Who gives a veg? Relations between personality and vegetarianism/veganism

Who Gives a Veg? Relations Between Personality and Veg*nism

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Abstract

With rates of vegetarianism and veganism (i.e., veg*nism) rising around the world, a growing body of research has begun to explore psychological characteristics that distinguish vegetarians and vegans from omnivores. However, relatively few studies have examined how veg*nism is related to differences in basic personality traits such as the "Big Five", with those that have tending to yield conflicting results. Moreover, none of these studies have examined personality at the lower levels of the personality trait hierarchy (i.e., aspects and facets of the Big Five). Thus, we sought to clarify how personality traits are related to veg*nism. In Study 1, comprising two samples (S1a: *N*=797, S1b: *N*=1,534), participants were categorised as Veg*n vs Restricted-omnivore vs Omnivore, and completed personality questionnaires at the domain and aspect levels of the Big Five. In Study 2, participants (*N*=562) completed both categorical and continuous measures of veg*nism, along with personality questionnaires at the domain, aspect, and facet levels. Across both studies, we found that people who scored higher on traits within the openness/intellect and agreeableness domains most consistently reported higher levels of veg*nism. Patterns in the data also suggested that the relation between personality and veg*nism might depend on the way veg*nism is measured. Theoretical and practical implications of these findings are discussed.

Keywords: vegetarianism, veganism, personality, agreeableness, openness/intellect.

1.0 Introduction

The popularity of vegetarianism and veganism (hereafter, *veg*nism*) has been growing around the world. According to a recent Gallup poll, 23% of survey respondents indicated that they have reduced their meat consumption in the last year (Justin, 2020). Similarly, a survey of Australian adults revealed that the number of people adhering to a plant-based diet has increased from 9.7% to 11.2% of the population between 2012 and 2016 ("The slow but steady rise of vegetarianism in Australia - Roy Morgan Research," n.d.). In response to these shifting trends, a growing body of research has sought to identify the motivations, attitudes, justifications, and beliefs that distinguish veg*ns from omnivores (Allen, Wilson, Ng, & Dunne, 2000; Dhont, Hodson, & Leite, 2016; Hopwood, Bleidorn, Schwaba, & Chen, 2020; Niemyjska, Cantarero, Byrka, & Bilewicz, 2018; Piazza et al., 2015; Rothgerber, 2013, 2015; Ruby et al., 2016). However, relatively few studies have examined how veg*nism is related to differences in broader personality traits such as the "Big Five" (John, Naumann, & Soto, 2008), with those that have been published yielding conflicting results. Mapping the relations between personality and veg*nism may yield valuable insights into the factors that may lead one to adopt a plant-based diet. Thus, our aim in the present research was to provide a comprehensive multi-sample assessment of personality differences between veg*ns and omnivores.

1.1 Veg*nism and its Psychological Correlates

Whereas *vegetarians* are usually described as those who refuse to eat the flesh of any animal, be it red meat (e.g., beef, pork), white meat (e.g., chicken), or fish, *vegans* are those who refuse to eat or use any animal products (e.g., eggs, dairy products, leather, etc; Ruby, 2012). However, there is surprising variation in the diets of self-identifying veg*ns and the strictness

with which these diets are adhered to. Indeed, studies reveal that many veg*ns report having recently consumed meat (Barr & Chapman, 2002; de Boer, Schösler, & Aiking, 2017; Gossard & York, 2003; Krizmanic, 1992; Rosenfeld & Tomiyama, 2019; White, Seymour, & Frank, 1999; Willetts, 2013). Thus, veg*nism is a more complex individual difference construct than is usually appreciated (Rosenfeld & Burrow, 2017). Indeed, it was proposed several decades ago that veg*nism is best conceptualised as a continuum or spectrum ranging from omnivore at one end and vegan at the other (Beardsworth & Keil, 1991, 1992). To date, however, most research has employed simple categorical measures of veg*nism (e.g., a yes/no checkbox).

Many previous investigations of the characteristics that distinguish veg*ns from omnivores have focussed on socio-demographic variables such as socioeconomic status (SES), education, gender, and age. These studies have found that veg*ns tend to be younger more educated, higher in SES, and more likely to be female (Aston, Smith, & Powles, 2013; de Boer et al., 2017; Stoll-Kleemann & Schmidt, 2017). These socio-demographic differences can potentially be understood in terms of personality and other psychological characteristics. For example, the observation that women are more likely to identify as vegetarian has spawned a research program demonstrating the perceived masculinity of meat-eating (Rothgerber, 2013; Rozin, Hormes, Faith, & Wansink, 2012; Sobal, 2005). Women also tend to score higher on personality traits such as conscientiousness and agreeableness (Weisberg, DeYoung, & Hirsh, 2011), which might also help to explain why gender is linked to veg*nism. Similarly, personality has known links with age, education, and socio-economic outcomes (Roberts, Kuncel, Shiner, Caspi, & Goldberg, 2007; Soto, John, Gosling, & Potter, 2011), and thus may shed light on why these factors are often associated with adherence to a plant-based diet.

Far fewer studies have focussed on relations between the Big Five personality traits and veg*nism. This represents a conspicuous gap in the literature, because the Big Five is thought to provide a comprehensive organising framework for psychological differences between people (John et al., 2008). The Big Five (i.e., openness/intellect, neuroticism, agreeableness, conscientiousness, extraversion) are relatively stable over the lifespan show reasonable cross-cultural generalizability, and predict a wide range of important life outcomes (Damian, Spengler, Sutu, & Roberts, 2019; Ozer & Benet-Martínez, 2006; Rolland, 2002). The Big Five trait model is organized hierarchically, with five broad 'domain' level traits subsuming the variance explained by their intermediate 'aspects', and they in turn their narrower 'facet' level traits (Costa & McCrae, 1995; DeYoung, Quilty, & Peterson, 2007; Markon, 2009). Whereas domain-level traits maximise 'bandwidth'—predicting a broader range of phenomena, though often only modestly—aspect and facet-level traits maximise 'fidelity'—predicting a narrower range of phenomena with greater strength (Hampson, John, & Goldberg, 1986; Soto & John, 2017). For instance, the domain level trait *openness/intellect*[1] describes a tendency to cognitively explore, whilst the aspect level traits *openness* and *intellect* reflect exploration through perception and reasoning, respectively (DeYoung, 2014). Moreover, as self-evident from the names of the traits themselves - the facet-level traits *intellectual curiosity*, *aesthetic sensitivity*, and *creative imagination* describe a narrower range of behaviours than their higher order aspect and domain counterparts.

[1]The compound label "Openness/Intellect" is used to refer to the domain level of this trait and stems from an old debate between researchers favouring the labels "Openness to Experience" or "Openness" versus "Intellect" (DeYoung, 2014). In this manuscript we refer to all domain-level measures of this trait as measures of "Openness/intellect", even when the names of the scales in question emphasise just one aspect of this domain (e.g., "openness to experience").

Of the few studies which have examined the association between Big Five personality and veg*nism, somewhat inconsistent results have been found. For instance, some studies that have focussed on the Big Five have found that higher extraversion is associated with veg*nism (Mõttus et al., 2012), and greater consumption of plant-based foods (Conner et al., 2017). Conversely, another study has reported a negative association between veg*nism and extraversion (Kessler et al., 2016). Similarly, some studies have found that veg*ns have higher scores on conscientiousness (Keller & Siegrist, 2015; Kessler et al., 2016; Mõttus et al., 2013; Pfeiler & Egloff, 2020), whereas at least one study reported lower scores (Pfeiler & Egloff, 2018). The same is true for neuroticism, which has sometimes been positively associated with veg*nism (e.g., Forestell & Nezlek, 2018), but at other times negatively associated (e.g., Pfeiler & Egloff, 2020). On the other hand, a more consistent pattern of findings suggests that veg*ns tend to be higher on both agreeableness and openness/intellect (Forestell & Nezlek, 2018; Forestell, Spaeth, & Kane, 2012; Goldberg & Strycker, 2002; Keller & Siegrist, 2015; Kessler et al., 2016; Pfeiler & Egloff, 2018, 2020). Greater fruit and vegetable consumption has also been correlated with higher openness/intellect (Conner et al., 2017).

