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Plant-based diets among students at Rhodes University, South Africa: prevalence, motivations, and barriers

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In the context of unsustainable food choices and consumption patterns, transition to plant-based diets is considered a pathway to reducing greenhouse gas emissions. The youths, and university students in particular, represent a distinctive demographic group with great potential to follow plant-based diets, but limited knowledge concerning the prevalence and motivations of plant-based diets exists in the Global South. The aim of this study this research was to examine the prevalence of, motivations for and barriers to plant-based diets among Rhodes University students in South Africa. A total of 300 students responded positively to an online questionnaire survey. About 31% of the survey students followed a plant-based diet but this figure dropped to 18% when flexitarians were excluded from the analysis, with more females than males reporting so. The leading motivation for following plant-based diets was animal welfare concerns, followed by environmental sustainability, personal health, influence of family and friends, taste preference, saving money and sensory issues. There was a significant positive association between values relating to the environment - respecting the earth and protecting the environment and following a plant-based diet. Key barriers to plant-based diets reported included perceived high costs and lack of knowledge on plant-based diets. Interventions for promoting plant-based diets should make explicit, links between plant-based diets and the values people consider important and focus on removing constraints to encourage uptake of plant-based diets.

KEYWORDS

plant-based diets, universities, prevalence, motivation, barriers

Introduction

Animal-based food systems are at the centre of sustainability debates due to their negative environmental footprints, contributing significantly to global sustainability challenges such as climate change and land degradation (Sabaté and Soret, 2014; Meybeck and Gitz, 2017; Polleau and Biermann, 2021; Gibbs and Cappuccio, 2022). The agricultural sector is largely responsible for biodiversity loss and environmental degradation as land is cleared for stock feed and food crops (Lacour et al., 2018; Xu et al., 2021), with about 38% of all earth's ice-free land under agriculture (Polleau and Biermann, 2021).

For example, about 80% of global deforestation is linked to food production activities (Xu et al., 2021). Further, up to 35% of anthropogenic greenhouse gas emissions (GHGs) globally is attributed to food systems, and out of this, animal-based food emissions are nearly twice (57%) that of plant-based food emissions (29%) (Xu et al., 2021). The adverse impacts of industrial livestock production on the environment are also evident in water and soil pollution from chemical runoff resulting in water and soil quality degradation (Sabaté and Soret, 2014; Lacour et al., 2018). Plant-based diets also use less water and

arable land than omnivorous diets (Chai et al., 2019; Jankielsohn, 2015; Vinnari and Vinnari, 2014; Xu et al., 2021). Veganism tends to make the least demand on the global water supply requiring 14% less fresh water and 21% less groundwater than omnivorous diets (Chai et al., 2019). Consistent with the preceding discussion, Rosi et al. (2017) found among Italian adults that when considering carbon, water, and ecological footprints ovo-lacto-vegetarian and vegan diets had a clear advantage over omnivorous diets. For example, the daily total carbon, water and ecological footprint for omnivorous diets (3959.3 g CO₂ eq., 3140.8 L and 26 global m²) was higher than that of ovo-lacto-vegetarian (2598.3 g CO₂ eq., 2304.7 L and 16.1 global m²) and vegan (2336.1 g CO₂ eq., 2,455 L and 14.5 global m²) diets, respectively (Rosi et al., 2017). Meanwhile the health benefits of plant-based diets are well documented ranging from lowering of body-mass index, blood pressure and cholesterol levels, which together help in reducing the amount and cost of medication for treating chronic diseases (Tuso et al., 2013; Viroli et al., 2023).

Given the environmental footprints of animal-based diets, consumption of plant-based diets is gaining traction (Ammann et al., 2023) amid growing evidence plant-based diets have substantial environmental and health benefits (Sabaté and Soret, 2014; Vinnari and Vinnari, 2014; Jankielsohn, 2015; Lacour et al., 2018; Chai et al., 2019; Polleau and Biermann, 2021). Plant-based diets are diverse, ranging from strictly vegan or vegetarian with non-consumption of animal products or by-products to occasional consumption of animal products or by-products (Sheen et al., 2023) (Table 1). However, though plant-based diets are said to be more sustainable than omnivorous diets, many ultra-processed foods such as vegan cheese or meat alternatives or substitutes have varying but substantial environmental impacts (Chai et al., 2019).

Globally, young adults (18–30 years) are at the centre of the shift to plant-based dietary choices. For example, a study in major Canadian cities found that 14% of the youths and young adults followed either a vegetarian, pescatarian or vegan diet (Vergeer et al., 2020). An investigation of dietary patterns at five UK universities found that around 10% of the students identified themselves as vegetarian, with more female than male students reporting so (Sprake et al., 2018). In a recent study in Switzerland, Ammann et al. (2023) found that consumers of plant-based alternatives to dairy products tended to be young and educated individuals.

TABLE 1 Definitions of plant-based diets.

