13.2		
Yorkshire and the Humber	1569	9.7		
East Midlands	1366	8.5		
West Midlands	1758	10.9		
East	1817	11.3		
London	2547	15.8		
South East	2693	16.7		
South West	1512	9.4		

Survey year		
2021	4099	25.5
2022	4003	24.9
2023	4001	24.8
2024	4001	24.8

Note. *M* = mean; *SD* = standard deviation. Scores for environmental knowledge and adult appraisals ranged from -3 (strongly disagree) to 3 (strongly agree). Scores for family income ranged from 1 (£0–£14,999) to 6 (£50,000+). Scores for nature connectedness ranged from 1 (least connected) to 7 (most connected).

An exploratory correlational analysis (Table 2) revealed a small but significant positive correlation between environmental knowledge and meat reduction ($r = .13, p < .01$), supporting the primary hypothesis. Moderate positive correlations were found between environmental knowledge and adult appraisals ($r = .41, p < .01$), as well as between environmental knowledge and nature connectedness ($r = .29, p < .01$). Additionally, a small positive correlation was observed between adult appraisals and survey year ($r = .15, p < .01$). All other variables were significantly correlated with each other, except for the correlations between age and income, and between age and survey year.

Table 2*Correlational analysis*

Variable	1	2	3	4	5	6	7
1. Meat reduction	1	.127**	.018*	.047**	.102**	-.034**	.042**
2. Knowledge	.127**	1	.409**	.093**	.286**	.076**	-.023**
3. Adult appraisals	.018*	.409**	1	.078**	.099**	.154**	-.026**
4. Income	.047**	.093**	.078**	1	.095**	.088**	0.001
5. Nature Connectedness	.102**	.286**	.099**	.095**	1	.105**	-.103**
6. Survey year	-.034**	.076**	.154**	.088**	.105**	1	0.015
7. Age	.042**	-.023**	-.026**	0.001	-.103**	0.015	1

** *The correlation is significant at the 0.01 level (2-tailed).*

* *The correlation is significant at the 0.05 level (2-tailed).*

3.2 Mediation

Fig. 2 illustrates the full conceptual model, including the mediation and moderation pathways involving environmental knowledge, adult appraisals, and meat reduction.

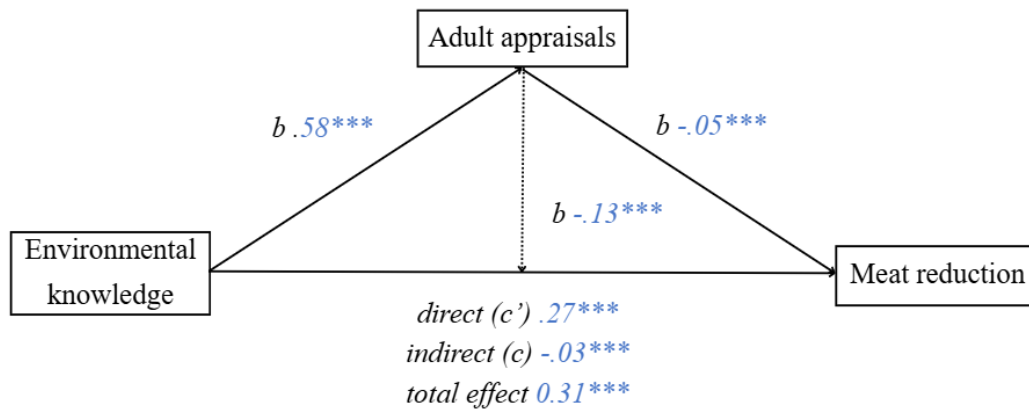


Fig. 2. Tested path model including mediation (solid lines) and moderation (dotted line) pathways between environmental knowledge, adult appraisals, and meat reduction (MRD), controlling for covariates (omitted for clarity). *** $p \leq .001$.

Environmental knowledge significantly predicted meat-reduced diets ($b = 0.31$, $SE = 0.02$, Wald $\chi^2(1) = 169.4$, $p < .001$, odds ratio (OR) = 1.35, 95% CI [1.29, 1.42]) in the total effect model. Each one-point increase in environmental knowledge was associated with 1.35 times higher odds of reporting a MRD, supporting H1.