Although some consistent patterns have begun to emerge in the fledgling research investigating personality and veg*nism, limitations to previous studies create some uncertainties about the robustness of their findings. Chiefly, some studies have used shortened measures of the Big Five (Pfeiler & Egloff, 2018, 2020) which diminishes the psychometric properties of standard measures (Gosling, Rentfrow, & Swann, 2003). Also, most studies in this area have adopted a somewhat restricted focus on domain level traits. The Big Five trait model is organized hierarchically, with the Big Five domain level traits subsuming the variance explained by their aspects, and they in turn, their facet level traits (Costa & McCrae, 1995; DeYoung et al., 2007;

Markon, 2009). It is possible that the previously observed associations between personality and veg*nism, which are modest and often inconsistent, can be brought into sharper focus by moving down the personality hierarchy to aspects or facets that provide greater fidelity or precision. Indeed, when describing any correlate of personality, it is important to ascertain the level of the trait hierarchy to which that correlate best applies (Machado-Oliveira, Nezlek, Rodrigues, & Sant'Ana, 2020; Mõttus, 2016). Thus, investigating both the Big Five traits and the narrower traits within this model may yield a more nuanced picture of the relations between personality and veg*nism. It is also important to examine whether associations between personality traits and veg*nism hold when controlling for demographic characteristics such as age, gender, and SES, given demographically-linked differences in personality and veg*nism.

1.2 Present Research

For the present research, we drew together three existing datasets to consolidate knowledge of the links between personality and veg*nism. Specifically, Study 1a comprised a sample of New Zealand young adults, Study 1b comprised New Zealand young adults and participants from the USA, and Study 2 consisted of participants from the USA. To identify individual differences along the continuum of veg*nism we utilised categorical (Study 1) and continuous measures (Study 2), and we measured personality at the domain, aspect, and facet levels. Moreover, we accounted for the influence of basic socio-demographic factors by running concurrent analyses controlling for age, gender, and either SES (Study 1), education (Study 1b & 2), and/or salary (Study 2). Based on the most consistent findings in the literature to date, we hypothesized that veg*ns would score higher on traits falling within the openness/intellect and agreeableness domains. However, we made no specific predictions regarding the level at which

these associations would emerge (domain, aspect, facet) and regarded comparisons between these levels as exploratory.

2.0 Study 1a

2.1 Methods

2.1.1 Participants and Procedure

In total, 1,482 participants were recruited as part of the Daily Life Study, a study of the daily life of university students in New Zealand. This study was conducted in several waves over four years (2011- 2014), however, we only included participants from 2013 and 2014 years because veg*nism was not measured in the previous years. Participants were all currently enrolled students (young adults ages 18 to 25) who were recruited from psychology classes or the wider university and participated in exchange for course credit or payment, respectively. After removing participants from 2011 and 2012 (n = 655) or those who had incomplete data (n = 30), the final sample was 797 (73% female, M_{age} = 19.72, SD_{age} = 1.73). All methods and procedures received ethical approval from the University of Otago Ethics Committee (#10/777).

Participants completed survey measures of demographics, personality, and veg*nism embedded within larger questionnaires. Participants gave in-person written informed consent and completed questionnaires in a private cubicle during study intake (demographics and personality) or study exit (veg*nism).

2.1.2 Materials

Personality traits. We administered the 60-item NEO Five Factor Inventory (NEO-FFI; Costa & McCrae, 1985), which assesses each of the Big Five domains with 12 items per trait. In

addition, the openness/intellect domain and its two aspect-level traits (openness and intellect) were assessed using the Big Five Aspect Scales (BFAS; DeYoung et al., 2007), which measured each aspect-level trait with 10 items. All responses to items on both scales were made on a 5-point Likert scale ranging from 1 (Strongly disagree) to 5 (Strongly agree). Trait scores were calculated as the mean response to each scale item and were then standardised. All scales yielded satisfactory internal consistency ($\omega_t > .79$). Because there are two measures of openness/intellect across the NEO-FFI and BFAS, we used Principal Axis Factoring to reduce the variable space and improve measurement. Thus, the openness/intellect scales from the NEO-FFI and the BFAS were factor analysed together and restricted to a one factor solution with their scores saved using the Bartlett method. These scales showed satisfactory loadings of .65 and higher on the composite factor, which was retained for all analyses involving the openness/intellect domain.

*Veg*nism.* Veg*nism was measured by asking participants to indicate whether they excluded each of the following: Red meat (beef, lamb, pork), poultry (chicken, turkey), fish, and other animal products (milk, cheese, eggs) from their diet. Participants were labelled *vegans* if they excluded red meat, poultry, fish, and other animal products (n = 6), *vegetarians* if they excluded red meat, poultry, and fish (n = 25), and *restricted-omnivores* if they excluded either red meat, poultry, or fish (n = 121). All remaining participants were labelled *omnivores* (n = 645). Given the small sizes of the vegan and vegetarian groups, these were collapsed into a single *veg*n* group. Thus, the independent variable was dietary group, which had three levels: Veg*n, Restricted-omnivore, and Omnivore (see Table 1). For comparisons between veg*n and restricted-omnivores and omnivores, this sample size provided 80% power to detect a significant mean difference of $d = 0.57$ and $d = 0.52$, respectively.

*Demographic characteristics.*In addition to measuring age and gender, participants were also assessed on a combined childhood and adult SES measure (6-item measure from Griskevicius, Delton, Robertson, & Tybur, 2011).

2.1.3 Data analysis

One-way analysis of covariance (ANCOVA) with follow-up pairwise independent sample t-tests (Bonferroni corrected) was used to compare dietary groups on the Big Five domains and aspects. We also sought to examine whether differences in personality among dietary groups were robust to socio-demographic variables by controlling for age, gender, and SES. Critically, because of pronounced differences in group size, violations of the assumption of homogeneity of variances seemed likely, thus Levene's test was used to determine whether this assumption was violated. All tests assumed a threshold of statistical significance at an alpha level of $\alpha = .05$. Statistical analysis was conducted using *R* (R Development Core Team, 2018) and the R packages *psych* (Revelle, 2018), *sjstats* (Lüdecke, 2019), and *rcompanion* (Mangiafico, 2020).

2.2. Results

Table 1 depicts personality trait scores by dietary group and indicates where groups differ significantly (for full results based on a series of ANCOVAs, see Supplemental Table S1). There were significant group differences for the domain-level trait openness/intellect and the aspect-level traits openness and intellect. Follow-up pairwise comparisons revealed that veg*ns were significantly higher on openness/intellect compared to both restricted-omnivores, $t(150) = 2.85$, $p = .007$, $d = 0.57$, and omnivores, $t(674) = 4.43$, $p < .001$, $d = 0.81$. Moreover, veg*ns were significantly higher on openness compared to restricted-omnivores, $t(150) = 2.68$, $p = .02$, $d = 0.54$, and omnivores, $t(674) = 3.28$, $p = .003$, $d = 0.60$. However, despite the significant one-way

ANCOVA, pairwise comparisons suggested that veg*ns were not significantly higher on intellect than restricted-omnivores, $t(150) = .65$, $p = 1.00$, $d = 0.13$, or omnivores, $t(674) = 1.80$, $p = .22$, $d = 0.33$. Thus, the three groups had disparate scores on intellect, but no two groups differed significantly[2].

3.0 Study 1b

3.1 Methods

3.1.1 Participants and Procedure

A total of 2,087 participants aged between 18 and 25 were recruited as part of a larger study on the lifestyles of young adults. Of these, 440 participants (21.1%) were recruited from a New Zealand (NZ) university and participated in exchange for course credit, whereas 1,647 participants (78.9%) were recruited online via Amazon's Mechanical Turk (MTurk) in exchange for $1.50 USD. MTurk participants were required to be residing in the US and have a Human Intelligence Task (HIT) approval rate of greater than 90%. The data were collected annually in 2017, 2018, and 2019. After removing participants who failed attention checks ($n = 500$), had incomplete data ($n = 41$), or showed signs of response bias (i.e., identical answers for all survey items; $n = 12$), the final sample was 1,534 (69% female, $M_{age} = 21.90$, $SD_{age} = 2.29$; 28% NZ/72% MTurk). All methods and procedures received ethical approval from the University of Otago Department of Psychology (Category B Ethics #D17/158).

[2] Although, several outliers were found for the personality traits that differed significantly between dietary groups, excluding these outliers did not substantively change the results.

The procedure for Study 1b was the same as Study 1a, with the exception that Participants in Study 1b gave online informed consent and completed their questionnaire remotely with no face-to-face contact with researchers.

3.1.2 Materials

Personality traits. We administered the full 100-item Big Five Aspect Scales (BFAS; DeYoung et al., 2007). The BFAS assesses each of the Big Five domains and their aspects (i.e., openness, intellect, withdrawal, volatility, compassion, politeness, industriousness, orderliness, assertiveness, and enthusiasm). All responses to items were made on a 5-point Likert scale ranging from 1 (Strongly disagree) to 5 (Strongly agree). Trait scores were calculated as the mean response to each scale item and were then standardised. All scales yielded satisfactory internal consistency ($\omega_t > .80$).