Diet	Definition
Vegan	Abstaining from the use or consumption of any animal products
Vegetarian	Abstaining from the consumption of meat but occasionally consuming dairy or egg products
Ovo-vegetarian	Supplements include a plant-based diet with eggs
Pescatarian	Follows a plant-based diet but occasionally consumes seafood or white meat
Flexitarian	Diet is mostly plant-based, but occasionally consumes all types of meat

Motivations for and barriers to plant-based diets

There are several motivations for following plant-based diets, including sustainability, health, religious, and animal welfare reasons. Another reason for shifting to plant-based diets include sheer dislike of or disgust toward animal flesh (Greenebaum, 2012). Further, personal values have also been reported to influence shifts to plant-based diets. For example, people who have “altruistic values” (affinity for equality and social justice) are more likely to follow a plant-based diet than those with a disposition to self-enhancement values (Ruby, 2012; Salonen and Helne, 2012). The influence of global warming concerns, health aspirations including weight management, friends and family members, religious values, and concern for animals have also been reported to be key motivators for the shift to plant-based diets by students in Malaysia (Tee, 2012). In developed countries, most people that follow plant-based diets do so for sustainability, health, and lifestyle reasons (Ruby et al., 2013). Interestingly, while environmental sustainability concerns tend to be the key reason for encouraging plant-based diets, evidence suggests that in some instances animal welfare concerns precedes environmental sustainability concerns in people’s choices of plant-based diets (Malek and Umberger, 2021). This trend has also recently been found among consumers of meat and dairy products in five European countries (Ammann et al., 2024).

However, the shift to plant-based diets is constrained by various cultural, financial, cognitive and societal factors (Ruby et al., 2013). Cultural analyses show links between meat consumption and masculine identity, though these idealized masculinity elements are increasingly challenged (Sobal, 2005; Buerkle, 2009; Ruby and Heine, 2011; Stanely et al., 2023). For example, De Backer et al. (2020) found that males were more likely to consume more meat, less likely to follow plant-based diets and more defensive against plant-based diets. A study on dietary intake patterns among university students in Lebanon found that male students had a higher consumption of meat diets than female students who tended to follow a vegetarian diet (Salameh et al., 2014). Further, negative perceptions of plant-based diets can constrain adoption of plant-based diets. For example, Ruby et al. (2013) found that males perceived vegetarian males as less masculine than omnivore males, consistent with common conceptions of masculinity. Plant-based diets are also perceived as very expensive and unhealthy, and associated with demographic groups such as White people and well-off people (Lindgren, 2020). Socio-demographic factors such as age can also explain variability in the uptake of plant-based diets. For example, older and less educated individuals are less willing to consider changing their diet than younger and university educated individuals (Ruby and Heine, 2011). Other barriers relate to a lack of detailed information about the benefits of vegetarian diets on public health, the environment, global food security and animal welfare (Salonen and Helne, 2012).

Meanwhile, there is criticism of proponents of vegetarianism based on framing plant-based diets as always good, that everyone should follow them, and that not doing so is tantamount to being narrow-minded and selfish. The point that antagonists make is that diets span every kind of dietary preference, and the framing of plant-based diets as the only sustainable dietary option, implicitly attempts to pitch plant-based eating as the only sustainable dietary option and might not yield the desired pro-plant-based diet behavior

(Greenebaum, 2012). This criticism relates to research that shows that pro-environmental initiatives can yield behavior that is opposite to the desired effect – the so-called boomerang effect (Byrne and Hart, 2009). Others feel that given the magnitude of the climate crisis, the overall environmental benefits of plant-based diets will be marginal hence there is no merit in “forcing” everyone to be a vegetarian (Clifford, 2023). Rather solutions do not lie in reducing demand for resources responsible for GHG emissions such as energy and meat only but also in advanced technology for producing clean energy (Clifford, 2023). However, it has been argued that while technological advances are important and should be pursued, they are insufficient to address the negative environmental impacts of global food systems (Sabaté and Soret, 2014).

In South Africa, demand for meat is increasing due to urbanization and a growing population, resulting in the replacement of traditional farms with industrial farming systems. About 75% of all South Africa's beef is now produced on feedlots (Jankielsohn, 2015). Despite the growing interest in plant-based diets, there is limited literature on the prevalence, motivations and barriers regarding plant-based diets among the youths, with a few notable exceptions (Sedupane, 2017; Tobias-Mamina and Maziriri, 2021). While there is a distinct lack of literature on plant-based diets in South Africa, popular media suggests that vegetarianism is growing (Axworthy, 2019). Therefore, empirical evidence is required to inform debates on and support the shift to plant-based dietary practices. Within this background, the main aim of the study was to examine the prevalence, perceptions, and barriers to plant-based dietary practices among students at Rhodes University, South Africa. Key questions included: (1) What is the prevalence of self-reported plant-based dietary practices among students at Rhodes University, (2) What factors explain the shift to plant-based dietary practices, (3) What are the perceived constraints to plant-based diets, and (4) based on the findings, what are the implications for promoting plant-based diets in universities?