When adult appraisals were included in the model, the direct effect of environmental knowledge on meat reduction remained significant with $b = 0.27$, $SE = 0.02$, OR = 1.31, 95% CI [1.25, 1.37], $p < .001$. Looking at each pathway of the mediation, each was significant, with a moderate effect for the path from environmental knowledge to adult appraisals ($b = .58$, $SE = 0.01$, 95% CI [0.56, 0.60], $p < .001$). Adult appraisals significantly and negatively predicted meat reduction, $b = -0.05$, $SE = 0.01$, OR = 0.95, 95% CI [0.92, 0.98], $p < .001$. The indirect effect of environmental knowledge on self-reported meat reduction, mediated by adult appraisals, was small but significant and negative ($ab = -0.03$, 95% bootstrap CI [-0.05, -0.01]). Thus, while environmental knowledge was positively associated with meat reduction overall, the mediated pathway through adult appraisals operated in the opposite direction. This

indicates an inconsistent mediation pattern, but is in line with the hypothesized negative mediation effect. Therefore, H2A was partially supported. The model was significant ($\chi^2(16) = 515.141$, $p < .001$), explaining 5% of variance in meat-reduced diets (Nagelkerke $R^2 = .05$), indicating limited but meaningful explanatory power.

3.3 Moderation

Contrary to H2B, the moderation analysis indicated that adult appraisals significantly and positively moderated self-reported meat reduction ($b = 0.04$, $SE = 0.01$, $OR = 1.05$, 95% CI [1.02, 1.07], $p < .001$), indicating a small but meaningful increase in odds. Conditional effects showed that environmental knowledge significantly predicted meat-reduced diets at low ($b = 0.21$, $SE = 0.03$, $OR = 1.24$, $p < .001$), mean ($b = 0.26$, $SE = 0.02$, $OR = 1.29$, $p < .001$), and high ($b = 0.35$, $SE = 0.03$, $OR = 1.41$, $p < .001$) levels of adult appraisals. A simple slopes analysis indicated that the positive effect of environmental knowledge on meat reduction was strongest among children with positive adult appraisals, suggesting that positive adult appraisals amplify the influence of knowledge on pro-environmental dietary behavior.

Overall, the model was significant ($\chi^2(19) = 545.288$, $p < .001$), explaining 6% of the variance in meat-reduced diets (Nagelkerke $R^2 = .06$).

3.4 Covariates

Most covariates were significant predictors of meat reduction. Family income ($b = .04$, $p < .001$) and nature connectedness ($b = .12$, $p < .001$) were positively associated with a higher likelihood of reporting a meat-reduced diet. Using male participants as the reference category, female gender significantly predicted meat reduction ($b = .27$, $p < .001$), indicating higher odds amongst girls. The third gender category, “other”, showed a positive but non-significant association ($b = .75$, $p = .149$, $N = 18$). Survey year was negatively associated with meat reduction ($b = -.12$, $p < .001$). With London as the reference category, all other regions showed significantly lower odds of reporting a meat-reduced diet, although effect sizes varied across regions ($b(\text{NorthEast}) = -.49$, $p < .001$, $b(\text{NorthWest}) = -.19$, $p = .014$, $b(\text{Yorks}) = -.28$, $p = .001$, $b(\text{EastMidlands}) = -.31$, $p < .001$, $b(\text{Westmidlands}) = -.30$, $p < .001$, $b(\text{East}) = -.19$, $p = .017$, $b(\text{SouthEast}) = -.15$, $p = .043$, $b(\text{Southwest}) = -.24$, $p = .006$).

4. Discussion

The aim of this study was to examine the context in which children decide to reduce their meat consumption for environmental reasons, with a particular focus on the effects of self-reported knowledge and adult appraisals.

4.1 Key findings

Environmental Knowledge

Environmental knowledge significantly predicted self-reported meat-reduced diets, with children reporting higher environmental knowledge being more likely to follow a meat-reduced diet. This finding supports our theorization that greater knowledge about environmental issues fosters concern and awareness of the consequences of one's actions, and it is consistent with the predictions of the Comprehensive Action Determination Model (Klöckner & Blöbaum, 2010). However, the cross-sectional design of the study precludes causal conclusions. It is also possible that children who reduce their meat intake perceive themselves as more knowledgeable about environmental issues.

Self-assessments of environmental knowledge may be subject to over- or underestimation, as perceived competence can be influenced by various factors. For example, an exploratory Mann-Whitney U test revealed that boys rated their environmental knowledge significantly higher than girls ($U = 32,060,090.50$, $Z = -3.21$, $p < .001$). However, broader UK educational data show that girls tend to outperform boys across most school subjects (Department for Education, 2025), suggesting that self-perceived and actual knowledge do not always correspond.