*Veg*nism.* We used the same measure of veg*nism employed in Study 1a with the exception that separate options were made for pork and dairy (milk, yoghurt, cheese, ice cream). Participants were labelled *vegans* if they excluded red meat, pork, poultry, fish, eggs, and dairy (*n* = 43), *vegetarians* if they excluded red meat, pork, poultry, and fish (*n* = 64), and *restricted-omnivores* if they excluded either red meat, pork, poultry, or fish (n = 200). All remaining participants were labelled *omnivores* (*n* = 1,227). Again, owing to the small sizes of the vegan and vegetarian groups, we collapsed these together into a *veg*n* group to permit more robust analysis. Thus, our dietary group factor again had three levels: Veg*n,restricted-omnivore, and omnivore (see Table 1). For comparisons between veg*n and restricted-omnivores and omnivores, our sample sizes provided 80% power to detect a significant mean difference equating to an effect size of *d* = 0.34 and *d* = 0.28, respectively.

Demographic characteristics. Similar to Study 1a, we assessed participants' age, gender, and combined childhood and adult SES. Additionally, we measured participants' education level (1 = Did not complete high school, 2 = Completed high school, 3 = Currently undertaking undergrad degree, 4 = Completed undergraduate degree, 5 = Currently undertaking higher degree, 6 = Completed higher degree).

3.1.3 Data analysis

We used the same data analysis plan as Study 1a.

3.2 Results

As in Study 1a, Table 1 presents personality trait scores as a function of dietary group and indicates where groups differ significantly (for full results based on a series of ANOVAs, see Supplemental Table S2). Analysis revealed significant differences between dietary groups on the aspect level traits compassion and intellect. Specifically, pairwise comparisons indicated veg*ns were significantly higher on compassion compared to restricted-omnivores, $t(305) = 2.77$, $p = .05$, $d = 0.33$, and omnivores, $t(1332) = 4.03$, $p = .001$, $d = .41$[3]. Moreover, we found that veg*ns were significantly higher on intellect compared to omnivores, $t(1332) = 3.26$, $p < .001$, $d = 0.33$, but there was no significant difference between veg*ns and restricted-omnivores, $t(305) = 2.07$, $p = .13$, $d = 0.25$[4]. We also examined whether the aforementioned pattern of results

[3] Levene's test indicated unequal variances between dietary groups on compassion, $F(2, 1531) = 3.25$, $p = .04$, however, the ratio between the largest and smallest group variance was less than 1.5 suggesting that our analysis was robust to this minor violation (Blanca, Alarcón, Arnau, Bono, & Bendayan, 2018; Tabachnick & Fidell, 2012).

[4] Similar to Study 1a, several outliers were found for the personality traits that differed significantly between dietary groups, however, their exclusion did not substantively change the results. Furthermore, when we excluded gender as a covariate, analysis revealed that dietary groups differed significantly on agreeableness $F(2,1528) = 5.02$, $p = .007$, $\eta^2 = .007$, and that

differs within each sub-sample, that is, between undergraduate NZ and MTurkers (i.e., adult Americans). Firstly, within the NZ sample, we found that veg*ns were significantly higher on intellect compared to omnivores, $t(369) = 2.44$, $p = .04$, $d = 0.38$, but not compared to restricted-omnivores, $t(104) = 1.40$, $p = .45$, $d = 0.27$. In contrast, within the MTurk sample, we found that dietary groups significantly differed on compassion with veg*ns being significantly higher on compassion comparted to omnivores, $t(961) = 3.07$, $p = .006$, $d = 0.41$, but not compared to restricted-omnivores, $t(199) = 1.86$, $p = .30$, $d = 0.29$.

veg*ns were significantly higher on agreeableness compared to omnivores $t(1332) = 3.27$, $p = .003$, $d = 0.33$, but not restricted-omnivores, $t(305) = 2.25$, $p = .14$, $d = 0.27$.

Table 1

Study 1 Standardized Means and Standard Deviations of Personality Traits by Dietary Groups

Trait	Study 1a			Study 1b		
	Veg*ns	Restricted-omnivores	Omnivores	Veg*ns	Restricted-omnivores	Omnivores
			Domain-level traits			
Openness/Intellect	**0.63 (0.86)[a]**	**0.10 (0.95)[b]**	**-0.06 (0.85)[b]**	0.17 (0.92)	0.03 (1.05)	-0.02 (1.00)
Neuroticism	-0.11 (1.19)	0.11 (1.00)	-0.02 (0.99)	0.02 (1.00)	0.01 (1.00)	0.00 (1.01)
Agreeableness	0.29 (1.19)	0.02 (1.04)	0.01 (0.98)	0.30 (0.85)	0.06 (0.91)	-0.03 (1.02)
Conscientiousness	-0.09 (1.26)	-0.02 (0.96)	0.04 (0.98)	-0.10 (0.98)	-0.01 (1.02)	0.01 (1.00)
Extraversion	-0.27 (1.13)	-0.14 (1.02)	0.04 (0.98)	-0.03 (0.99)	0.11 (0.90)	-0.02 (1.02)
			Aspect-level traits			
Openness	**0.56 (0.85)[a]**	**0.02 (1.03)[b]**	**-0.04 (1.01)[b]**	0.00 (0.89)	0.01 (1.06)	0.00 (1.07)
Intellect	**0.28 (1.16)[a]**	**0.15 (1.00)[a]**	**-0.05 (0.99)[a]**	**0.29 (0.92)[a]**	**0.05 (1.00)[ab]**	**-0.03 (1.00)[b]**
Withdrawal	—	—	—	0.11 (0.89)	-0.03 (1.00)	-0.01 (1.01)
Volatility	—	—	—	-0.07 (0.87)	0.04 (1.00)	0.00 (1.01)
Compassion	—	—	—	**0.37 (0.82)[a]**	**0.08 (0.89)[b]**	**-0.04 (1.03)[b]**
Politeness	—	—	—	0.12 (0.97)	0.01 (0.93)	-0.01 (1.01)
Industriousness	—	—	—	-0.11 (0.96)	0.02 (1.03)	0.01 (1.00)
Orderliness	—	—	—	-0.04 (0.95)	-0.05 (1.03)	0.01 (1.00)
Enthusiasm	—	—	—	0.01 (0.98)	0.08 (0.95)	-0.01 (1.01)
Assertiveness	—	—	—	-0.06 (0.94)	0.11 (0.86)	-0.01 (1.03)

Note. Standard deviations are reported in parentheses. Within each study, bolded rows indicate significant differences between dietary groups at the omnibus level (see Supplemental Tables S1 & S2 for full results). Differing superscripts in the same row refer to means which differ significantly, $p < .05$ (details reported in text). In Study 1a, personality domains were measured using the NEO Five Factor Inventory (NEO-FFI; Costa & McCrae, 1985) with openness/intellect aspects additionally measured using the Big Five Aspects Scale (BFAS; DeYoung et al., 2007). As such, the openness/intellect domain scores from Study 1a were

composite scores computed from NEO-FFI and BFAS openness/intellect items. In Study 1b, personality domains and aspects were measured using the BFAS. All trait measures were z-scored.

4.0 Study 1 Summary

Results of Study 1a and 1b echoed previous findings that vegetarians are higher on the domain-level trait of openness/intellect. They also revealed that veg*ns were higher on several aspect-level traits—i.e., compassion, openness, and intellect—as compared to restricted-omnivores and omnivores. However, like much previous research in this area, these findings were somewhat inconsistent across, questionnaire (i.e., NEO-FFI vs BFAS), and sample (undergraduate NZ vs adult Americans). For instance, the between-group differences on openness/intellect in Study 1a had not emerged in Study1b. Similarly, whereas intellect differentiated veg*ns from omnivores in the undergraduate NZ sample, compassion did for the American adult sample. Nevertheless, findings were somewhat more consistent at the aspect level. Specifically, veg*ns were distinguished by higher scores on intellect in both of our samples, and this association held when controlling for socio-demographics. Conspicuously, across both Study 1a and 1b, most of the group differences in personality were found at the aspect-level of the trait hierarchy. Thus, the aspect level traits may indeed provide a more fine-grained and robust description of the personality differences between veg*ns and omnivores, namely, for the traits compassion and intellect.

5.0 Study 2

In Study 2, we employed a third sample to further examine the links between veg*nism and personality. Enabling close comparison of findings from our first study, this dataset again included the BFAS measure of the Big Five domains and aspects. It also included a second hierarchical assessment of the Big Five, the Big Five Inventory version 2 (BFI-2; Soto & John, 2017), which divides each Big Five domain into three facet-level scales. Finally, there were

concerns that the small number of veg*ns compared to restricted-omnivores and omnivores in Study 1 could have affected the robustness of our analysis. Thus, we introduced measures of veg*nism which allowed us to construct both categorical and continuous indices which also enabled us to follow early (yet largely unheeded) advice that veg*nism may be best measured continuously from less to more restricted intake of meat and other animal products (Beardsworth & Keil, 1991, 1992).