The focus of the study among a young demographic group in a university setting in the Global South is significant in various ways. First, while the youths are not entirely responsible for global environmental challenges such as climate change, they tend to have the potential for catalyzing the transformative behavior change needed to achieve sustainable lifestyles (Dahl et al., 2018; Thomaes et al., 2023) and it has been shown that they are actively involved in advocacy and action needed to respond to climate change (Bandura and Cherry, 2020). Second, universities are considered “small cities” due to the high number of people and high resource (energy, water and food) demand, resulting in a substantial environmental footprint (Ralph and Stubbs, 2014). Thus, promoting sustainable living such as plant-based diets at universities can have positive impacts on the environment. Second, universities are important entities in efforts for addressing sustainability concerns beyond university boundaries. Through research, education, and community involvement, universities can engender sustainable practices and be the vehicle for societal change by equipping students with sustainability knowledge and practices that they can take back to their respective societies (Ralph and Stubbs, 2014). Third, the independence of university students can translate into positive responses to sustainability calls. According to Ruby (2012), nuclear families are often not supportive of vegetarian or plant-based diets, which can constrain the transition to plant-based diets among youths who are seldom independent of parental control. Fourth, social influences can explain the transition

to plant-based diets (Ralph and Stubbs, 2014; Miki et al., 2020), and universities tend to offer both independence and social influence. Therefore, the youths can be an important demographic for addressing sustainability debates within and beyond university remits. Last, pro-environmental behavior research tend to focus more on the Global North than the Global South (Brick et al., 2024), resulting in limited empirical standing for advancing sustainability behavior debates in the Global South. Hence this research might contribute to relevant research than can stimulate discussions on sustainability research in the Global South.

Materials and methods

The study was exploratory in nature, aimed at gaining a deeper understanding and insight into a phenomenon of plant-based diet that is rapidly gaining traction in South Africa. The study participants were students at Rhodes University, South Africa. Rhodes University is located in Makhanda, in the Eastern Cape Province of South Africa (S33°18'57.72"; E26°31'24.67"). The university has around 8,410 students and about half of the students live on campus, with the remaining students in off-campus private accommodation (Rhodes University, 2022). Residence students have three meals (breakfast, lunch and supper) a day in the university dining halls, with a range of dietary options offered including default, vegetarian, Halaal, fast food, health platters and African dishes (Painter et al., 2016).

The university has an environmental sustainability policy aimed at achieving sustainability goals through promoting sustainable practices in energy, food and water consumption (Rhodes University, 2015). However, sustainable food choices are not promoted as a potential pathway towards meeting the university's environmental targets. Several sustainability studies have been undertaken at Rhodes University focused on food waste (Painter et al., 2016), energy use (Bulunga and Thondhlana, 2018), water saving (Thondhlana and Hlatshwayo, 2018) and recycling (Mtutu and Thondhlana, 2016) but there has not been a focus on the sustainability of diets. A focus on plant-based diets on campus presents an opportunity for encouraging sustainability practices through changes in dietary choices and lifestyles.

Data collection

The student participants were recruited through an invite to complete an online questionnaire sent via the official university student mailing lists, a WhatsApp group, and a Facebook group. All the students were approached and a total of 300 students responded positively to the invite.

The online questionnaire was divided into different sections. The questionnaire asked the participants to identify the diet they identified with using the definitions in out of the five types plant-based diets given (Table 1), following Sedupane (2017) and Miki et al. (2020). Depending on the dietary practice reported, the participants who followed meat-based diets and plant-based diets were directed to the respective sections. The second section, with a combination of open-ended and closed-ended questions, required participants to indicate their general views on plant-based diets, motivations for and barriers to plant-based diets. Questions on impediments to plant-based diets

were informed by relevant literature (e.g., Mäkinen and Vainio, 2014). The third section was designed to measure the participants' level of environmental concern using the Ecological Welfare and Animal Welfare values (Ruby et al., 2013), with responses on a five-point scale ranging from Unimportant (1) to Critical (5). The last section collected the socio-demographic information of the participants including gender, age, race and faculty of registration. We recognize the problematics associated with racial distinctions, but the distinctions were necessary because this study explored how following a plant-based diet may be influenced by such social structures. The questionnaire was validated via two ways, first by (i) asking a colleague to read the questionnaire and second (ii) by piloting the questionnaire to 10 willing students to check whether questions were clear and framed in a way that captured the topic under investigation.

Data collection was guided by standard ethical guidelines, observing key principles of confidentiality and anonymity of responses. This study was granted ethical clearance by the Rhodes University Human Research Ethics Committee, approval number 2022-5604-6737. An online questionnaire was administered between June and August 2022.