Mediation

Our data provided partial support for the hypothesis H2A, which predicted that the relationship between environmental knowledge and self-reported meat-reduced diets would be negatively mediated by adult appraisals.

This finding aligns with our theorization that children with negative adult appraisals may feel compelled to take action themselves and reduce meat intake, linking their pro-environmental behavior to frustration for previous generations, as described by Thomas et al. (2022). However, examination of each pathway individually revealed an unexpected pattern: children with higher environmental knowledge were more likely to report more positive adult appraisals. This finding contrasts with our initial theorization that children with greater

environmental knowledge would perceive more deficits in adult action, as suggested by global reports showing that no country currently meets climate targets (e.g., Burck et al., 2025). One possible explanation for this unforeseen finding is related to the survey administration: parents may have been present while children completed the questionnaire, which could have prompted socially desirable responses. Another explanation is that children with higher environmental knowledge may have acquired it from adults in their surroundings who are proactive about environmental issues, which could increase children's optimism regarding adult action.

Overall, these findings highlight the need for further research on intergenerational dynamics in the context of environmental behavior, as few studies have addressed how children perceive and are influenced by adult environmental action.

Moderation

Contrary to our hypothesis H2B, our data suggested that adult appraisals positively moderate the relationship between environmental knowledge and self-reported meat-reduced diets. Conditional effects were observed at low, mean, and high levels of adult appraisals. Specifically, children with higher environmental knowledge who also perceived more positive adult appraisals were more likely to follow a meat-reduced diet. One possible explanation is that children living in contexts with adults who are proactive about the environment may feel more motivated to engage in pro-environmental behaviors and develop higher self-efficacy regarding these actions. Conversely, children with low environmental knowledge and negative perceptions of adult action may feel demotivated or believe that their own behavioral changes will not have a meaningful impact. This explanation is supported by Collado, Evans, and Sorrell (2017), who found that parents' pro-environmental behavior was positively associated with their children's behavior. In an experiment based on Bandura's social learning theory (Liang, Chen & Zhou, 2022), only teachers' demonstration of picking up litter increased children's pro-environmental behavior, whereas peer demonstration had no effect. Together, these findings suggest that adults in a child's immediate environment can shape whether environmental knowledge is translated into behavior.

Comparing Moderation and Mediation

In the context of moderation, adult appraisals may function less as an indicator of perceived urgency to act and more as a positive amplifier of the existing effect of environmental knowledge on meat-reduced diet behaviors. Our moderation results may reflect the immediate social environment of a child, including parents and teachers who can serve as role models and

motivators. In contrast, the mediated pathway may capture perceptions of adult appraisals in a broader societal context, such as politics. For example, a child may perceive their own parents as highly engaged in climate issues while simultaneously noting substantial shortcomings in adult action at a societal level.

As an alternative explanation, other hidden factors may influence whether adult appraisals function as a moderator or a mediator. This factor could be e.g. a demographic characteristic. For example, individuals with higher socio-economic status are associated with taking more pro-environmental action (Piao & Managi, 2024). Children in such households with high income might notice that their parents contribute substantial resources to climate causes, which could lead them to perceive that their own meat-reduced diet has comparatively little impact.

Other factors not measured in the present study, such as climate anxiety, may also play a role. For instance, children with higher levels of climate anxiety might feel even more compelled to reduce their meat intake than those with negative adult appraisals alone. A study by Becht et al. (2024) supports the hypothesis that climate anxiety promotes pro-environmental behavior in adolescents, and more evidence suggests that climate anxiety is even associated particularly with intentions of meat reduction in adults (Boaitey, 2025).

Overall, these findings underscore the complexities and tensions inherent in intergenerational climate issues. Questions of responsibility are politically charged and intersect with psychological research on phenomena such as diffusion of responsibility, group dynamics, and climate anxiety.

4.2 Secondary results

Descriptives

Estimating the overall proportion of children reporting meat-reduced diets was of particular interest, as descriptive data on meat reduction among children and adolescents remain scarce. To the authors' knowledge, no descriptive study has examined meat-reduced diets in this age group in England, which excludes opportunities for direct comparison. As discussed in the theoretical background, prevalence estimates in this area are highly time-sensitive and depend strongly on how dietary behavior is operationalized, with some studies focusing on vegetarianism or veganism, and others on broader forms of meat reduction.