5.1 Methods

5.1.1 Participants and Procedure

A total of 589 Americans aged between 18 and 77 were recruited online via MTurk and reimbursed USD$6.00 for their time (approximately 40 minutes). After removing participants who failed attention checks (n = 24) or had missing data (n = 3), the final sample was 562 (55% female, M_{age} = 37.31, SD_{age} = 11.36). All methods and procedures received ethical approval at The University of Melbourne (Ethics #1750193.2).

Participants completed survey measures of demographics, personality, and veg*nism embedded within larger questionnaires. Participants gave online informed consent and completed questionnaires online.

5.1.2 Materials

Personality traits. We again administered the BFAS, which was described in Study 1. We also administered the 60-item BFI-2 (Soto & John, 2017), which comprises three 4-item facet-level traits per 12-item domain-level trait (i.e., anxiety, depression, emotional volatility, compassion, respectfulness, trust, organization, productiveness, responsibility, sociability,

assertiveness, energy level, intellectual curiosity, aesthetic sensitivity, and creative imagination). Many of these facet-level scales map reasonably well to the aspect-level scales of the BFAS (e.g., the respectfulness facet of BFI-2 agreeableness approximates the politeness aspect of BFAS agreeableness; the organization facet of BFI-2 conscientiousness approximates the orderliness aspect of BFAS conscientiousness). However, other facet-level traits assess narrower constructs that are less clearly represented in the BFAS (e.g., the trust facet of BFI-2 agreeableness, which has no clear parallel in the BFAS; the anxiety and depression facets of BFI-2 emotionality, which are combined in BFAS withdrawal). Participants responded to each item using a 5-point Likert scale (1 = Strongly disagree, 5 = Strongly agree). Personality traits scores were again computed using the mean of relevant items and then standardised. All facet and aspect level scales yielded satisfactory internal consistency ($\omega_t > .77$).

Because there are two measures of each domain-level trait across the BFAS and BFI-2, we used Principal Axis Factoring to reduce the variable space and improve measurement. Thus, relevant facet level and aspect level traits from each of the BFAS and BFI-2 domains were factor analysed together and restricted to a one factor solution (e.g., for neuroticism, this included BFAS withdrawal and volatility, and BFI-2 anxiety, depression, and emotional volatility) with their scores saved using the Bartlett method. All scales showed satisfactory loadings of .57 and higher on their corresponding composite factor. All analysis directed at the Big Five domains were thus performed on these composite measures.

*Veg*nism.* Four measures and an overall composite measure were used to assess veg*nism to more thoroughly analyse associations with personality. First, participants completed a *refuse-to-eat* measure similar to that employed in Study 1a and 1b, by indicating which of the eight animal products (beef, lamb, pork, chicken, fish, shellfish, eggs, dairy products) they eat

using a 7-point scale ranging from 1 (Readily eat) through 4 (Reluctantly eat) to 7 (Refuse to eat). A total score was then calculated by computing the mean of all eight items, providing an index of the degree to which one restricts intake of meat and other animal products ($\omega_t = .92$). Second, participants completed a *self-placement* measure by indicating which diet described them best on a 10-point scale ranging from 1 (Vegan) to 10 (Omnivore; Allen et al., 2000). This measure was reversed scored such that higher scores indicated greater veg*nism. Third, participants then completed a *rank-order* measure by ranking six dietary descriptions (e.g., "Meat Lover", "Omnivore", "Restricted Omnivore", "Pescetarian", "Vegetarian", "Vegan") from "best describes" to "least describes" their diet. These dietary descriptions were coded from least restrictive (Meat Lover = 1) to most restrictive (Vegan = 6) and scores of the highest rank descriptor (i.e., “best describes”) were used for analyses. Fourth, participants completed an *agreement* measure by indicating their agreement with a statement commonly included in market research and panel studies, "The food I eat is all, or almost all, vegetarian", using a 4-point scale ranging from 1 (Strongly disagree) to 4 (Strongly agree). Finally, in a similar approach to reducing the overlap and redundancy between multiple measures of personality, we reduced these four highly correlated measures of veg*nism (*r*s = .42 - .65) into a single *composite measure*[5] using Principal Axis Factoring, with scores saved using the Bartlett method[6]. The four measures of veg*nism included in the composite measure showed satisfactory loadings on the

[5] A Parallel Analysis test and inspection of the scree plot recommended a one factor solution.
[6] Because some of our veg*nism measures were ordinal (e.g., rank-ordered rather than continuous or interval scaled), Principal Axis Factoring may have been an inappropriate means to derive a composite measure. We thus confirmed the robustness of our results using *Polychoric* Principal Axis Factoring to derive a composite of veg*nism (i.e., based on polychoric correlations as opposed to Pearson correlations). Re-running our analysis using this composite yielded the same pattern of results as reported below. Thus, we conclude that our analyses were robust to our use of ordinal variables.

composite factor of .78 and higher. Subsequent analysis examining associations between personality and veg*nism are performed using this composite measure (see Supplemental Tables S5 through S14 materials for results based on each measure of veg*nism individually).

Demographic characteristics. In addition to age and gender (male, female, gender diverse), we assessed participants' education level (1 = High school, 2 = Trade, technical or vocational training, 3 = Bachelor degree, 4 = Postgraduate degree), and Salary (ranging from 1 = "less than $9,999", to 12 = "More than $150,000"), as indicators of SES.

5.1.3 Data Analysis

Given the similarity of the refuse-to-eat measure of veg*nism to the categorical measure administered in Study 1, we also converted this scale into a categorical dietary measure to allow closer comparison to the findings of Study 1. Specifically, participants were labelled *vegans* if they refused to eat beef, pork, chicken, fish, shellfish, eggs, and dairy (n = 11), *vegetarians* if they refused to eat beef, pork, chicken, fish, and shellfish (n = 19), and *restricted-omnivores* if they refused to eat either beef, pork, chicken, fish, or shellfish (n = 66). All remaining participants were identified as *omnivores* (n = 466). As in studies 1a and 1b, we collapsed the vegans and vegetarians into a *veg*n* group to permit a more robust analysis (see Table 2). For comparisons between veg*n and restricted-omnivores and omnivores, this sample size provided 80% power to detect a significant mean difference of d = 0.62 and d = 0.53, respectively. As in Study 1, one-way ANCOVAs controlling for socio-demographics and follow-up Bonferroni corrected pairwise independent sample t-tests were used to examine group differences in personality.

Next, we ran a series of multiple linear regressions controlling for socio-demographics in which we regressed our continuous composite measure of veg*nism onto a) each of the Big Five domains, b) each pair of the BFAS aspects, and c) each triplet of the BFI-2 facets. To account for positive skew, we used non-parametric Gamma regression to confirm any significant results from the linear analyses, and these results are reported only if they yield different results to the parametric analyses (Histograms are detailed in Supplemental Figures S1 through S5 and full results are detailed in Supplemental Tables S5 through S14).

5.2 Results and Discussion

5.2.1 Personality differences between dietary groups

Table 2 presents the personality trait scores by dietary group, and highlights groups that differed significantly. Analysis revealed significant group differences between dietary groups on the domain-level trait agreeableness and conscientiousness; the aspect-level traits openness, compassion, and industriousness; and the facet-level traits compassion and trust. Probing these results further, pairwise comparisons indicated that veg*ns were (a) significantly higher on agreeableness than restricted-omnivores, $t(94) = 2.66$, $p = .02$, $d = .59$, and omnivores, $t(494) = 2.76$, $p = .02$, $d = .52$; (b) significantly higher on openness compared to omnivores, $t(494) = 2.46$, $p = .05$, $d = .46$, but not compared to restricted-omnivores, $t(94) = 1.13$, $p = .76$, $d = .25$; (c) significantly higher on aspect-level compassion than omnivores, $t(494) = 2.67$, $p = .02$, $d = .50$, but not restricted-omnivores, $t(94) = 2.49$, $p = .052$, $d = .55$; (d) significantly higher on facet-level compassion than restricted-omnivores, $t(94) = 2.39$, $p = .03$, $d = .53$, but not omnivores, $t(494) = 2.33$, $p = .07$, $d = .44$; and (e) significantly higher on facet-level trust than omnivores, $t(494) = 2.74$, $p = .02$, $d = .52$, but not restricted-omnivores, $t(94) = 1.78$, $p = .20$, $d = .39$.

Finally, despite the significant omnibus test for conscientiousness and industriousness, there were no significant pairwise differences between dietary groups on these traits[7].

