



Pro-environmental behavior predicts adherence to plant-based diets

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ABSTRACT

Plant-based diets are beneficial to human health and environmental sustainability but suffer from low rates of adherence. For example, many people who self-identify as vegetarian sporadically eat meat and eventually give up their vegetarian diet entirely. We theorize that valuing a lifestyle of pro-environmental behaviors can enable people to adhere to a plant-based diet more successfully. In the current survey study, we tested this prediction among plant-based dieters for two outcomes: short-term adherence (for the past three days) and future-intended dietary adherence (intention to continue one's diet for the next 1–2 years). Over and above other dietary, motivational, and demographic factors, pro-environmental behavior positively predicted both short-term and future-intended adherence to plant-based diets. Moreover, pro-environmental behavior mediated links between (a) connectedness to nature and dietary adherence and (b) political ideology and dietary adherence. These findings highlight pro-environmental behavior as a tool for explaining and predicting adherence to plant-based diets.

According to the United Nations, a global move toward a plant-based diet is necessary to counteract climate change (Alvaro, 2017), as shifting away from meat-based diets would promote more sustainable use of natural resources (Steinfeld, Wassenaar, & Jutzi, 2006). For example, livestock husbandry is responsible for an estimated 12% of all anthropogenic greenhouse gas emissions (Lal, 2020), and direct livestock non-carbon dioxide emissions cause approximately 19% of the total modeled global warming from all anthropogenic emissions (Reisinger & Clark, 2018). Despite the promising benefits of plant-based nutrition for environmental sustainability, odds are that few people will adopt and successfully adhere to vegetarian diets (Odegard & Van der Voet, 2014). Indeed, vegetarians represent a minority group among mainstream consumers, even with expanding awareness of ecological, ethical, and health benefits of vegetarian eating patterns (Schenk, Rössel, & Scholz, 2018). The majority of people who do become vegetarians, moreover, eventually give up their diet and return to eating meat (Herzog, 2014). Thus, there arises an important call for psychological research to identify what factors promote and undermine individuals' abilities to adhere to a plant-based diet.

Whereas many studies have identified what motivates people to adopt a plant-based diet (e.g., Beardsworth & Keil, 1992; Fox & Ward, 2008; Hoffman, Stallings, Bessinger, & Brooks, 2013), many fewer

studies have examined factors involved in *maintaining* a plant-based diet. Some results suggest that ethically motivated vegetarians are more likely to adhere to their diets (Ogden, Karim, Choudry, & Brown, 2006; Rozin, Markwith, & Stoess, 1997), particularly when their ethical motivations concern animal rights/welfare and coincide strong feelings of disgust toward meat (Rosenfeld, 2019). Other findings have highlighted more external factors related to dietary adherence, such as social support (Jabs, Devine, & Sobal, 1998). We propose that environmental psychology can advance existing knowledge on plant-based dietary adherence by revealing additional unexplored factors. Namely, we assert that valuing a lifestyle of pro-environmental behaviors can enable people to adhere to a plant-based diet more successfully.

Research has demonstrated positive links between pro-environmental behavior, connectedness to nature, and vegetarian status (Beardsworth & Keil, 1992; Clayton, 2003; Fox, 2000; Fox & Ward, 2008; Twigg, 1979). One's relationship with nature and the environment may encourage engagement in vegetarianism and environmentalism (Nisbet, Zelenski, & Murphy, 2009), with existing research centering on the pro-environmental benefits of vegetarian diets (Bacon & Krpan, 2018; Bajželj et al., 2014; Fox, 2000; Hallström, Röö, & Börjesson, 2014; Rozin, 2005; Stoll-Kleemann & Schmidt, 2017). Research thus far has focused principally on whether one reports being a

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vegetarian or not, overlooking whether one actually *adheres* to vegetarian dieting. In the current research, we hone in on pro-environmental behavior (behavior to benefit the environment) as a determinant of plant-based dietary adherence.

1. Plant-based dieting and pro-environmental behavior

By engaging in pro-environmental behaviors, people lessen the strain that their individual consumption practices have on the environment (Dhanda, 2019). Consumers play a vital role in assuming their part as more responsible citizens willing to balance hedonic consumption with long-term sustainable behaviors, such as reduced meat consumption (De Bakker & Dagevos, 2012). Accordingly, environmental movements often urge for active individual engagement through the means of personal intentions and behaviors, in order to ultimately reach a collective shift toward a more sustainable society (Mayer & Frantz, 2004). Eating behavior, as a highly personal process, is thus a ripe domain for considering individual differences in values, attitudes, and actions. Ecological motivation for vegetarianism operates via connecting awareness of one's food choices to their environmental impact (Evers, 2002). In a study by Kalof, Dietz, Stern, and Guagnano (1999), the belief that vegetarianism benefits the environment emerged as the strongest predictor that a person self-identifies as vegetarian, suggesting that food choices are largely influenced by environmental values and beliefs.

A perspective on promoting sustainability via increased connectedness to nature provides an effective strategy to encourage pro-environmental behavior among different targets (Nisbet et al., 2009; Nisbet & Zelenski, 2011). Furthermore, this line of pro-environmental behavior promotion would be particularly useful in developed countries, where consumer habits require an urgent shift to create more sustainable societies (Mayer & Frantz, 2004). Meat consumption is foreseen to increase globally through 2050, with this growth particularly accelerated in developing countries (Lal, 2020) that mimic the consumer patterns of developed economies (Alvaro, 2017). As a result, the world's meat production per capita is projected to increase by 63% by 2050 (FAO, 2019; Revell, 2015).