Nature connectedness

Our findings regarding nature connectedness are consistent with previous research linking connectedness to pro-environmental behavior. For example, Collado and Sorrell (2019) found that children who feel more connected to nature tend to judge actions harmful to the environment, particularly those affecting animals, more critically. This aligns with our results, where higher nature connectedness predicted greater likelihood of meat reduction. Additionally, female participants reported higher levels of both meat-reduced diets and nature connectedness compared with male participants, which is consistent with prior findings (Price et al., 2022).

Age

Participants from the older age group were more likely to report a meat-reduced diet. A plausible explanation is that older children tend to be more independent and are therefore more capable of preparing their own meals or influencing grocery choices, whereas younger children are more dependent on their parents' dietary decisions.

Region

Children from London were more likely to report MRDs than children from other regions. This finding aligns with prior research indicating that meat reduction is more common in urban areas (Allès et al., 2017).

Year

Meat-reduced diets were reported significantly less frequently as the study progressed across years. One possible explanation is that parts of the study coincided with the COVID-19 pandemic. The pandemic was accompanied by shifts in food choice motives, as reported by Mertens et al. (2022), who found that health considerations became more important in dietary decision-making during this period. Given the common belief that meat-reduced diets don't provide adequate nutritional value (Paslakis et al., 2020), health concerns may have influenced food decisions. Moreover, the pandemic elicited comparatively rapid responses from organizations and governments, relative to the responses observed for the climate crisis (Meijers et al., 2022). The strong discrepancy in perceived urgency may have signaled to children that the climate crisis is a comparatively less pressing issue that doesn't need to be addressed immediately.

Income

Children from higher-income households were more likely to report meat reduction in our study. Here, family income was used as a proxy for educational background, as children are still in school and direct measures of educational attainment were unavailable; nonetheless, income and education are often positively correlated.

Higher socioeconomic status has been specifically associated with greater engagement in pro-environmental behaviors (Piao & Managi, 2024), which the authors attribute partly to a negative relationship between household income and full-time employment, suggesting greater time availability, and partly to the greater financial capacity of higher-income individuals to donate to pro-environmental causes.

Conversely, lower-income families may face more immediate existential concerns, such as financial insecurity or time scarcity, which can limit opportunities for participation in pro-environmental behaviors. Because environmental action (e.g., shifting diets, purchasing sustainable products) often entails additional costs or cognitive resources, it is frequently observed more among higher-income groups than lower-income groups.

Theoretical implications

The CADM served as a theoretical reference when formulating our research question. However, this study does not aim to test the CADM as a comprehensive theoretical framework. Several variables included in our analyses do not map onto a single component of the CADM and are therefore not directly comparable to the original model. For example, adult appraisals represent a novel variable that can be interpreted as reflecting normative processes, thereby extending the original model. Self-reported environmental knowledge was treated as an awareness-of-consequences variable, which in the CADM does not directly predict pro-environmental behavior. According to the CADM, the effects of awareness-of-consequences are mediated by habitual, situational, and intentional processes (Klöckner & Blöbaum, 2010).

4.3 Strengths and Limitations

Sample size & national representativeness

A principal strength of this study lies in its substantial sample size, which, when coupled with the rigorous data collection and quality assurance protocols employed by government authorities, supports a high degree of confidence in the findings for English children aged 8-15. The dataset is both nationally representative and weighted, supporting the generalizability

and robustness of the results. Missing data were extremely rare, with only two participants needing to be excluded, thereby minimizing the risk of response bias.

Finding representative, up-to-date data on the prevalence of meat-reduced diets is challenging because such information is highly time-sensitive and rarely reported in the context of environmental behavior. Most studies focus on the absolute number of vegetarians and vegans, rather than on people who reduce meat consumption more generally. Moreover, existing research is usually limited to adults, as studies with children involve additional challenges, such as designing age-appropriate questionnaires and obtaining consent from caregivers. This study makes an important contribution by addressing this gap with descriptive, population-based statistics on children's meat-reduced diets.

Self-reports

A key limitation is the reliance on self-reported data. Children may overestimate or underestimate their meat consumption, and their perceptions of what constitutes a “meat-reduced diet” may vary. This introduces potential measurement bias and should be considered when interpreting the results.