Table 2

Study 2 Standardized Means and Standard Deviations of Personality Traits by Dietary Groups

Trait	Veg*ns	Restricted-omnivores	Omnivores
	Domain-level traits		
Neuroticism	-0.22 (1.09)	-0.03 (1.03)	0.01 (0.97)
Agreeableness	**0.48 (0.87)[a]**	**-0.08 (1.00)[b]**	**0.00 (0.93)[b]**
Conscientiousness	**0.37 (0.79)[a]**	**0.13 (1.01)[a]**	**-0.03 (0.96)[a]**
Extraversion	-0.04 (0.97)	0.13 (0.98)	-0.02 (0.95)
Openness/Intellect	0.30 (0.85)	0.09 (1.05)	-0.02 (0.95)
	Aspect-level traits		
Withdrawal	-0.19 (1.12)	-0.05 (1.03)	0.02 (0.99)
Volatility	-0.22 (1.00)	0.01 (1.04)	0.01 (1.00)
Compassion	**0.48 (0.87)[a]**	**-0.05 (0.99)[ab]**	**-0.02 (1.00)[b]**
Politeness	0.33 (0.77)	-0.11 (0.97)	-0.01 (1.01)
Industriousness	**0.39 (0.89)[a]**	**0.16 (1.03)[a]**	**-0.05 (1.00)[a]**
Orderliness	0.15 (1.03)	0.13 (0.93)	-0.03 (1.01)
Enthusiasm	0.10 (1.10)	0.07 (0.95)	-0.02 (1.00)
Assertiveness	-0.11 (1.00)	0.18 (0.99)	-0.02 (1.00)
Openness	**0.41 (0.91)[a]**	**0.16 (1.04)[ab]**	**-0.05 (0.99)[b]**
Intellect	0.15 (1.06)	0.06 (1.10)	-0.02 (0.98)
	Facet-level traits		
Anxiety	-0.14 (1.11)	0.01 (1.03)	0.01 (0.99)
Depression	-0.21 (0.98)	-0.03 (0.97)	0.02 (1.01)
Emotional Volatility	-0.20 (1.06)	0.03 (1.04)	0.01 (0.99)
Compassion	**0.42 (0.91)[a]**	**-0.15 (1.14)[b]**	**-0.01 (0.98)[ab]**
Respectfulness	0.38 (0.81)	-0.08 (1.13)	-0.01 (0.99)
Trust	**0.47 (1.13)[a]**	**0.07 (0.98)[ab]**	**-0.04 (0.99)[b]**
Organization	0.30 (0.91)	0.12 (1.03)	-0.04 (1.00)
Productiveness	0.34 (0.89)	0.06 (1.05)	-0.03 (1.00)

[7] Although several outliers were found for the personality traits that differed significantly between groups, excluding these outliers did not substantively change the results reported above.

Responsibility	0.34 (0.86)	0.08 (1.08)	-0.03 (0.99)
Sociability	-0.14 (0.98)	0.08 (0.99)	0.00 (1.00)
Assertiveness	-0.17 (1.06)	0.13 (1.01)	-0.01 (1.00)
Energy Level	0.23 (1.10)	0.08 (1.04)	-0.03 (0.99)
Intellectual Curiosity	0.19 (0.84)	-0.01 (1.07)	-0.01 (1.00)
Aesthetic Sensitivity	0.30 (1.08)	0.11 (1.00)	-0.04 (0.99)
Creative Imagination	0.19 (0.85)	0.06 (1.04)	-0.02 (1.00)

Note. Standard deviations are reported in parentheses. Within each study, bolded rows indicate significant differences between dietary groups at the omnibus level (see Supplemental Tables S3 for full results). Differing superscripts in the same row refer to means which differ significantly, $p < .05$ (details reported in text). Aspect-level traits were measured using the Big Five Aspects Scale (BFAS; DeYoung et al., 2007), and facet-level traits were measured using the Big Five Inventory 2 (BFI-2; Soto & John, 2017). Domain-level traits are composite scores computed from corresponding BFI-2 and BFAS traits. All trait scores are z-scored.

5.2.2 Personality predictors of the veg*nism composite

A series of multiple linear regression analyses, within each of which the composite veg*nism measure was regressed on to (a) the five trait domains (i.e., a five-predictor model), (b) each pair of the ten trait aspects (i.e., five two-predictor models) and (c) each triplet of the 15 trait facets (i.e., five three-predictor models)[8], revealed that there were significant predictors of veg*nism at the aspect levels of conscientiousness and neuroticism, and at the facet levels of extraversion and agreeableness. Specifically, we found that industriousness, $\beta = .11$, $t(556) = 2.29$, $p = .02$, withdrawal, $\beta = -.14$, $t(556) = -2.17$, $p = .03$, trust, $\beta = .14$, $t(555) = 2.72$, $p = .007$, and energy level, $\beta = .13$, $t(555) = 2.49$, $p = .01$, were significant predictors of scores on the composite measure of veg*nism. In addition to these predictors, non-parametric analysis

[8] Variance inflation factors (VIF) were calculated for each aspect and facet trait within their respective models and none were found to exceed 2.62, indicating that multicollinearity was not a problem.

suggested that the facet-level trait respectfulness, β = -.13, t(556) = -2.26, p = .02 was a significant predictor[9].

5.3 Summary

Results of study two showed, using both categorical and continuous measures of veg*nism, that veg*ns tended to be higher on the domain-level trait agreeableness, the aspect-level traits compassion, openness, and industriousness, and the facet-level traits trust and energy level. As we found in Study 1, these findings were somewhat inconsistent across the kind of measure used (e.g., categorical vs continuous). For instance, the significant relationship between veg*nism and compassion emerged only when using the categorical measure. Nevertheless, more consistent findings were found at the facet level of the Big Five. Specifically, veg*ns were distinguished by their higher scores on trust, and this effect held for both parametric and non-parametric analyses, when controlling for socio-demographics, and across both the group-based and continuous measure. This is in contrast to agreeableness and withdrawal, which emerged inconsistently across analysis and measures. Thus, facet-level traits—and perhaps especially the trust facet of agreeableness—may provide a more robust description of the personality traits that distinguish veg*ns from restricted-omnivores and omnivores.

[9] Although several multivariate outliers (i.e., Mahalonobis score greater than chi-square with 2 degrees of freedom) were found, excluding these did not substantively change the results reported above.

6.0 General Discussion

Our aim in the present research was to consolidate knowledge of the relations between veg*nism and personality. Previous studies in this area have suggested that veg*ns may be distinguished by relatively high scores on traits within the agreeableness and openness/intellect domains, but these findings have been relatively inconsistent from one study to the next. We considered that these inconsistencies may be partly owing to the use of shortened measures of personality, and that they might also be clarified by assessing personality traits at lower levels of the trait hierarchy, below the (very broad) Big Five domains. Thus, we drew together three large samples containing multiple measures of veg*nism and full-length measures of personality at the domain, aspect, and facet levels. We carefully checked the robustness of any significant findings via a series of supplementary analyses (e.g., to account for non-normality). Across our three samples, and in line with previous research, we found that veg*ns were most consistently distinguished by traits within the openness/intellect and agreeableness domains. Specifically: Veg*ns were higher on the domain-level traits openness/intellect (Study 1a & b) and agreeableness (Study 2); the aspect-level traits openness (Study 1a & 2), intellect (Study 1a & b), and compassion (Study 1b); and the facet-level traits trust (Study 2), and energy level (Study 2). Crucially, the specific traits that were associated with veg*nism appear to depend on the measure of veg*nism employed (as explained below).

6.1 Openness/Intellect

In partial support of the first hypothesis, we found that veg*ns were significantly higher in openness/intellect compared to omnivores, however, this was only found in Study 1a. This difference was also significant at the aspect-level of this domain, for openness, both in Study 1a and Study 2. People higher on openness/intellect are thought to be more motivated information—

perceptual forms of information in the case of openness, and abstract sources of information in the case of intellect (DeYoung, 2014). Thus, the involvement of openness/intellect is potentially in line with previous research which posits that a receptiveness to new ideas and willingness to try new veg*n foods leads to the adoption of a veg*n diet (Conner et al., 2017; Forestell & Nezlek, 2018; Forestell et al., 2012; Goldberg & Strycker, 2002; Kessler et al., 2016; Mõttus et al., 2013; Pfeiler & Egloff, 2018, 2020). Moreover, the association with openness suggests that it may be perceptual forms of information (e.g., new flavours, imagery used in persuasive appeals to adopt a plant-based diet) that are particularly motivating for veg*ns.