In spite of the growing body of research on vegetarianism as a feasible solution for current environmental challenges, (Bacon & Krpan, 2018; Bajželj et al., 2014; Fox, 2000; Hallström et al., 2014; Rozin, 2005; Stoll-Kleemann & Schmidt, 2017), there has not yet, to our knowledge, been research linking environmental commitment to plant-based dieters' intentions and abilities to continue with their dietary pattern consistently. Our research sought to address this knowledge gap.

2. Predicting adherence to plant-based diets

Not everyone who says they follow a plant-based diet avoids meat to the same degree. Broadly, with respect to plant-based dieting, one can identify two levels of meat-avoiders: (1) flexitarians, who limit their meat intake partially, and (2) vegetarians, who exclude meat from their diets entirely (De Backer & Hudders, 2015; Rosenfeld, 2018). By definition, vegetarians avoid meat to a greater degree than do flexitarians and thus follow a stricter plant-based diet. Yet even among vegetarians, variance exists in degree of plant-based dieting. A common definition for a vegetarian is a person who does not eat any form of meat, or animal flesh. However, many self-identified vegetarians are inconsistent with their diet and allow themselves to consume some meat (Ruby, 2012). In fact, Rosenfeld and Tomiyama (2019) found that 51% of self-identified vegetarians reported having eaten meat at least once since becoming vegetarian. Thus, even among individuals who report being vegetarians, actual *adherence* to a meatless diet is not guaranteed.

Might a plant-based dieter's pro-environmental behavior values play a role in their dietary adherence—that is the extent to which they abstain from eating meat? In the current research, we conceptualized and assessed two aspects of dietary adherence: 1) *short-term dietary adherence*, operationalized as the extent to which one has followed a

plant-based diet in the past three days, and 2) *future-intended dietary adherence*, operationalized as whether or not one intends to continue one's plant-based diet for the next 1–2 years. Understanding short-term dietary adherence provides an important insight into participants' actual ongoing eating, enabling us to identify predictors of one's current everyday adherence to a plant-based diet. Yet plant-based diets only benefit the environment to the degree that people maintain them in the long-term. Thus, considering people's future intentions regarding adherence is also critical.

With this approach, we acknowledge that despite some shortcomings of uncommitted dieting a vegetarian occasionally may incur in the short term, this could be possibly compensated by individual future intention to commit to a meat-reduced diet more consistently. If individuals violate a vegetarian diet regularly, yet still persist with their pursuit of vegetarianism in the long term, then a meaningful benefit of their diet for the environment, their health, and the well-being of nonhuman beings would likely be realized. Although a gap in intentions' translations into behaviors exists (e.g., Sheeran, 2002), behavioral intentions are still good predictors of a successful dietary change (Ogden et al., 2006). Consequently, we distinguish between the past behavior and future intentional behavior for the purpose of framing new perspective to achieve more effective environmental policy implementation.

Perspectives across environmental psychology, cognitive dissonance theory, and motivational science converge to suggest that plant-based dieters who value engagement in pro-environmental behaviors should be inclined to adhere to their diet more strictly. Specifically, given that feeling connected to nature can cause individuals to value engagement in pro-environmental behavior (Chawla, 1999; Gomes, Roszak, & Kanner, 1995; Hohle, 2014; Mayer & Frantz, 2004; Nisbet et al., 2009; Schultz, 2002), values related to pro-environmental behavior likely serve to mediate the link between nature connectedness and adherence to plant-based diets. This perspective is substantiated by theoretical (e.g., Gomes et al., 1995), qualitative (e.g., Chawla, 1999), and quantitative (e.g., Mayer & Frantz, 2004; Nisbet et al., 2009) evidence. Theorists have drawn parallels between *nature relatedness* (Nisbet et al., 2009) and *ecological identity* (Naess, 1973), proposing that internalized identification with nature can coincide a sense of agency to minimize the impact of one's own actions on the ecosystem (Hohle, 2014). If people relate to nature, then they become more motivated and committed to protect it via pro-environmental behaviors, in turn positively affirming their ecological identity (Mayer & Frantz, 2004). Vegetarianism represents a bridge that connects people with nature (Fox, 2000), enabling them to affirm an ecological identity every day through their food choices. Vegetarians, not surprisingly then, do report feeling more connected to nature than do meat-eaters (Nisbet et al., 2009).

Therefore, we theorize that developing a strong ecological identity might promote positive behavior change across pro-environmental behavior and meat avoidance, since this identity involves a feeling of nature connectedness that drives pro-environmental commitment. Indeed, vegetarians motivated by ethical concerns enclosing environmental and animal well-being are more likely to develop a robust ecological identity and stay longer as vegetarians than health-oriented vegetarians (Hoffman et al., 2013; Rothgerber, 2014), and our theorizing suggests that ethically motivated vegetarians' stronger awareness of interconnectedness with nature might contribute to this duration difference.

The means by which valuing pro-environmental behavior promotes plant-based dietary adherence may reflect motivational processes related to the self. Following a plant-based diet is theorized to influence an individual's sense of identity, with the fact that one is a meat-avoider—along with the motivations one has for avoiding meat—being an important aspect of one's self-concept (Rosenfeld & Burrow, 2017a). If following a plant-based diet affirms one's value for pro-environmental behavior, then identity processes may intersect one's ecological identity with one's identity as a plant-based dieter. This may in turn promote dietary adherence through basic attempts to avoid cognitive dissonance.