Recruitment and data collection context

Another limitation is the lack of detailed information on recruitment and survey administration. The company responsible for data collection, Verian, withheld these details due to commercial confidentiality. As a result, we do not know the exact context in which children completed the questionnaires. For example, parents may have been present during survey completion, potentially prompting socially desirable responses. This uncertainty limits our ability to fully interpret the findings.

Motivation for meat reduction

The item measuring meat reduction explicitly framed the behavior as being “for the environment.” It is possible that some children reduced their meat consumption for other reasons, such as health, taste preferences or ethical concerns, which could have introduced systematic bias in how the survey was completed. While Natural England conducts regular checks to control for systematic biases, the wording of this item limits our ability to capture motivations beyond environmental considerations.

Additionally, children could only respond on a binary scale, which did not allow for more nuanced answers. We relied on their self-reports on meat consumption, but no data were

collected on the frequency or extent of reduction. Assessing such behaviors may have been challenging for children as young as eight years old, potentially introducing biases.

Single-item measurements

A recurring limitation in this study was the use of single-item measures to capture complex constructs, which in some cases made it unclear what was truly being assessed. For example, the item measuring environmental knowledge, “I know what I can do to look after the environment,” may reflect perceived environmental agency rather than objective knowledge, potentially threatening the construct validity. Similarly, the item “I think adults are doing enough for the environment” captures perceived sufficiency of adult action but does not differentiate between adults in general and primary caregivers. This distinction could have provided more insight into the nature of intergenerational influences. Previous research has addressed such nuances. For instance, Guan and Geng (2024) examined how psychological richness in parents affect children’s pro-environmental behaviors.

Gender measurement

The item on children’s gender was ambiguous. Parents were asked, “Is this child...?” without specifying whether the question referred to biological sex or gender identity. Given the political sensitivity of this topic, this ambiguity may have been intentional. We attempted to compare the proportion of diverse participants in our sample to population estimates; however, England does not collect official gender identity data for individuals under the age of 16. The only available estimate suggests that 0.06% of the population identify as non-binary (Office for National Statistics, 2023). In our sample, an even smaller proportion (0.01%) of children were reported as non-binary by their parents, which may reflect underreporting or misclassification, or a lower prevalence in this age group.

Secondary data

A major limitation of this study is its reliance on secondary data, which constrained the information available for addressing our research question. Future studies would benefit from collecting primary data that includes detailed information on the specific types of diets children follow and the reasons underlying their meat-reduced diets. Allowing participants to indicate one or multiple motivations would clarify which factors are most influential in driving pro-environmental dietary choices. Such insights could guide targeted interventions and extend

prior work, such as Hussar and Harris (2010), on why young children choose vegetarian or meat-reduced diets.

Causality

It is important to emphasize that this study is based exclusively on cross-sectional data, which precludes any causal inferences. Although the proposed model posits unidirectional influences, the statistical analyses are limited to assessing associations between variables.

Parental and contextual influences

Another important gap in this study is the lack of information on children's caregivers' diets. Understanding whether children choose a meat-reduced diet independently or simply follow parental habits would provide crucial insight into the mechanisms driving dietary behavior. Additional contextual information, such as children's ability to prepare their own meals or the availability of meat alternatives at school, would further clarify the feasibility of meat reduction for different children.

4.4 Future Research

Future research could design surveys specifically to disentangle the influence of family and environmental contexts on children's dietary choices. For example, studies could use paired parent-child samples to examine the role of parents' diets, while also observing eating behaviors within the household to account for children's independence in making food choices.

Longitudinal or retrospective designs would allow researchers to examine the development and sustainability of meat-reduced diets. Such studies could track children or adults over time to determine when pro-environmental dietary behaviors emerge, whether they are maintained, and which factors influence adherence or relapse. Combining longitudinal approaches with detailed information on parental and contextual influences would provide a more comprehensive understanding of the motivations and barriers behind meat reduction.

To further clarify the interactions between environmental knowledge, adult appraisals, and meat reduction, future research should also include additional constructs, such as climate anxiety, as well as group-level factors like diffusion of responsibility.