6.2 Agreeableness

Similarly, in partial support of our second hypothesis, we found that veg*ns in Study 2 were higher on agreeableness compared to omnivores. In both Study 1b and 2, this difference held for the compassion aspect of agreeableness but not the politeness aspect. In Study 2, it also held for the compassion *facet* of agreeableness, as assessed by the BFI-2. Those higher on Agreeableness tend to be pro-social, considerate of others, and motivated to preserve social harmony (Graziano & Tobin, 2009). Whereas those higher on the politeness aspect of this domain tend to place importance on norms and standards surrounding etiquette, respect, and ‘manners’, while those higher on compassion have a tendency towards feelings of empathy, sympathy, and emotional concern for others (DeYoung et al., 2007). Given that a common motivation for many veg*ns is ethical concern for animal welfare (Ruby, 2012), it stands to reason that agreeable and compassionate individuals are more likely to transition to a veg*n diet, as they are more likely to experience feelings of sympathy towards farm animals that suffer and die to produce meat (Keller & Siegrist, 2015; Kessler et al., 2016; Mõttus et al., 2013).

6.2.1 Trust

Intriguingly, at the facet level of the Big Five, the most robust predictor of veg*nism was the trust facet of agreeableness, and this association was significant using both categorical and continuous measures of veg*nism. Those higher on trust have a tendency to hold more positive generalized beliefs of others (Soto & John, 2017), and it is perhaps not immediately clear why this might dispose an individual toward maintaining a plant-based diet. One possible explanation lies in the fact that each individual can only make a small impact (on animal welfare, the environment, etc.) through their choice to adhere to a plant-based diet. Thus, trust in others may strengthen one's motivation to become a veg*n by increasing the perceived efficacy of veg*nism. For instance, the abolishment of factory farming is a commonly invoked goal of veg*ns motivated by animal welfare concerns (Ruby, 2012). Crucially, this goal requires the cooperation of others to eschew meat and reduce its demand (Singer & Mason, 2007). Thus, one must trust that others will cooperate in this collective action problem—by adopting or maintaining their plant-based diet—in order to perceive that their own participation in this effort will effectively reduce demand for meat (Cox, Koster, & Russell, 2004). Of course, this explanation is speculative, and the relation between trust and veg*nism is novel to this literature and must first be independently replicated.

6.3 Inconsistency in Findings

Amid our more stable pattern of results there were many inconsistent findings in the present research, mirroring patterns of inconsistency in the literature to date. This was somewhat unexpected, given that we improved substantially on prior research through the use of multiple full-length personality questionnaires. Here, we offer four possible explanations for the seemingly fragile and unstable relations between personality and veg*nism.

First, there is some indication in the present findings that the associations between veg*nism and personality may best be described at the lower levels of the personality trait hierarchy. Specifically, associations at the aspect- and facet-level traits of openness/intellect and agreeableness appeared to have somewhat more robust associations with veg*nism. Thus, the inconsistencies observed in previous research may, in part, have resulted from the use of broad bandwidth scales to assess relations that are better captured by narrow 'high fidelity' traits, lower in the trait hierarchy (Hampson et al., 1986; Soto & John, 2017). Unfortunately, we could not fully evaluate this possibility in the present research as facet-level traits were administered in only one of our three samples.

Second, the way veg*nism is measured might also help to explain the inconsistencies found in previous research. As demonstrated in Study 2, our categorical and continuous indices of veg*nism yielded different patterns of results in terms of correlations with personality traits. Currently, there is no consensus on how to measure veg*nism with some studies employing categorical measures (Forestell & Nezlek, 2018; Pfeiler & Egloff, 2018) and others continuous measures (Forestell et al., 2012; Keller & Siegrist, 2015; Mõttus et al., 2013, 2012; Pfeiler & Egloff, 2020). Further compounding these issues, recent theorizing suggests that veg*nism is more than just diet—whether measured categorically or continuously—but also a complex identity composed of various beliefs, attitudes, and motivations (Rosenfeld & Burrow, 2017). Thus, coming to a consensus on how to best measure veg*nism and designing an appropriate measure is vital for future research in this area.

Third, the fact that a small minority of the population adheres to a plant-based diet (Pfeiler & Egloff, 2018; Ruby, 2012) remains a complicating factor that may help account for the disparate findings in the literature. Indeed, in the present research, only a minority of participants

were classified or described themselves as veg*ns (4% in Study 1a, 7% in Study 1b, 5% in Study 2). Although we attempted to address this issue by checking for violations of homogeneity of variances, addressing the presence of outliers, and utilising non-parametric analysis, we cannot rule out the possibility that unequal group sizes and skewed data unduly influenced our results. Moreover, few previous studies have examined how this problem may influence analyses and the conclusions drawn from them. One potential solution to this problem would be to oversample veg*n participants to achieve a less skewed distribution.

Finally, broader sampling differences may help account for the inconsistencies observed in previous research. For instance, in Study 1b, we found that veg*ns in the NZ undergraduate sub-sample were distinguished by higher levels of intellect, while veg*ns in the adult American sub-sample were characterized by higher levels of compassion. Perhaps young NZ undergraduates are less aware of the ethical issues surrounding meat consumption (e.g., factory farming practices), or are less concerned about ethical issues due to more natural farming practices in New Zealand (e.g., more free-range beef and lamb farms and fewer feedlots), with the result that differences in compassion do not differentiate dietary groups. In contrast, the most intellectually curious undergraduates may be more likely to seek and be exposed to information regarding these ethical issues, thus making it more likely that they would be persuaded to adopt a plant-based diet.

6.4 Limitations

Alongside several strengths of our study, such as the use of multiple long-form personality assessments targeting multiple levels of the trait hierarchy, some limitations to the present research should also be noted. First, we did not recruit nationally-representative samples, and two of our samples were recruited using MTurk. Although this is extremely common

practice in psychological science (and the social sciences more broadly), recent evidence suggests that the quality of data collected from Mturk workers has been worsening over time (Chmielewski & Kucker, 2020). Although we cannot rule out the possibility of poor-quality responses influencing our results, we have attempted to mitigate its effect by employing strict data cleaning procedures. Second, facet level personality traits were assessed only in Study 2, and thus we could not confirm the consistency of any findings at this level across our multiple samples. For instance, although we found that trust was significantly related to veg*nism in both the group-based and continuous analysis in Study 2, this finding could not be directly compared with the results from our two samples in Study 1. Finally, the presentation order of our measures in Study 2 was not counterbalanced. This could have introduced a tendency for participants to anchor their responses to the first veg*nism measure shown. However, given that we combined these measures to create a composite, this seems unlikely to have affected our results substantially. Nevertheless, replication of the present research counterbalancing the order of presentation is warranted.

6.5 Implications

Why is it important to understand the links between personality and veg*nism? Beyond its theoretical and academic value, the knowledge base to which our findings contribute can be drawn on for a number of practical purposes. For example, researchers in various fields have sought to identify effects of veg*nism on health and other outcomes (e.g., the environment; Godfray et al., 2018). But such research may be confounded by differences in personality, which may be associated both with veg*nism and with the outcomes of interest. In nutrition research, socio-demographic variables such as age and gender are already recognized as potential confounds (Jacobs & Temple, 2012). However, personality is not typically assessed in such

studies, despite the robust links between personality and important health outcomes (Friedman & Kern, 2014; Ozer & Benet-Martínez, 2006; Strickhouser, Zell, & Krizan, 2017). In the present study, we found that traits within the openness/intellect and agreeableness domains were associated with veg*nism even when controlling for socio-demographic variables, which suggest that they could well be at play in nutritional and epidemiological studies of veg*nism. This highlights the importance of including measures of personality within such studies in the future.

Although the links between personality and veg*nism are still emerging, a better understanding of these links may also have implications for interventions aimed at reducing or eliminating meat consumption. Personality traits capture individual differences in behavioural and motivational tendencies, and can be leveraged to tailor or 'personalize' persuasive appeals (e.g., Hirsh, Kang, & Bodenhausen, 2012). Thus, by identifying the personality traits that tend to distinguish veg*ns, we can design interventions that are tailored to the tendencies and motivations of individuals. For instance, interventions that emphasize the welfare benefits adopting a veg*n diet may fail to motivate individuals low in agreeableness or compassion. Moreover, an intervention which outlined the suffering of animals would be more impactful for agreeable and compassionate individuals. In contrast, those lower on these traits may require different approaches to those outlined above.

Additionally, the present research brings into sharp focus the inconsistency of findings across previous studies in this area, and hint at factors that potentially explain these inconsistencies. As outlined above, these factors include the level of the trait hierarchy to test and how to measure veg*nism. To our knowledge, no prior study has specifically drawn attention to the fragile nature of these kinds of associations, potentially creating a misleading impression of robustness.

Finally, the present research suggests how personality impacts important life outcomes – in this case, the adoption of a plant-based diet. Moreover, this was the first examination of these associations at the domain, aspect, and facet levels of the personality trait hierarchy.