People have a fundamental desire to avoid holding conflicting cognitions (Festinger, 1957), and an inconsistency between one's identity and one's behavior can be a threatening source of cognitive dissonance (Aronson, 1968). To view oneself as a pro-environmental plant-based eater while concurrently eating meat would be aversely arousing by threatening one's self-integrity and moral identity. Thus, if one has strong pro-environmental behavior values, then one could feel psychologically at ease by adhering to one's plant-based diet consistently and intending to continue adherence in the future.

Identity-based motivational processes may also promote plant-based dietary adherence through the construction and enactment of a sense of purpose in life. Eating a plant-based diet is not an ultimate goal itself but a means of achieving a larger goal, often one that is prosocial in nature—such as efforts to benefit the environment (Fox & Ward, 2008). Awareness of a plant-based diet's environmental benefits can lead one to construe meat avoidance as a way of life that propels a compassionate cohabitation with other living beings. Such prosocial pursuits, or those that seek to benefit a cause beyond one's own self, can underlie how a person feels a sense of purpose in life (Damon, Menon, & Bronk, 2003). Accordingly, scholars have theorized that eating a plant-based diet may be a way of enacting purpose (Rosenfeld & Burrow, 2017b).

Plant-based dieters with strong pro-environmental values may construe their plant-based dietary identity as prosocially grounded and purpose-driven, one that is beneficial to the planet and its inhabitants (Fox, 2000). In line with this, people who feel related to nature and use vegetarianism as a catalyst also report having a sense of purpose in life and more self-acceptance (Nisbet, Zelenski, & Murphy, 2011). Feeling purposeful may promote greater plant-based dietary adherence by enhancing one's psychological stability and supporting goal pursuit (e.g., Hill, Burrow, & Bronk, 2016; Hill, Sin, Turiano, Burrow, & Rainone, 2018). Furthermore, one's sense of purpose in life is strongly intertwined with one's sense of identity (Hill & Burrow, 2012), with purpose acting as a future-oriented compass that temporally extends one's identity. As such, plant-based dieters who with strong pro-environmental behavior values are likely inclined to continue adhering to their diets in the future, as the sense of purpose they derive from meat avoidance may temporally extend their plant-based identity and increase its self-importance.

3. Political ideology

Prior research has highlighted links between political ideology and plant-based dieting. Compared to liberals (left-wing), conservatives (right-wing) tend to view vegetarianism more negatively, are less open to becoming vegetarian, and are less likely to adhere to vegetarian diets successfully (Hodson & Earle, 2018; Rosenfeld & Tomiyama, 2020; Črnič, 2013). Studies linking ideological beliefs and sustainability have reported that people who tend to the political left are more likely to commit to sustainable consumption behavior via political action on ecological concerns than people who hold binding moral values, which are associated with the political right (Watkins, Aitken, & Mather, 2016). Accordingly, vegetarian ecological identity considers not only environmental concern, universalism, and food wholeness but also political ideology as a relevant factor (Lindeman & Sirelius, 2001).

We theorized that if pro-environmental behavior uniquely predicts adherence to plant-based diets, then it may mediate the link between political ideology and adherence, given the clear ties between political ideology and environmental attitudes. Specifically, conservatives' lower pro-environmental behavior values may explain why they adhere to plant-based diets at lower rates than do liberals.

4. Additional factors

Beyond pro-environmental behavior, other factors surely play a significant role in adherence to plant-based diets. Among negative predictors hindering the chances to adopt a vegetarian diet are social

factors and current food habits of consuming meat (Salonen & Helne, 2012). Not surprisingly then, factors undermining the ability to maintain a vegetarian diet include lacking a sense of self-efficacy, including feeling unskilled in preparing vegetarian meals and perceiving vegetarian dieting as inconvenient (Bacon & Krpan, 2018; Haverstock & Forgays, 2012; Lea, Crawford, & Worsley, 2006; Schenk et al., 2018; Schösler, De Boer, & Boersema, 2012). Accordingly, we controlled for perceived convenience of plant-based dieting as a covariate.

Motivations to follow a plant-based diet for animal rights or health reasons are common (Rosenfeld, 2018; Ruby, 2012) and thus are important to control for as covariates in order to rigorously test the unique predictive value of pro-environmental behavior. Motivations to follow a plant-based diet for social reasons or out of taste preference may also be relevant, influential factors to consider (Hoffman et al., 2013; Plante, Rosenfeld, Plante, & Reysen, 2019). For example, prior research has found that animal rights and social motivations significantly predict adherence (Plante et al., 2019; Rosenfeld, 2019). By entering these four specific motivations (animal, health, social, and taste) as covariates, we partial out any variance they might explain in our outcomes.

Prior research has identified younger people as more open-minded and receptive to new alternative lifestyles and cultural trends as well as more likely to adopt vegetarian-oriented behaviors compared to older adults (Janda & Trocchia, 2001). Consequently, young educated individuals represent a gradually expanding and trend-setting consumer group (Schenk et al., 2018). A person's identity evolves throughout the lifespan and is influenced by the surrounding environment and life experiences (Fox & Ward, 2008), such as going to university, which can possibly trigger internal transformational process and adoption of vegetarianism (Jabs et al., 1998). In this vein, one's dietary practice may lead to the emergence of explicit identities since food choices mirror attitudes, knowledge, and socio-demographic conditions (Bisogni, Connors, Devine, & Sobal, 2002; Fox & Ward, 2008). University students tend to share their living and studying spaces and, coupled with their greater openness to new ideas and experiences, relatedness becomes crucial during this time. Recent research identified relatedness aspect to be an important factor for the management of vegetarian well-being, with nature connectedness interacting positively with psychological well-being of vegetarian profiles (Krizanova & Guardiola, 2020).