Data analyses

Data analysis was done in Excel and RStudio. Categorization and tallying of responses of responses closed-ended questions was performed to show the proportion of participants who selected a particular response, as a basis for showing patterns of plant-based diets. Responses to open-ended questions were analyzed through thematic coding via creating codes for the text and categorizing frequent themes. Descriptive statistics in the form of frequency tables were used to present data relating to the prevalence of plant-based diets, and motivations and barriers to a plant-based diet. Where relevant, direct quotes were used to support claims and express meanings, following Newing (2010). Chi-squared tests were performed to test for association between plant-based diets and gender and race. Our analysis aligned racial distinctions with Rhodes University's racial categorization (Rhodes University, 2022). In this study, the racial distinction "Black people" defines those of black African descent, while "White people" as inclusive of those of Caucasian descent. The racial distinction "Colored people" defines those of "mixed race" or KhoiSan descent, while "Indian people" refers to a South Africa category known elsewhere as western Asian. A Spearman rank correlation was done to identify the relationship between plant-based diets and Ecological Welfare and Animal Welfare values. Modal responses were used to analyze Likert scale responses.

Limitations of the study

Key limitations of the study are twofold. First, one of the researchers, experienced an ethical dilemma about her positionality as a vegetarian, which could have shaped the framing of the study and interpretation of the findings. However, chances of a pro-vegetarian bias and narratives were countered by the involvement of the other researcher (non-vegetarian) in the conceptualization of the study and analysis of data. The second limitation relates to the propensity of open,

online questionnaires to self-selection bias, which could distort the representation of the true population and interpretation of the results (Heckman, 1990), and make generalization of the results problematic. Despite this, an online survey was considered as convenient for the students given data collection took place between the examination period and vacation (May – July 2022). Further, the demographic profile of the respondents in terms of gender, racial and faculty composition mirrors that of Rhodes University (Rhodes University, 2022), suggesting the sample is a reliable representation of the true student population. The third limitation relates to the imprecise definition of flexitarian. What is deemed "occasional" to one person might be deemed frequent to another. Thus, a portion of the flexitarians are likely to be omnivores by most criteria which could influence the results. Nonetheless, analysis of the results was informed by the standard definition of a plant-based diet following Derbyshire (2017).

Results

The socio-demographic profile of the respondents

Females comprised the highest proportion (68%) of respondents in the sample population, followed by males (29%) and non-binary individuals (7%). There was a higher representation of Black people (60%), than White people (32%), Colored people (5%) and Indians (3%) (Table 2).

The mean age of participants was 23 years. Undergraduates comprised the largest proportion (58%) of the total sample and the Humanities faculty was the most represented constituting 44% of the respondents. There were more off-campus students (56%) than residence students (44%) in the sample. The results generally mirror Rhodes University's statistical composition of the students by gender (64% Females; 36% Males), race (78% Black people; 12% White people; 6% Colored people and 4% Indians), faculty of registration (42% Humanities) and residence status (40% resident and 60% non-resident students) (Rhodes University, 2022).

Prevalence of plant-based diets

Approximately 31% of the respondents reported following a plant-based diet, and the remaining proportion followed an omnivorous diet. Out of this, the largest plant-based diet followed by students was a flexitarian diet (52%), followed by vegetarian (22%), and pescatarian (19%) diets. Vegans (4%) and ovo-vegetarians (2%) accounted for the smallest proportion of the respondents. The results show that significantly more female students (65%) than males (28%) and non-binary students (7%) followed a plant-based diet ($\chi^2 = 48.6$, $p \leq 0.001$). Analysis by race shows a statistically higher proportion of White students (50%) than Black students (35%) and Colored students or Indians (5%) followed a plant-based diet ($\chi^2 = 22.5$, $p \leq 0.001$).

Motivations for plant-based diets

The reported motivations for following a plant-based diet were diverse and varied, in terms of the number of respondents citing them

TABLE 2 The socio-demographic profile of respondents.

Aspect	Value
Gender	
Female	68%
Male	29%
Non-binary	3%
Age (mean)	23
Race	
Black African	60%
White	32%
Colored	5%
Indian	3%
Level of study	
Undergraduate	58%
Honors	20%
Masters	16%
PhD	6%
Faculty	
Humanities	44%
Science	34%
Commerce	14%
Education	5%
Law	3%
Residence status	
Off-campus	56%
Residence	44%
Religion	
Christian	55%
Not religious	31%
Traditional African Religion	5%
Other	9%

(Figure 1). Animal rights and ethical concerns were the leading motivation cited by about 85% of the respondents, followed by environmental sustainability (55%) and personal health (35%) reasons. The respondents also reported the influence of family or friends (30%), with some citing there were raised on plant-based diets, taste preference (28%), saving money (23%) and sensory issues around meat (16%). Other reasons cited include reducing world hunger, religion and political correctness but these were cited by very few respondents (Figure 1). Ethical and animal rights considerations related to concerns about the ill-treatment of animals within factory farming settings and seeing animals as sentient as evident in remarks by a respondent: “It is most important for me to eat locally and only eat meat that has been ethically raised and slaughtered.” Some respondents said they loved animals as sentient creatures and companions, so the idea of eating them for any reason less than absolute desperation made them feel sick – “like eating another person.” Environmental sustainability concerns raised by the respondents relate to one’s carbon footprint, the unsustainability of factory farming, and the

environmental impacts of livestock production. For example, one respondent said, “there is a growing bank of evidence indicating that commercial animal farming is one of the least environmentally friendly sectors of food production.” Personal health benefits reported by the respondents included weight loss and a strengthened immune system that reduced the risk of chronic diseases such as diabetes and hypertension. Over 60% of respondents said they had become more environmentally aware since shifting to plant-based diets.