6.6 Conclusion

Across three samples, the findings from this research help to consolidate evidence linking basic personality traits with veganism and vegetarianism. Indeed, to the best of our knowledge this is the first study to examine these associations at the domain, aspect, and facet levels of the personality trait hierarchy, while controlling for socio-demographic factors and assessing robustness through the use of parametric and non-parametric analyses. Although the patterns of association revealed in this study were often inconsistent across our three samples, highlighting this inconsistency—both in the present findings and in previous research—is in itself a valuable contribution to the literature. At the same time, our findings also provide encouragement that some apparently more reliable trends in the literature are indeed reproducible. In particular, we confirmed our expectation that individuals who score higher on openness/intellect and agreeableness, along with aspects and facets of these domains (i.e., openness, compassion, and trust), are more likely to report adhering to a veg*n diet. These observations provide valuable insights into the characteristic tendencies of veg*ns, and may help to shed light on the motivations that incline one to adopt a plant-based diet. Finally, we have highlighted important avenues for future research; chiefly, the design of more robust measures of adherence to a plant-based diet.

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Author Contributions

The research idea was conceived of by the second, fourth and last author. Data collection was completed by the second, third, and last author. Data analysis was conducted by the first author. The first author wrote the initial version of the manuscript and all authors revised the manuscript and approved the final version.

Declaration of interest

None.

References

Allen, M. W., Wilson, M., Ng, S. H., & Dunne, M. (2000). Values and beliefs of vegetarians and omnivores. *Journal of Social Psychology*, *140*(4), 405–422. https://doi.org/10.1080/00224540009600481

Aston, L. M., Smith, J. N., & Powles, J. W. (2013). Meat intake in Britain in relation to other dietary components and to demographic and risk factor variables: Analyses based on the National Diet and Nutrition Survey of 2000/2001. *Journal of Human Nutrition and Dietetics*, *26*(1), 96–106. https://doi.org/10.1111/j.1365-277X.2012.01278.x

Barr, S. I., & Chapman, G. E. (2002). Perceptions and practices of self-defined current vegetarian, former vegetarian, and nonvegetarian women. *Journal of the American Dietetic Association*, *102*(3), 354–3360. https://doi.org/10.1016/S0002-8223(02)90083-0

Beardsworth, A. D., & Keil, E. T. (1991). Vegetarianism, veganism and meat avoidance: Recent trends and findings. *British Food Journal*. https://doi.org/10.1108/00070709110135231

Beardsworth, A. D., & Keil, E. T. (1992). The vegetarian option: Varieties, conversions, motives and careers. *The Sociological Review*, *40*(2), 253–293. https://doi.org/10.1111/j.1467-954X.1992.tb00889.x

Blanca, M. J., Alarcón, R., Arnau, J., Bono, R., & Bendayan, R. (2018). Effect of variance ratio on ANOVA robustness: Might 1.5 be the limit? *Behavior Research Methods*, *50*(3), 937–962. https://doi.org/10.3758/s13428-017-0918-2

Chmielewski, M., & Kucker, S. C. (2020). An MTurk Crisis? Shifts in Data Quality and the Impact on Study Results. *Social Psychological and Personality Science*, *11*(4), 464–473.

https://doi.org/10.1177/1948550619875149

Conner, T. S., Thompson, L. M., Knight, R. L., Flett, J. A. M., Richardson, A. C., & Brookie, K. L. (2017). The role of personality traits in young adult fruit and vegetable consumption. *Frontiers in Psychology, 8*, 119. https://doi.org/10.3389/fpsyg.2017.00119

Costa, P. T., & McCrae, R. R. (1985). *The NEO personality inventory*. Psychological Assessment Resources Odessa, FL.

Costa, P. T., & McCrae, R. R. (1995). Domains and facets: Hierarchical personality assessment using the Revised NEO Personality Inventory. *Journal of Personality Assessment*, *64*(1), 21–50. https://doi.org/10.1207/s15327752jpa6401_2

Cox, D. N., Koster, A., & Russell, C. G. (2004). Predicting intentions to consume functional foods and supplements to offset memory loss using an adaptation of protection motivation theory. *Appetite*, *43*(1), 55–64. https://doi.org/10.1016/j.appet.2004.02.003

Damian, R. I., Spengler, M., Sutu, A., & Roberts, B. W. (2019). Sixteen going on sixty-six: A longitudinal study of personality stability and change across 50 years. *Journal of Personality and Social Psychology, 117*(3), 674–695. https://doi.org/10.1037/pspp0000210

de Boer, J., Schösler, H., & Aiking, H. (2017). Towards a reduced meat diet: Mindset and motivation of young vegetarians, low, medium and high meat-eaters. *Appetite, 113*, 387–397. https://doi.org/10.1016/j.appet.2017.03.007

DeYoung, C. G. (2014). Openness/intellect: A dimension of personality reflecting cognitive exploration. In *APA handbook of personality and social psychology, Volume 4: Personality processes and individual differences.* https://doi.org/10.1037/14343-017

DeYoung, C. G., Quilty, L. C., & Peterson, J. B. (2007). Between facets and domains: 10 aspects of the Big Five. *Journal of Personality and Social Psychology*, *93*(5), 880. https://doi.org/10.1037/0022-3514.93.5.880

Dhont, K., Hodson, G., & Leite, A. C. (2016). Common ideological roots of speciesism and generalized ethnic prejudice: The Social Dominance Human–Animal Relations Model (SD-HARM). *European Journal of Personality*, *30*(6), 507–522. https://doi.org/10.1002/per.2069

Forestell, C. A., & Nezlek, J. B. (2018). Vegetarianism, depression, and the five factor model of personality. *Ecology of Food and Nutrition*, *57*(3), 246–259. https://doi.org/10.1080/03670244.2018.1455675

Forestell, C. A., Spaeth, A. M., & Kane, S. A. (2012). To eat or not to eat red meat. A closer look at the relationship between restrained eating and vegetarianism in college females. *Appetite*, *58*(1), 319–325. https://doi.org/10.1016/j.appet.2011.10.015

Friedman, H. S., & Kern, M. L. (2014). Personality, well-being, and health. *Annual Review of Psychology*, *65*(1), 719–742. https://doi.org/10.1146/annurev-psych-010213-115123

Godfray, H. C. J., Aveyard, P., Garnett, T., Hall, J. W., Key, T. J., Lorimer, J., … Jebb, S. A. (2018). Meat consumption, health, and the environment. *Science (New York, N.Y.)*, *361*(6399). https://doi.org/10.1126/science.aam5324

Goldberg, L. R., & Strycker, L. A. (2002). Personality traits and eating habits: The assessment of food preferences in a large community sample. *Personality and Individual Differences*, *32*(1), 49–65. https://doi.org/10.1016/S0191-8869(01)00005-8

Gosling, S. D., Rentfrow, P. J., & Swann, W. B. (2003). A very brief measure of the Big-Five personality domains. *Journal of Research in Personality*. https://doi.org/10.1016/S0092-6566(03)00046-1

Gossard, M. H., & York, R. (2003). Social structural influences on meat consumption. *Human Ecology Review*, 1–9.

Graziano, W. G., & Tobin, R. M. (2009). Agreeableness. *Handbook of Individual Differences in Social Behavior*.

Griskevicius, V., Delton, A. W., Robertson, T. E., & Tybur, J. M. (2011). Environmental contingency in life history strategies: The influence of mortality and socioeconomic status on reproductive timing. *Journal of Personality and Social Psychology, 100*(2), 241–254. https://doi.org/10.1037/a0021082

Hampson, S. E., John, O. P., & Goldberg, L. R. (1986). Category breadth and hierarchical structure in personality. Studies of asymmetries in judgments of trait implications. *Journal of Personality and Social Psychology, 51*(1), 37–54. https://doi.org/10.1037/0022-3514.51.1.37

Hirsh, J. B., Kang, S. K., & Bodenhausen, G. V. (2012). Personalized persuasion: Tailoring persuasive appeals to recipients' personality traits. *Psychological Science, 23*(6), 578–581. https://doi.org/10.2307/41489743

Hopwood, C. J., Bleidorn, W., Schwaba, T., & Chen, S. (2020). Health, environmental, and animal rights motives for vegetarian eating. *PLoS ONE, 15*(4). https://doi.org/10.1371/journal.pone.0230609

Jacobs, D. R., & Temple, N. J. (2012). Methods in nutrition research. In N. J. Temple, T. Wilson, & D. R. Jacobs Jr. (Eds.), *Nutritional Health: Strategies for Disease Prevention* (pp. 1–27). https://doi.org/10.1007/978-1-61779-894-8_1

John, O. P., Naumann, L. P., & Soto, C. J. (2008). Paradigm shift to the integrative Big Five Trait taxonomy. *Handbook of Personality: Theory and Research*, *3*(2), 114–158. https://doi.org/10.1016/S0191-8869(97)81000-8

Justin, M. (2020). Nearly one in four in U.S. have cut back on eating meat. Retrieved April 30, 2020, from Gallup website: https://news.gallup.com/poll/282779/nearly-one-four-cut-back-eating-meat.aspx

Keller, C., & Siegrist, M. (2015). Does personality influence eating styles and food choices? Direct and indirect effects. *Appetite*, *84*(128–138). https://doi.org/10.1016/j.appet.2014.10.003

Kessler, C. S., Holler, S., Joy, S., Dhruva, A., Michalsen, A., Dobos, G., & Cramer, H. (2016). Personality profiles, values and empathy: Differences between lacto-ovo-vegetarians and vegans. *Forschende Komplementarmedizin*, *23*(2), 95–102. https://doi.org/10.1159/000445369

Krizmanic, J. (1992). Here's who we are! *Vegetarian Times*, (182), 72–79.