5. Study aims and hypotheses

A novel aim of the current research was to distinguishing between short-term dietary adherence and intention for long-term adherence as unique outcomes. A broader aim of these tests is to identify factors that may promote adherence to plant-based diets, knowledge that can ultimately be used to create a more sustainable food system.

In the current study, we investigated three main research questions. First, is pro-environmental behavior a unique predictor of adherence to plant-based diets, including current level of short-term dietary adherence and future intention to continue adherence? Second, does pro-environmental behavior mediate the relationships between connectedness to nature and dietary adherence? Third, does pro-environmental behavior mediate the relationships between political ideology and dietary adherence? We hypothesized that pro-environmental behavior would be a positive predictor of adherence (research question 1). We also hypothesized that pro-environmental behavior would mediate nature connectedness and political ideology links to adherence (research questions 2 and 3), such that higher pro-environmental behavior would explain why people who feel more connected to nature and are more politically liberal adhere more strictly to plant-based diets.

6. Method

6.1. Participants and procedure

Data were collected via questionnaire during the periods of March

and April of 2019 in a classroom environment of undergraduates from different areas of study (economics, politics, pedagogy, environment, sociology, engineering, medicine, social work, and information technology) at the University of Granada in Southern Spain. The questionnaire was completed in Spanish. Before beginning the survey, participants read guidelines of the study and were informed about the data protection policy and their anonymity. The completion of the survey took approximately 25 min per participant. No economic or academic compensation was provided for the completion of the survey. This study received ethical approval from the University of Granada.

Our recruitment period from March–April 2019 resulted in data from a total of 1,283 participants. After excluding missing and nonsense values, our full sample included 1,068 participants. Within this sample, 148 (13%) participants were flexitarians and 96 (8%) were vegetarians, who were retained for analyses. These 244 participants comprised our final sample. Participants ranged in age from 18 to 46 years, with a mean of 21.12 years ($SD = 3.51$), reflecting that our sample included several adult learners who were older than the typical college attendee. This sample provided 80% power to detect small-medium effects of $r = .18$.

6.2. Materials

6.2.1. Short-term dietary adherence

Short-term dietary adherence was assessed by the question, “In the past 3 days, how many times did you eat red and white meats (pork, chicken, beef, meat products such as ham, jelly, hamburgers, etc.)?” In this case, we followed the measure of dietary strictness employed previously by Allen, Wilson, Ng, and Dunne (2000) approaching a 3-day period optimized to reduce floor effects and make accurate counts.

6.2.2. Future-intended dietary adherence

Future-intended dietary adherence was assessed by the question, “Will you continue this diet with a reduced consumption of meat and meat products in the near future (1–2 years)?” Responses included “yes” and “no.”

6.2.3. Dietary status

Dietary status was assessed by the following item: “Please select the option that best describes your diet.” Responses included: omnivore, ecological omnivore, flexitarian, lacto-pesco vegetarian, lacto-ovo vegetarian, and vegan, described as follows: a. Omnivorous: eats meat and its derivatives, fish and seafood, as well as fruit, vegetables and cereals. b. Organic omnivore: buys organic meat. c. Flexitarian: does not eat meat at least once a week. d. Lacto-pesco vegetarian: eats dairy products, fish and seafood, but does not eat meat. e. Lacto-ovo vegetarian: eats eggs and dairy products but does not eat fish, seafood, white or red meats. f. Vegan: Eats fruits, vegetables, legumes and cereals but does not eat red or white meats, dairy products, eggs, seafood and fish. This measure was also employed in previous works when inquiring about vegetarian identity (Allen et al., 2000; Lea et al., 2006). Lacto-pesco vegetarians, lacto-ovo vegetarians, and vegans were combined into a single “vegetarian” category, as to represent all participants who fully excluded meat from their diets.

6.2.4. Pro-environmental behavior

Pro-environmental behavior was assessed by 16 items, adapted from Binder, Blankenberg, and Guardiola (2019), which asked participants to indicate how often they perform pro-environmental activities. Example items included, “Turn off lights in rooms that are not being used,” “Buy recycled products such as toilet paper or recycled paper tissues,” and “Carry your own shopping bag.” Responses were on a 5-point scale from 1 (very little or nothing) to 5 (extremely often).

6.2.5. Connectedness to nature

Connectedness to nature was assessed by 14 items adapted from Mayer and Frantz (2004). Example items included, “I often feel a sense

of oneness with the natural world around me” and “I think of the natural world as a community to which I belong.” Responses were on a 5-point scale ranging from 1 (strongly disagree) to 5 (strongly agree).

6.2.6. Convenience

Convenience was assessed by asking participants if they consider it easy to find and prepare meat-reduced foods, with responses including “yes” and “no.” We employed binary response scales in our research in order to provide participants with simpler answer options and reduce the chance of survey fatigue.

6.2.7. Dietary motivations

To estimate the unique predictive values of pro-environmental behavior and nature connectedness, we simultaneously accounted for several specific other motivations participants had for avoiding meat. The following motivations (in italics) were assessed, with their item(s) in parentheses and quotations: *animal* (“I follow this diet to defend animal rights,” “I follow this diet because I want to boycott the big meat industry”), *health* (“I follow this diet for health reasons,” “I follow this diet because I want to cleanse my body,” “I follow this diet because I want to lose weight”), *social* (“My friends also follow this diet,” “I follow this diet for my family”), and *taste* (“I follow this diet because I don’t like the taste of meat”). Responses to each item included “yes” and “no.” For motivations that were assessed by multiple items, participants were classified as having that motivation if they responded “yes” to any of the items.