A spearman correlation analysis was performed to explore the relationship between the propensity to follow a plant-based diet and personal values (and ecological welfare scale). There was a significant but relatively weak negative correlation between following a plant-based diet and self-enhancement values (valuing authority and wealth) (Table 3). The results also yielded significant positive correlations between being plant-based and values relating to the environment such as respecting the earth and protecting the environment (Table 3).

For the ecological welfare scale (Table 4), significant positive correlations between following a plant-based diet and values relating to food that is packaged in an environmentally friendly way; produced in a way that has not caused pain to animals and produced in a manner that respects animal. There was a significant negative correlation between being plant-based diets and religious value orientations relating to forbidden animal-based foods (Table 4).

Perceptions of and barriers to plant-based diets

Openness to plant-based diets among the respondents who followed an omnivorous diet was assessed. More than half (58%) of the respondents said they had considered following a plant-based diet before, and 44% had followed a plant-based diet before reverting to an omnivorous diet. Analysis by race shows that a significantly higher proportion of White students (76%) than Black students (48%), Colored students, and Indian students reported considering a plant-based diet ($\chi^2 = 17.7$, $p < 0.001$). When asked about their feelings towards vegetarians, just above half (53%) of respondents said they either liked or strongly liked people who followed plant-based diets while (42%) were neutral. Only three respondents said that they either disliked or strongly disliked people who followed a plant-based diets.

Concerning barriers to plant-based diets, high costs associated with plant-based food items was perceived as a major constraint, cited by 42% of the respondents (Figure 2). Lack of knowledge about plant-based diets was the second most cited barrier reported by 31% of the respondents. The third most reported barrier was lack of interest (15%), with respondents stating anaemia, food allergies, poor nutrition, or interruptions in menstrual cycles as reasons for not shifting to plant-based diets. Other barriers reported, albeit by fewer respondents, related to general dislike of taste of plant-based diets, enjoyment and cravings of meat, limited meal options and availability of plant-based products and the convenience of buying meat products that the respondents perceived to be readily available. Particularly among residence students, it was mentioned that there is always one plant-based meal option at lunch and dinner compared to meat-based meals with up to five options.

To gauge the institutional influence on plant-based diets, the participants who followed a plant-based diet were asked to indicate their