Lüdecke, D. (2019). *sjstats: Statistical functions for regression models (Version 0.17.7)*. https://doi.org/10.5281/zenodo.1284472

Machado-Oliveira, M. C., Nezlek, J. B., Rodrigues, H., & Sant'Ana, A. S. (2020). Personality traits and food consumption: An overview of recent research. *Current Opinion in Food*

Science. https://doi.org/10.1016/j.cofs.2020.02.005

Mangiafico, S. (2020). *rcompanion: Functions to support extension education program evaluation*. Retrieved from https://cran.r-project.org/package=rcompanion

Markon, K. E. (2009). Hierarchies in the structure of personality traits. *Social and Personality Psychology Compass*, *3*(5), 812–826. https://doi.org/10.1111/j.1751-9004.2009.00213.x

Mõttus, R. (2016). Towards more rigorous personality trait–outcome research. *European Journal of Personality*, *30*(4), 292–303. https://doi.org/10.1002/per.2041

Mõttus, R., McNeill, G., Jia, X., Craig, L. C. A., Starr, J. M., & Deary, I. J. (2013). The associations between personality, diet and body mass index in older people. *Health Psychology*, *32*(4), 353. https://doi.org/10.1037/a0025537

Mõttus, R., Realo, A., Allik, J., Deary, I. J., Esko, T., & Metspalu, A. (2012). Personality traits and eating habits in a large sample of Estonians. *Health Psychology*, *31*(6), 806. https://doi.org/10.1037/a0027041

Niemyjska, A., Cantarero, K., Byrka, K., & Bilewicz, M. (2018). Too humanlike to increase my appetite: Disposition to anthropomorphize animals relates to decreased meat consumption through empathic concern. *Appetite*, *127*, 21–27. https://doi.org/10.1016/j.appet.2018.04.012

Ozer, D. J., & Benet-Martínez, V. (2006). Personality and the prediction of consequential outcomes. *Annual Review of Psychology*, *57*, 401–421. https://doi.org/10.1146/annurev.psych.57.102904.190127

Pfeiler, T. M., & Egloff, B. (2018). Examining the veggie personality. *Appetite*, *120*, 246–255.

https://doi.org/10.1016/j.appet.2017.09.005

Pfeiler, T. M., & Egloff, B. (2020). Personality and eating habits revisited: Associations between the big five, food choices, and Body Mass Index in a representative Australian sample. *Appetite*, *149*. https://doi.org/10.1016/j.appet.2020.104607

Piazza, J., Ruby, M. B., Loughnan, S., Luong, M., Kulik, J., Watkins, H. M., & Seigerman, M. (2015). Rationalizing meat consumption. The 4Ns. *Appetite*, *91*, 114–128. https://doi.org/10.1016/j.appet.2015.04.011

R Development Core Team, R. (2018). R: A language and environment for statistical computing. In *R Foundation for Statistical Computing*. https://doi.org/10.1007/978-3-540-74686-7

Revelle, W. (2018). *psych: Procedures for psychological, psychometric, and personality research*. Evanston, Illinois: Northwestern University.

Roberts, B. W., Kuncel, N. R., Shiner, R., Caspi, A., & Goldberg, L. R. (2007). The power of personality: The comparative validity of personality traits, socioeconomic status, and cognitive ability for predicting important life outcomes. *Perspectives on Psychological Science : A Journal of the Association for Psychological Science*, *2*(4), 313–345. https://doi.org/10.1111/j.1745-6916.2007.00047.x

Rolland, J.-P. (2002). The cross-cultural generalizability of the Five-Factor model of Personality. In *The Five-Factor Model of Personality Across Cultures* (pp. 7–28). https://doi.org/10.1007/978-1-4615-0763-5_2

Rosenfeld, D. L., & Burrow, A. L. (2017). Vegetarian on purpose: Understanding the motivations of plant-based dieters. *Appetite, 116,* 456–463.

https://doi.org/10.1016/j.appet.2017.05.039

Rosenfeld, D. L., & Tomiyama, A. J. (2019). When vegetarians eat meat: Why vegetarians violate their diets and how they feel about doing so. *Appetite*, *143*, 104417. https://doi.org/10.1016/j.appet.2019.104417

Rothgerber, H. (2013). Real men don't eat (vegetable) quiche: Masculinity and the justification of meat consumption. *Psychology of Men and Masculinity*, *14*(4), 363. https://doi.org/10.1037/a0030379

Rothgerber, H. (2015). Underlying differences between conscientious omnivores and vegetarians in the evaluation of meat and animals. *Appetite*, *87*, 251–258. https://doi.org/10.1016/j.appet.2014.12.206

Rozin, P., Hormes, J. M., Faith, M. S., & Wansink, B. (2012). Is meat male? A quantitative multimethod framework to establish metaphoric relationships. *Journal of Consumer Research*, *39*(3), 629–643. https://doi.org/10.1086/664970

Ruby, M. B. (2012). Vegetarianism. A blossoming field of study. *Appetite*, *58*(1), 141–150. https://doi.org/10.1016/j.appet.2011.09.019

Ruby, M. B., Alvarenga, M. S., Rozin, P., Kirby, T. A., Richer, E., & Rutsztein, G. (2016). Attitudes toward beef and vegetarians in Argentina, Brazil, France, and the USA. *Appetite*, *96*, 546–554. https://doi.org/10.1016/j.appet.2015.10.018

Singer, P., & Mason, J. (2007). The ethics of what we eat: Why our food choices matter. In *Rodale*.

Sobal, J. (2005). Men, meat, and marriage: Models of masculinity. *Food and Foodways*, *13*(1–

2), 135–158. https://doi.org/10.1080/07409710590915409

Soto, C. J., & John, O. P. (2017). The next Big Five Inventory (BFI-2): Developing and assessing a hierarchical model with 15 facets to enhance bandwidth, fidelity, and predictive power. *Journal of Personality and Social Psychology*, *113*(1), 117. https://doi.org/10.1037/pspp0000096

Soto, C. J., John, O. P., Gosling, S. D., & Potter, J. (2011). Age differences in personality traits from 10 to 65: Big Five domains and facets in a large cross-sectional sample. *Journal of Personality and Social Psychology*, *100*(2), 330–348. https://doi.org/10.1037/a0021717

Stoll-Kleemann, S., & Schmidt, U. J. (2017). Reducing meat consumption in developed and transition countries to counter climate change and biodiversity loss: a review of influence factors. *Regional Environmental Change*, *17*(5), 1261–1277. https://doi.org/10.1007/s10113-016-1057-5

Strickhouser, J. E., Zell, E., & Krizan, Z. (2017). Does personality predict health and well-being? A metasynthesis. *Health Psychology*, *36*(8), 797. https://doi.org/10.1037/hea0000475

Tabachnick, B. G., & Fidell, L. S. (2012). Using multivariate statistics (6th ed.). In *New York: Harper and Row*.

The slow but steady rise of vegetarianism in Australia - Roy Morgan Research. (n.d.). Retrieved July 10, 2020, from http://www.roymorgan.com/findings/vegetarianisms-slow-but-steady-rise-in-australia-201608151105

Weisberg, Y. J., DeYoung, C. G., & Hirsh, J. B. (2011). Gender differences in personality across the ten aspects of the Big Five. *Frontiers in Psychology*, *2*, 178.

https://doi.org/10.3389/fpsyg.2011.00178

White, R. F., Seymour, J., & Frank, E. (1999). Vegetarianism among US women physicians. *Journal of the American Dietetic Association*, *99*(5), 595. https://doi.org/10.1016/S0002-8223(99)00146-7

Willetts, A. (2013). “Bacon sandwiches got the better of me”: Meat-eating and vegetarianism in South-East London. In *Food, Health and Identity*.