6.2.8. Political ideology

Political ideology was assessed on a scale from 1 (extremely left) to 10 (extremely right).

7. Results

Data and analysis scripts are available at https://osf.io/6vdsu/?view_only=673025642cd04fffb2373409ca9a80f5. Table 1 displays intercorrelations for all main variables.

7.1. Short-term dietary adherence

We conducted a hierarchical ordinary least squares (OLS) regression to test which factors predict level of short-term dietary adherence, which was operationalized as the degree to which participants have avoided meat in the three days prior to survey completion. In all steps, we controlled for participants’ dietary status as flexitarian versus vegetarian in order to isolate the unique predictive value of psychological factors. By doing so, we adjusted our estimates to account for the possibility that flexitarians and vegetarians might have different intentions to continue their diets. In the first step, we regressed short-term dietary adherence on environmental value variables, including pro-environmental behavior and connectedness to nature. In the second step, we added dietary motivations (animal, health, social, and taste) and perceived convenience of following one’s meat-reduced diet into the model. In the third and final step, we added demographic variables of age, gender, and parents’ income into the model. Results indicated that, over and above all other predictors, higher pro-environmental behavior and motivation to avoid meat out of concern for animals predicted higher short-term dietary adherence—that is, lower consumption of meat in the past three days (see Table 2). Valuable to note is that one’s status as a vegetarian versus flexitarian did not predict level of short-term dietary adherence. Thus, the extent to which one actually engages in the behavior of avoiding meat can be more directly traced back to one’s pro-environmental behavior and animal motivation, rather than one’s self-ascribed status as a flexitarian versus vegetarian.

7.1.1. Mediation analyses

Our hypothesis that pro-environmental behavior would predict level of short-term dietary adherence in the past three days was supported,

Table 1
Displays intercorrelations for all main variables.

| Variable | Pro. | Conn. | Anim. | Health | Social | Taste | Conv. | Diet | Pol. | Short. |
|-----------------------------------|--------|--------|--------|--------|--------|-------|--------|------|--------|--------|
| Pro-Environmental Behavior | - | | | | | | | | | |
| Connectedness to Nature | .40*** | - | | | | | | | | |
| Animal Motivation | .35*** | .31*** | - | | | | | | | |
| Health Motivation | .00 | -.09 | -.18** | - | | | | | | |
| Social Motivation | -.09 | -.19** | -.07 | .00 | - | | | | | |
| Taste Motivation | -.03 | .05 | -.08 | -.05 | .02 | - | | | | |
| Convenience | .21** | .10 | -.02 | .01 | .00 | .14* | - | | | |
| Dietary Status | .12 | .07 | .34*** | -.02 | .04 | -.09 | -.09 | - | | |
| Political Ideology | -.19** | -.18** | -.17* | .12 | .08 | -.05 | -.07 | -.08 | - | |
| Short-Term Dietary Adherence | .35*** | .23*** | .44*** | -.09 | -.02 | .05 | .16* | .14* | -.19** | - |
| Future-Intended Dietary Adherence | .28*** | .18** | .19** | -.10 | -.17** | .09 | .30*** | .13* | -.15* | .28*** |

Table 1: Intercorrelations for all main variables. Dietary status represents status as flexitarian versus vegetarian, with flexitarian coded as 0 and vegetarian coded 1. * $p < .05$; ** $p < .01$; *** $p < .001$.

Table 2

OLS regression predicting level of meat avoidance in the past three days, with a higher score reflecting higher short-term dietary adherence (i.e., lower meat consumption). Dietary status represents status as flexitarian versus vegetarian, with flexitarian coded as 0 and vegetarian coded 1. Gender represents status as man versus woman, with man coded as 0 and woman coded as 1. Significant predictors are displayed in bold font.

| Predictor | <i>b</i> | SE <i>b</i> | β | R ² | <i>p</i> |
|-----------------------------------|----------------|-------------|-------------|----------------|------------------|
| Step 1 | | | | 15% | |
| Pro-Environmental Behavior | 0.58*** | 0.13 | 0.30 | | < .001 |
| Connectedness to Nature | 0.18 | 0.12 | 0.11 | | .115 |
| Dietary Status | 0.26 | 0.15 | 0.11 | | .089 |
| Step 2 | | | | 25% | |
| Pro-Environmental Behavior | 0.37** | 0.13 | 0.19 | | .005 |
| Connectedness to Nature | 0.06 | 0.12 | 0.04 | | .596 |
| Dietary Status | -.02 | 0.16 | -.01 | | .918 |
| Animal Motivation | 0.88*** | 0.18 | 0.37 | | < .001 |
| Health Motivation | 0.02 | 0.15 | 0.01 | | .901 |
| Social Motivation | 0.08 | 0.25 | 0.02 | | .741 |
| Taste Motivation | 0.25 | 0.21 | 0.07 | | .243 |
| Convenience | 0.24 | 0.16 | 0.10 | | .128 |
| Step 3 | | | | 25% | |
| Pro-Environmental Behavior | 0.35** | 0.14 | 0.19 | | .009 |
| Connectedness to Nature | 0.03 | 0.12 | 0.02 | | .791 |
| Dietary Status | -.04 | 0.16 | -.02 | | .818 |
| Animal Motivation | 0.90*** | 0.15 | 0.38 | | < .001 |
| Health Motivation | 0.06 | 0.15 | 0.02 | | .692 |
| Social Motivation | 0.06 | 0.25 | 0.01 | | .812 |
| Taste Motivation | 0.23 | 0.22 | 0.06 | | .308 |
| Convenience | 0.22 | 0.16 | 0.09 | | .176 |
| Age | 0.01 | 0.02 | 0.04 | | .485 |
| Gender | 0.05 | 0.17 | 0.02 | | .780 |
| Income | 0.00 | 0.04 | 0.01 | | .910 |