4.5 Policy implications

Our study offers valuable insights for potential interventions. Environmental knowledge emerged as a key predictor of meat-reduced diets. Hahn et al. (2021) suggest that adults often avoid discussing the origin of meat or even withhold information about animal slaughter, limiting opportunities for children to make informed food choices. Cognitive dissonance may also play a role, as conversations about meat consumption may evoke conflicting beliefs and emotions about one's own meat consumption ("meat paradox"; Rothgerber, 2020). Notably, phrasing such as "meat production" or "meat consumption" illustrates how collective discourse often employs euphemisms that obscure the involvement of animals, potentially contributing to cognitive dissonance.

Simple, targeted interventions in schools that inform children about actions with the greatest environmental impact could help increase the proportion of meat-reducing individuals and reduce the substantial carbon emissions associated with meat consumption. Equally important, interventions targeting adults are needed. Encouraging adults to address the implications of the meat industry and engage with a topic that is often avoided can help foster reflection and behavior change at a societal level. Adults can benefit from learning about their own meat consumption and gain knowledge they can pass on to younger generations as parents, caregivers, and educators.

4.6 Conclusion

Overall, this study provides valuable insights across several areas. First, it offers descriptive data on the young English population that can inform future research and intervention planning. Second, it sheds light on the relationship between environmental knowledge and meat reduction, highlighting the essential role of adults in children's pro-environmental behaviors. Adults can either reinforce or mitigate children's meat reducing behaviors, making them key actors in efforts to address the climate crisis. Collectively, these findings enhance our understanding of the factors predicting children's meat-reduced diets and can inform interventions and policies aimed at promoting environmentally motivated dietary behaviors among young people.

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Appendices

Appendix A: Questionnaire

The following are selected items from *The Children's People and Nature Survey for England* (Natural England, 2020). See the original source for the pictograms used in this questionnaire.

SCREENING QUESTIONS ASKED OF PARENTS

[CS_S_Region] Where in the UK do you live?

Please select one answer only

- North East
- North West
- Yorkshire and the Humber
- East Midlands
- West Midlands
- East
- London
- South East
- South West
- Scotland (SCREEN OUT)
- Wales (SCREEN OUT)
- Northern Ireland (SCREEN OUT)

[CS_S_Income] Which of the following best describes your total annual household income before tax?

Please select one answer only

- £0– £14,999
- £15,000–£19,999
- £20,000–£29,999
- £30,000–£39,999
- £40,000–£49,999

- £50,000–£59,999
- £60,000–£79,999
- £80,000–£99,999
- £100,000–£149,999
- £150,000 +
- Don't know
- Prefer not to say

[CS_S_Age] How old is this child?

Please type in the age of the child who is going to take part in the survey

- Open text box (allow answers between 8-15)
- Don't know (SCREEN OUT)
- Prefer not to say (SCREEN OUT)

[CS_S_Gender] Is this child __ ?

Please select one answer only

- Male
- Female
- Other
- Don't know
- Prefer not to say

QUESTIONS ASKED OF CHILDREN

These questions are being asked for Natural England, an organisation which looks after nature and wildlife in England and this will take around 5 to 10 minutes to complete. Your answers will help us understand how children and teenagers spend time outdoors.

Your answers will be kept private. Verian's privacy policy can be found here <https://www.veriangroup.com/uk-surveys>

This survey is interested in what you think and feel, it is not a test and there are no right or wrong answers. You do not have to take part if you do not want to, and you can stop the survey at any time by closing the window browser.

Please click the (>) button to confirm you are content to take part and to start the survey.

[CS_Q10] Which of the following things do you do to look after the environment? [TILED RESPONSE LIST](#)

SPONTANEOUS – [HIDE](#) None of the above/ [Don't Know/Prefer not to say](#)

There are lots of options but they may not all apply to you or all make sense. Only pick the ones you understand and do yourself to look after the environment.

Please choose one or more options

[RANDOMISE LIST](#)

- Eat less meat (including vegetarian or vegan)
- Turn lights off
- Turn the tap off while I brush my teeth
- Think about the environment when I buy things
- Recycle my waste
- Do things in the garden to help the wildlife (e.g. feed birds, grow plants that insects like, make homes for wildlife)
- Pick up litter
- Walk, cycle, scooter, skateboard or take public transport as much as I can
- Read about (online or in books) or watch programmes about the environment
- Talk to friends and family about looking after the environment
- Volunteer my time (e.g. litter pick, planting, raising awareness)
- Try and change what our leaders are doing (e.g. sign petitions, demonstrate, or write to them)
- Raise awareness by posting/sharing information online
- None of the above ([EXCLUSIVE](#)) [HIDE](#)
- Don't know ([EXCLUSIVE](#)) [HIDE](#)
- Prefer not to say ([EXCLUSIVE](#)) [HIDE](#)