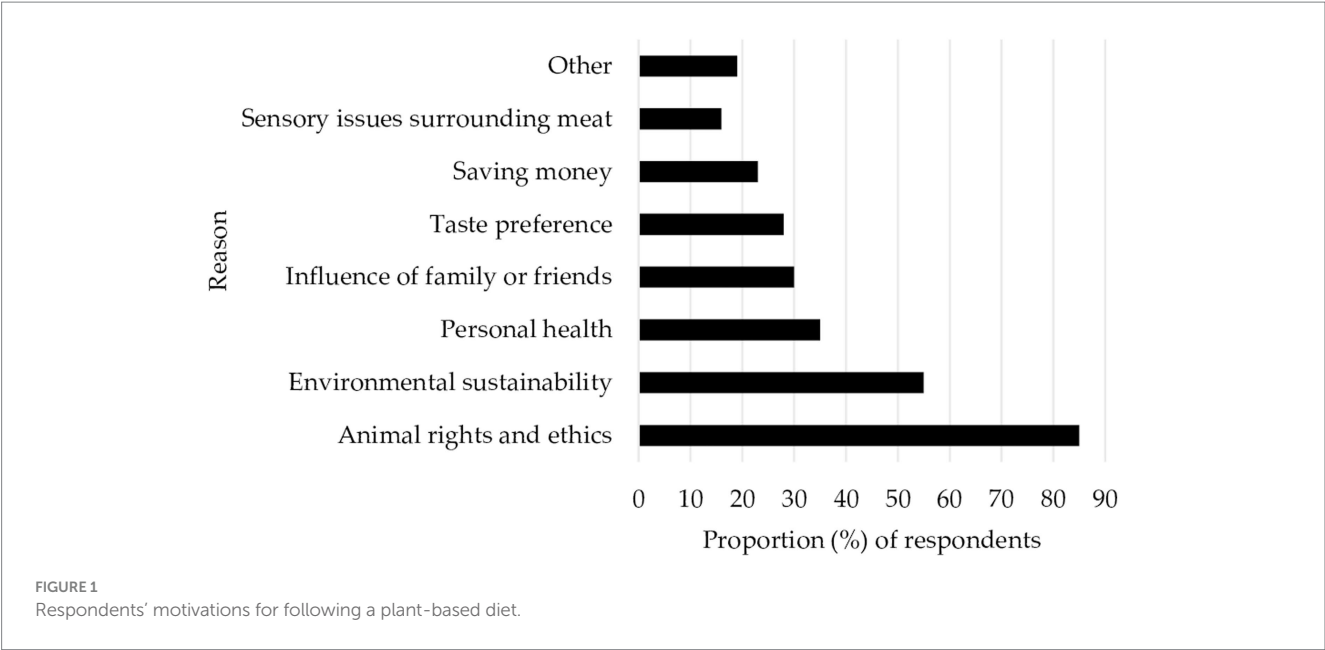


TABLE 3 The relationship between personal values and plant-based diets.

Variable	Spearman's ρ (rho)
Authority	−0.157**
Social power	−0.052
Wealth	−0.188**
Influential	0.047
Social justice	0.010
Helpful	−0.018
Equality	−0.033
A world at peace	−0.031
Respecting the earth	0.142*
Unity with nature: fitting into nature	0.102
Preventing pollution	0.067
Protecting the environment	0.154**

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

level of agreement with the statement “*Rhodes University has influenced my decision to follow a plant-based diet.*” The mean response was 2.34, showing a strong disagreement. Those who disagreed stated that the decision to follow a plant-based diet was personal and intrinsically motivated. Those in agreement with the statement cited the influence of friends who followed a plant-based diet, with one respondent saying, “*there are many people here who follow a plant-based diet. Getting used to the idea and being exposed to good vegetarian food through these people has definitely been an inspiration for me.*”

Residence students were asked if living in the residence system had made it difficult to follow a plant-based diet due to limited options. The mean response was 3.30, suggesting the respondents were generally ambivalent. When asked to explain further, the respondents felt residence meals did not adequately cater for plant-based diets or that the plant-based options were very limited and not nutritionally beneficial. Discussions with students who once followed a plant-based

TABLE 4 The relationship between ecological welfare scale and plant-based diets.

Variable	Spearman's ρ (rho)
It is important to me that the food I eat:	
Is packaged in an environmentally friendly way?	0.130*
Comes from countries I approve of politically?	0.103
Has the country of origin clearly marked?	0.019
Has been produced in a way that animals have not experienced pain?	0.247**
Has been produced in a way that animals rights have been respected?	0.237**
Has been prepared in an environmentally friendly way?	0.226**
Has been produced in a way which has not shaken nature?	0.199**
Comes from a country in which human rights are not violated?	0.027
Has been prepared in a way that does not conflict with my political values?	0.093
Is not forbidden in my religion?	−0.133*
Is in harmony with my religious views?	−0.104

* $p < 0.05$, ** $p < 0.01$.

diet supported this sentiment, with respondents citing limited plant-based choice (a single choice) at lunch and dinner, relative to meat-based options (five choices) as reflected in a statement by one respondent “*I did not receive enough nutrition from the plant-based food I received in residence, which affected my health.*”

Discussion

The current study examined the prevalence of, motivations for and barriers to plant-based diets among university students.

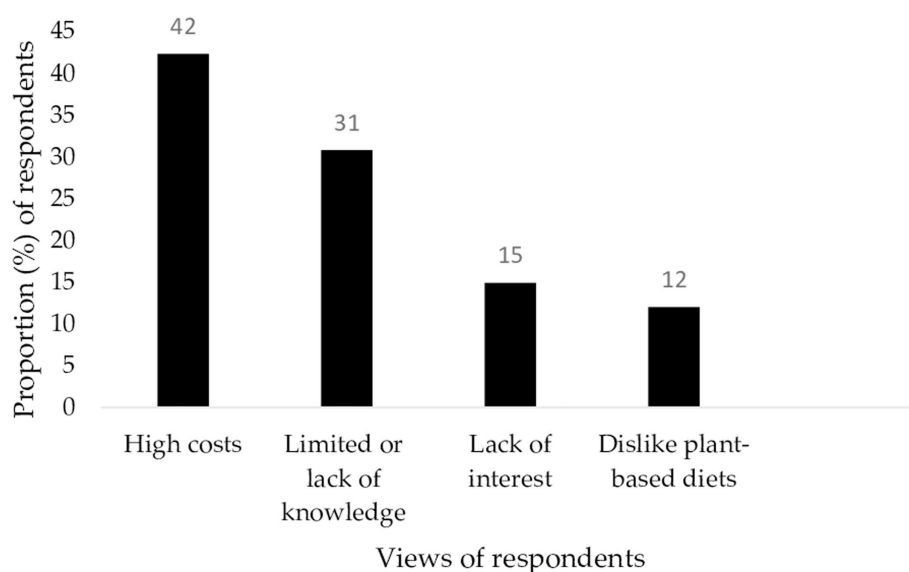


FIGURE 2
Perceptions of plant-based diets.