and thus we proceeded with our planned analyses that conceptualize pro-environmental behavior as a mediator. Through two separate mediation models, we tested whether pro-environmental behavior would explain why feeling more connected to nature and being more politically liberal may predict higher meat avoidance. In each model, we controlled for participants' dietary status as flexitarian versus vegetarian as a covariate in order to isolate the unique explanatory role of pro-environmental behavior, given that one's status as vegetarian over flexitarian would by definition correspond bivariately to higher meat avoidance.

7.1.1.1. Connectedness to nature. Higher connectedness to nature predicted higher short-term dietary adherence, $\beta = 0.22, p < .001$. Higher connectedness to nature also predicted higher pro-environmental behavior, $\beta = 0.40, p < .001$. Higher pro-environmental behavior, in turn, predicted higher short-term dietary adherence, $\beta = 0.30, p < .001$, controlling for connectedness to nature. The direct effect of connectedness to nature on short-term dietary adherence was no longer significant, $\beta = 0.11, p = .115$, when

controlling for pro-environmental behavior. A test of the indirect effect of connectedness to nature on short-term dietary adherence through pro-environmental behavior—conducting using path analysis via structural equation modeling with the lavaan package in R—was significant, $p < .001$, 95% CI [0.10, 0.31], suggesting that pro-environmental behavior fully mediated the link between connectedness to nature and short-term dietary adherence.

7.1.1.2. Political ideology. More liberal political ideology predicted higher short-term dietary adherence, $\beta = 0.19, p = .006$. More liberal political ideology also predicted higher pro-environmental behavior, $\beta = 0.18, p = .007$. Higher pro-environmental behavior, in turn, predicted higher short-term dietary adherence, $\beta = 0.31, p < .001$, controlling for political ideology. The direct effect of political ideology on short-term dietary adherence was reduced but remained significant, $\beta = 0.13, p = .048$, when controlling for pro-environmental behavior. A test of the indirect effect of political ideology on short-term dietary adherence through pro-environmental behavior was significant, $p = .013$, 95% CI [0.01, 0.08], suggesting that pro-environmental behavior partially mediated the link between political ideology and short-term dietary adherence.

7.2. Intention to continue meat-reduced diet

We conducted a hierarchical logistic regression to test which factors predict future-intended dietary adherence, which was operationalized as intention to continue a meat-reduced diet in the near future (1–2 years). As with the test of short-term dietary adherence, we controlled for participants' dietary status as flexitarian versus vegetarian in all steps in order to isolate the unique predictive value of psychological factors. In the first step of the hierarchical regression, we regressed intention to continue diet on environmental value variables, including pro-environmental behavior and connectedness to nature. In the second step, we added dietary motivations (animal, health, social, and taste) and perceived convenience of following one's meat-reduced diet into the model. In the third and final step, we added demographic variables of age, gender, and parents' income into the model. Results indicated that, over and above all other predictors, higher pro-environmental behavior, lack of social motivation, and higher perceived convenience predicted that participants were more likely to intend to continue a meat-reduced diet (see Table 3).

7.2.1. Mediation analyses

Our hypothesis that pro-environmental behavior would predict intention to continue a meat-reduced diet was supported, and thus we proceeded with our planned analyses that conceptualize pro-environmental behavior as a mediator. Through two separate mediation models, we tested whether pro-environmental behavior would explain why feeling more connected to nature and being more politically

Table 3

Logistic regression predicting intention to continue meat-reduced diet in the near future (1–2 years). Intention to continue is coded as 1; intention to discontinue is coded as 0. Dietary status represents status as flexitarian versus vegetarian, with flexitarian coded as 0 and vegetarian coded 1. Gender represents status as man versus woman, with man coded as 0 and woman coded as 1. Significant predictors are displayed in bold font.

| Predictor | <i>b</i> | SE <i>b</i> | Odds Ratio | R ² | <i>p</i> |
|-----------------------------------|--------------|-------------|----------------|----------------|----------|
| Step 1 | | | | | |
| Pro-Environmental Behavior | 1.54 | 0.45 | 4.66*** | 16% | < .001 |
| Connectedness to Nature | 0.33 | 0.34 | 1.40 | | .324 |
| Dietary Status | 0.95 | 0.54 | 2.59 | | .080 |
| Step 2 | | | | | |
| Pro-Environmental Behavior | 1.34 | 0.52 | 3.80* | 33% | .010 |
| Connectedness to Nature | 0.09 | 0.44 | 1.10 | | .832 |
| Dietary Status | 1.30 | 0.65 | 3.66* | | .045 |
| Animal Motivation | 0.96 | 0.76 | 2.60 | | .207 |
| Health Motivation | −0.80 | 0.54 | 0.45 | | .139 |
| Social Motivation | −1.49 | 0.72 | 0.23* | | .039 |
| Taste Motivation | 1.46 | 1.19 | 4.32 | | .219 |
| Convenience | 2.07 | 0.54 | 7.94*** | 36% | < .001 |
| Step 3 | | | | | |
| Pro-Environmental Behavior | 1.23 | 0.52 | 3.42* | | .018 |
| Connectedness to Nature | 0.16 | 0.47 | 1.18 | | .726 |
| Dietary Status | 1.19 | 0.65 | 3.28 | | .069 |
| Animal Motivation | 1.08 | 0.78 | 2.96 | | .162 |
| Health Motivation | −0.77 | 0.57 | 0.47 | | .176 |
| Social Motivation | −1.56 | 0.73 | 0.21* | | .031 |
| Taste Motivation | 1.62 | 1.21 | 5.04 | | .182 |
| Convenience | 1.94 | 0.55 | 6.97*** | | < .001 |
| Age | 0.12 | 0.12 | 1.13 | | .317 |
| Gender | −0.61 | 0.64 | 0.54 | | .337 |
| Income | −0.01 | 0.13 | 0.99 | | .928 |