- Something else...(please write in below) (open text box- allow answers between 0-400 characters)

[CS_Q12_b] How much do you agree or disagree with the following: I think adults are doing enough to look after the environment

SPONTANEOUS – HIDE Don't Know/Prefer not to say

Please select one answer only

- Completely agree
- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree
- Completely disagree
- Don't know - HIDE
- Prefer not to say - HIDE

[CS_Q12_e] How much do you agree or disagree with the following: I know what I can do to look after the environment

SPONTANEOUS – HIDE Don't Know/Prefer not to say

Please select one answer only

- Completely agree
- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree
- Completely disagree
- Don't know - HIDE
- Prefer not to say - HIDE

[CS_Q11] How connected do you feel to nature? Please choose the picture that best describes your relationship to nature

SPONTANEOUS – HIDE Don't Know/Prefer not to say

Please select one answer only

(See the original source for the pictograms used in this questionnaire)

- Don't know - HIDE
- Prefer not to say - HIDE

Appendix B: AI Acknowledgement

I hereby declare that I have used the following AI tools in the making of my master's thesis entitled *Meat Reduction as a Pro-Environmental Behavior: Results From a Nationally Representative Sample of 16,102 Children and Adolescents in England*. I confirm that the documentation of the AI tools used is complete, including the purpose of use, the product name, and, where applicable, the prompts and outputs of the AI tool. I take full responsibility for the selection and the use of all results generated by the AI tools I have employed.

Purpose of use	Name of AI tool	Exemplary prompts
Research	ChatGPT	Do you know of any studies that examined whether nature connectedness mediates the relationship between environmental knowledge and meat reduction? Find the missing DOIs in my reference list.
Statistics	ChatGPT	Give step-by-step instructions on how to conduct a Mann-Whitney-U-Test in SPSS. Explain what the F value stands for in this context.
Form	ChatGPT	Do you spot any mistakes in my reference list according to APA guidelines? Improve the form and grammar of this passage.

Appendix C: German Abstract

Fleischlose Ernährungsweisen gehören zu den wirksamsten Möglichkeiten, den eigenen ökologischen Fußabdruck zu reduzieren. Da Ernährungsgewohnheiten bereits in der Kindheit geprägt werden und im Erwachsenenalter schwerer veränderbar sind, ist es entscheidend, die Mechanismen zu identifizieren, die nachhaltige Ernährungsweisen begünstigen. Die vorliegende Studie untersucht, unter welchen Bedingungen Minderjährige sich aus Umweltgründen für eine fleischreduzierte Diät (MRD) entscheiden. Grundlage ist ein für England national repräsentativer, querschnittlicher Datensatz von 16 104 Kindern im Alter von 8 bis 15 Jahren. Im Mittelpunkt steht die Rolle von umweltbezogenem Wissen als Haupteffekt sowie die Wahrnehmung des Umweltengagements von Erwachsenen („adult appraisals“) als Mediator und Moderator. Alter, Familieneinkommen, Region, Erhebungsjahr und Naturverbundenheit wurden als Kontrollvariablen berücksichtigt. Insgesamt gaben 17,5 % der Stichprobe an, ihren Fleischkonsum aus Umweltgründen zu reduzieren. Umweltwissen stand in positivem Zusammenhang mit selbstberichteter fleischreduzierter Ernährung. Die Ergebnisse stützen teilweise eine negative Mediation über adult appraisals. Negative adult appraisals waren mit einer höheren Wahrscheinlichkeit mit einer MRD verbunden, während höheres Umweltwissen mit positiveren adult appraisals assoziiert war. Darüber hinaus moderierten adult appraisals den Zusammenhang zwischen Umweltwissen und MRD signifikant und positiv, sodass der positive Zusammenhang zwischen Umweltwissen und MRD bei Personen mit positiveren adult appraisals stärker ausfiel. Die Effekte blieben auch unter Kontrolle der Kovariaten signifikant. Die Ergebnisse unterstreichen die Komplexität generationsübergreifender Dynamiken bei der Ausprägung klimabezogenen Verhaltens und liefern Einblicke in Faktoren, die mit Fleischreduktion bei Kindern und Jugendlichen zusammenhängen.