Plant-based diets represented the minority dietary choice, with prevalence of flexitarian and pescatarian diets. The overall prevalence of plant-based diets (18%, excluding flexitarians) among Rhodes students roughly matches other studies conducted among young people. For example, a study conducted in Germany found that 61% of respondents were omnivores, 25% were flexitarian, 10% vegetarian, and 2% vegan (Heinrich Böll Stiftung, 2021). A similar study in Canada found that nearly 14% of the respondents reported vegetarian dietary practices (Vergeer et al., 2020). Out of those who followed a plant-based diet, the high proportion of full vegetarians (22%) relative to semi vegetarians found in this study is comparable to the 21% found among young adults in Malaysia (Tee, 2012). Therefore, it is plausible to argue that the prevalence of plant-based diets found in this study mirrors global patterns. However, this relatively high prevalence of plant-based diets might not be reflective of the entire young demographic group in South Africa for varied reasons. First, there could have been a social desirability bias, which is common in self-reported environmental sustainability behavior (Vesely and Klöckner, 2020; Koller et al., 2023). Though the research was based on standardized, structured and impartial survey questions, social desirability bias cannot be completely disregarded as suggested by Vesely and Klöckner (2020). Further, it is reasonable to suggest that students who are more pro-environmental such as following a plant-based diet might have been more inclined to respond to the survey, which could have resulted in an elevation of the proportion of respondents following a plant-based diet.

The results show that several omnivorous respondents were open to plant-based diets, with close to 60% having considered following a plant-based diet. There was also a high degree of positive feelings towards people who followed plant-based diets, with a few exceptions. This is consistent with Chin et al. (2002) who found that attitudes towards vegetarians were usually positive. Ruby et al. (2016) found that women tended to have more positive attitudes towards vegetarians. There was a high degree of ambivalence towards the environmental impacts of omnivorous diets, which could suggest low

awareness of the environmental impacts of meat-based diets (Polleau and Biermann, 2021), or unwillingness to highlight the negative impacts given the tendency for a yes-saying bias for socially acceptable practices.

More female than male and non-binary participants followed plant-based diets. Although this could be attributed to the fact that females made up a slightly larger proportion of the sample size, the trends are generally consistent with literature elsewhere (Modlinska et al., 2020). The high proportion women following plant-based diets is attributed to various factors including a higher concern for other animal species than males as demonstrated in a cross-cultural study of universities in 22 countries (Randler et al., 2021), genetic influences as seen in Finland (Çınar et al., 2022) or early childhood exposure (Aldridge et al., 2009) though the latter was not explored in this study. Another plausible explanation relates to the association between meat consumption and conceptions of masculinity. For example, vegetarian diets are often associated with deficiencies in masculinity (Ruby et al., 2013). Given the dominance of normative masculinities in South Africa (Morrell et al., 2012), it is plausible to suggest a higher consumption of meat by males than females. This suggests interventions for promoting reduced meat consumption should be gender sensitive. For example, interventions that speak to the health and animal welfare benefits of plant-based diets can appeal to females while interventions that highlight the environmental costs of meat-based diets might convince males to pursue plant-based diets. There was significant association between race and plant-based diets. The high proportion of White students who followed plant-based diets could be attributed to the culture surrounding meat consumption. Ruby et al. (2013) state that Black and Asian participants ate more meat than Caucasian participants, in line with suggestions that plant-based diets are linked to Whiteness, making them exclusionary or unavailable to people of Color (Aiswarya, 2019; Lindgren, 2020).

The motivations for following a plant-based diet found in this study were varied, including animal welfare considerations, environmental sustainability, personal health reasons, taste, sensory

factors and saving money. Of particular interest to the plant-based diet literature is that in this study the primary motivation was animal welfare concerns, which is consistent with emerging evidence on prioritization of animal welfare concerns over environmental sustainability among consumers of both plant-based diets (Malek and Umberger, 2021) and animal-based diets (Ammann et al., 2024). Other studies have also highlighted animal welfare concerns and personal health considerations as the primary motivations for pursuing plant-based diets (Greenebaum, 2012; Lindgren, 2020). Though cited by few participants in this study, motivations relating to sensory issues around meat, influence from family and friends, weight loss, religion and taste preference have been reported elsewhere (Ruby and Heine, 2011; Tee, 2012; Ruby et al., 2013; Lindgren, 2020; Miki et al., 2020). Together, the results suggest the motivations for following a plant-based diet are diverse and consistent with the extant literature.