liberal may predict intention to continue a meat-reduced diet. In each model, we controlled for participants' dietary status as flexitarian versus vegetarian as a covariate in order to isolate the unique explanatory role of pro-environmental behavior, given that one's status as flexitarian versus vegetarian may inform intention to continue one's diet. OLS regression was employed when the outcome in the model was pro-environmental behavior (a continuous variable), whereas logistic regression was employed when the outcome was intention to continue meat-reduced diet (a dichotomous variable). In order to make the logistic regression model's coefficients and standard errors compatible with the OLS model's coefficients and standard errors in computing the indirect effect, we employed [Kenny \(2008\)](#) and [Herr's \(2013\)](#) recommendations for rescaling: For the logistic model, we multiplied the predictor's coefficient and standard error by the standard deviation of that predictor and divided by the standard deviation of the outcome variable.

7.2.1.1. Connectedness to nature

Higher connectedness to nature predicted intention to continue one's meat-reduced diet, $OR = 2.12, p = .014$. Higher connectedness to nature also predicted higher pro-environmental behavior, $\beta = 0.40, p < .001$. Higher pro-environmental behavior, in turn, predicted intention to continue one's meat-reduced diet, $OR = 4.66, p < .001$, controlling for connectedness to nature. The direct effect of connectedness to nature on intention was no longer significant, $OR = 1.40, p = .324$, when controlling for pro-environmental behavior. Distribution-of-the-product confidence limits for the indirect effect of connectedness to nature on intention through pro-environmental behavior did not include zero, 95% CI of OLS-scaled regression coefficients [0.42, 1.80], suggesting that pro-environmental behavior fully mediated the link between connectedness to nature and intention to continue one's meat-reduced diet.

7.2.1.2. Political ideology

More liberal political ideology predicted intention to continue one's

meat-reduced diet, $OR = 1.30, p = .040$. More liberal political ideology also predicted higher pro-environmental behavior, $\beta = 0.18, p = .007$. Higher pro-environmental behavior, in turn, predicted intention to continue one's meat-reduced diet, $OR = 4.69, p < .001$, controlling for political ideology. The direct effect of political ideology on intention was no longer significant, $OR = 1.18, p = .204$, when controlling for pro-environmental behavior. Distribution-of-the-product confidence limits for the indirect effect of political ideology on intention through pro-environmental behavior did not include zero, 95% CI of OLS-scaled regression coefficients [−0.43, −0.04], suggesting that pro-environmental behavior fully mediated the link between political ideology and intention to continue one's meat-reduced diet.

8. Discussion

Our study revealed three main findings. First, pro-environmental behavior positively predicted adherence to plant-based diets, in terms of individuals' self-reported short-term adherence as well as their intentions to continue dietary adherence longer-term (for the next 1–2 years). Second, pro-environmental behavior mediated the link between connectedness to nature and dietary adherence, fully explaining why people who feel more connected to nature report greater short-term adherence and are more likely intend to continue their diet in the future. Third, pro-environmental behavior mediated the links between political ideology and dietary adherence, explaining why—compared to conservatives—liberals report greater short-term adherence (partial mediation) and are more likely intend to continue their diet in the future (full mediation).

Identifying pro-environmental behavior as a unique predictor of adherence to plant-based diets—over and above the effects of dietary motivation, convenience, and demographics—has promising implications for enabling individuals to follow plant-based diets successfully. Critically, we note that the correlational nature of our data prevents true causal inference. If causal mechanisms are indeed driving the relationship between pro-environmental behavior and adherence, then our data suggest that an effective strategy for enabling people to adhere to plant-based diets is to make them value pro-environmental behaviors more in general. An exciting implication of this notion is that greater dietary adherence may be achievable without any need to make people feel specifically more motivated to follow a plant-based diet. A clear way to make people more committed to vegetarianism, for example, might be to persuade them that avoiding meat is better for the environment, animals, or their health. Yet these efforts may often fail because people can easily rationalize the decision to eat meat ([Rothgerber, 2019](#)). We suggest that increasing the extent to which people value pro-environmental behavior in general, without any specific mention of meat or plant-based eating, has the potential to bypass meat-eating rationalizations and ultimately improve plant-based dietary adherence. Additional research building on this notion can have policy implications, ultimately informing how decision-makers allocate resources for environmental awareness.

Although pro-environmental behavior did predict adherence at noteworthy small to medium effect sizes, it was not the strongest predictor of either our short-term adherence or long-term adherence intention. Rather, being motivated to avoid meat for animals was the strongest predictor of short-term adherence, whereas a) lacking motivation to avoid meat for social reasons and b) feeling as though plant-based dieting is convenient were the two strongest predictors of intention for long-term adherence. Our results support previous findings that individuals with high animal motivation are more consistent in adhering to meatless diets ([Rozin et al., 1997](#); [Ogden et al., 2006](#); [Rosenfeld, 2019](#)) as well as findings that social motivations and inconvenience may undermine one's commitment to meatless dieting ([Menzies & Sheeshka, 2012](#); [Plante et al., 2019](#)). Thus, to achieve the greatest gains in promoting dietary adherence, it may be most effective to target these variables in addition to pro-environmental behavior. Still, however, a

notable finding from our study is that pro-environmental behavior was the only factor that significantly predicted both short-term adherence and long-term adherence intention. Targeting pro-environmental behavior may accordingly be a particularly efficient means of encouraging sustained meat reduction.

If causality is indeed at play, then the precise mechanisms by which pro-environmental behavior can promote adherence to plant-based diets remain unclarified and warrant further investigation. We theorize that this effect may be driven by processes related to the self, including desires to affirm one's ecological identity (Naess, 1973), to avoid cognitive dissonance (Aronson, 1968), and to construct and fulfill a sense of purpose in life (Damon et al., 2003; Fox, 2000; Hill et al., 2016, 2018). When one strongly values pro-environmental behavior, eating a plant-based diet may feel less effortful and require less self-control because these self-based mechanisms may naturally make plant-based eating more appealing. Perspectives on identity-based motivation theory (Oyserman et al., 2017), which predict that people are driven to act in ways that affirm their identities, might be useful for researchers and activists to consider. This theory suggests that rather than trying to change individuals' attitudes about animal rights, health, or the environment, an alternative strategy for promoting meat-reduction behavior change might be to affirm preexisting beliefs individuals already hold as central to their identity—for many individuals, one such belief may entail seeing oneself as an environmentally sustainable person.

Two particular foci of our research were political ideology and connectedness to nature. We found that more liberals were more committed to plant-based diets than were conservatives, an effect we theorize can be attributed to liberals' more active engagement in pro-environmental behavior. This finding adds to existing evidence that more liberally oriented individuals practice more—and more successful—meat avoidance (Allen et al., 2000; Hodson & Earle, 2018; Pfeiler & Egloff, 2018). We also found that individuals who felt more connected to nature were more committed to plant-based diets, potentially because of their more active pro-environmental behavior. In light of theorizing suggesting positive links between nature connectedness and vegetarianism (Beardsworth & Keil, 1992; Fox & Ward, 2008; Nisbet et al., 2009; Twigg, 1979), we advance that making people feel more connected to nature may promote valuing of pro-environmental behavior, in turn supporting adherence to plant-based diets.

8.1. Limitations

One limitation of our study is its use of self-reported short-term dietary adherence, relying on participants' recalls of their meat intake in the three days prior to taking the survey. In future research, ecological momentary assessment techniques could overcome potential memory biases in self-reporting food consumption, and studies should consider varying intervals of time over which to consider dietary behaviors other than three days. A second limitation is the study's cross-sectional nature, which undermines the causal inferences permitted. It would be valuable to test experimentally and longitudinally whether changes in individuals' pro-environmental behavior cause changes in plant-based dieters' adherence as well as employ mechanisms able to measure actual long-term vegetarian adherence. Although our research centered on meat-reducers' adherence to their already meat-reduced diet, a direct extension of our work would be to investigate the role of pro-environmental behavior—along with nature connectedness and political ideology—among individuals who do not currently limit their meat intake. A third limitation is that many of our variables were assessed with binary responses; measurement of these variables via continuous response scales may be preferable in future research.

A fourth limitation of the current research is that its findings warrant cross-cultural validation, in order to demonstrate the reliability of the observed effects outside of Spain. Our sample was emplaced in the geographic area where many people follow a Mediterranean diet, which

already integrates health benefits with a higher sustainability factor and resembles flexitarian and vegetarian diets (semi-vegetarians and pescatarians) (van Dooren, Marinussen, Blonk, Aiking, & Vellinga, 2014). Therefore, we suspect that our effects could differ in countries with higher standard levels of meat intake. Furthermore, another important aspect is that following a Mediterranean diet in Spain does not require further investment or expensive food purchase due to the rich availability and affordability of plant-based food options; these factors may differ across geographic locations and hence affect the convenience factor, commitment, and/or intention to continue with a meat-reduced diet. Accordingly, it would be valuable to test our research questions in countries with more limited fresh produce, where opting for vegetarianism is more expensive, and/or where dietary traditions and habits differ markedly. Furthermore, the present research participants resided in Granada, the city that ranks as the vegetarian capitol of Spain, with one vegetarian restaurant for every 17,905 inhabitants (Ideal, 2019).

A fifth limitation of the present research is that we did not assess participants' sense of purpose in life and therefore could not test this line of theorizing empirically. A sixth limitation of the study is that there certainly exist further factors that may play a role in vegetarian dietary adherence. For example, it would be valuable to consider constructs such as disgust sensitivity, moral foundations, other relevant values, and self-control when considering with meat consumption.

8.2. Conclusion

There is an urgent need to preserve ecosystems by shifting toward a plant-based diet, yet many individuals who adopt plant-based diets lapse back into eating meat. The current study identified pro-environmental behavior as a significant predictor of adherence to plant-based diets, highlighting potential value in promoting sustainable eating by encouraging people to place greater value on environmentalism in general, thus avoiding any potentially backlashing effect of specifically promoting meat reduction. This and other research identifying determinants of commitment to sustainable eating patterns can inform optimal strategies for improving environmental well-being.

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Ethical statement

Before beginning the survey, participants read guidelines of the study and were informed about the data protection policy and their anonymity. This study received ethical approval from the University of Granada.

Declaration of competing interest

None.

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