Concerning barriers, the perceived high costs for plant-based diets, were reported as a key constraint, consistent with studies elsewhere (Lea and Worsley, 2003; Modlinska et al., 2020). Mäkinen and Vainio (2014) also found that high price was the most important barrier to climate-friendly food choices in Finland. However, in our case, further studies are needed to quantify the costs of a plant-based food basket versus a meat-based food basket as studies suggest the former is significantly associated with lower food expenditure than the latter (Pais et al., 2022). If plant-based diets turn out to be cheaper than meat-based diets, then interventions linking health and sustainability benefits and food affordability might promote uptake of plant-based diets. Lack of knowledge on plant-based diets was the second most cited barrier, consistent with findings by Mäkinen and Vainio (2014) and Lea and Worsley (2003). In a study of consumers' perceptions of diets in Germany, Polleau and Biermann (2021) found that the consumers underestimated the environmental and health-benefits of meat-free diets, suggesting a knowledge gap which potentially constrained uptake of plant-based diets. Other barriers reported in this study have also been reported in studies elsewhere including perceived difficulty in changing from a meat-based lifestyle, enjoyment of meat or meat cravings (Menzies and Sheeshka, 2012), inconvenience of vegetarian diets (Barr and Chapman, 2002), dislike of plant-based diet food taste and perceived limited nutritional value of vegetarian diets (Barr and Chapman, 2002). Bryant (2019) summarizes the three consistent negative beliefs about vegetarian diets – as “difficult, expensive, and not enjoyable.”

For example, Modlinska et al. (2020) found that the eating habits of the family played a large role in whether someone could maintain a vegetarian diet. In other words, there may be family related constraints in adopting a vegetarian diet given the costs and inconvenience of cooking different dishes. Barr and Chapman (2002) found that health consideration was the primary reason why some study participants who had initially followed a plant-based diet returned to meat-based diets. This is plausible as plant-based diets have been linked to anemia, B-12 deficiencies, and other health-related problems for some people (Pawlak et al., 2018). Other institutional constraints such as lack of diverse meal options for vegetarian diets have been reported elsewhere. Taken together, the barriers are in line with findings elsewhere and suggest that understanding them might inform potential interventions for encouraging the uptake of plant-based diets within universities and beyond. For example, getting feedback from students regarding taste

of plant-based diets on offer in dining halls might allow improvement of plant-based meals on offer and increase their uptake by students. Providing more information on plant-based diets and tasty recipes for off campus students can be used to guide their food basket and address constraints relating to lack of knowledge and perceived inconvenience of plant-based diets. Other barriers related to high costs would require collective efforts between universities and other actors such as local supermarkets and government to support increased supply of affordable plant-based products. Indeed, these barriers are cross cutting, suggesting that interventions should be broad enough to encourage a plant-based lifestyle on campus.

Much of the literature on barriers to plant-based diets looks at the values that people have, and how that may prevent them from following a plant-based diet. For example, people with more conservative values are less likely to follow a plant-based diet (Dietz et al., 1995; Lindgren, 2020; Stanley, 2022). According to Ruby and Heine (2011) vegetarians report greater concern for environmental issues and are less likely to support social hierarchies. The negative correlation that yielded between authority and following a plant-based diet suggest that individuals who have an affinity towards self-enhancement values are less likely to consider environmentally sustainable lifestyle choices such as following a plant-based diet. The positive correlations between plant-based diet and values related to environment concern suggest that individuals who value the environment are likely to be receptive to lifestyle changes such as shifts to plant-based diets. For example, according to Ruby et al. (2013) vegetarians are generally more concerned about the impact of their daily food choices on animal welfare and the environment.

Conclusion

The prevalence, motivation and barriers regarding plant-based diets found in this study suggest similarities with findings elsewhere. Though the high number of flexitarians found in this study tends to elevate the number of respondents categorized as following a plant-based diet, encouraging a substantial proportion of people to consider plant-based diets as part of broader meal choices can have the desired effect of reducing meat and dairy intake, and in turn, the negative environmental impacts of food systems. Given the multiple reasons for following meat-based diets, it might seem unreasonable to advocate for vegan or vegetarian diets only. Rather, flexitarianism should be encouraged as it forms the middle ground between vegans and omnivores and can avoid defensiveness against plant-based diets. Another key point that advances literature on plant-based food preferences and choices, is that while plant-based diets tend to be framed primarily based on environmental sustainability benefits, the main motivation for following plant-based diets among the participants was animal welfare rights. Thus, making explicit, the links between plant-based diets and the values considered important by people, e.g., animal welfare, environmental concern, personal health and monetary savings can encourage uptake of plant-based diets. Central to efforts for encouraging uptake of plant-based diets is addressing barriers via interventions such as campaigns at universities and increasing plant-based food options in canteens. In a nutshell, university managers who are responsible for promoting campus

sustainability should recognize the heterogeneity of motivations and barriers regarding plant-based diets to provide tailored interventions. At a broader level, addressing some constraints that are beyond the control of universities, will likely require collaboration between the university, local retailers and government and local food providers. An understanding of the motivations and barriers of consuming a plant-based diet will allow the implementation of strategies to influence values related to plant-based diets and change in dietary behavior. Future studies should focus on prevalence, motivations, and barriers to plant-based diets in the broader society to provide a complete picture of the situation in South Africa. With a growing meat demand, promoting plant-based diets might contribute towards broader environmental efforts for a reduced carbon footprint.

Data availability statement

The datasets presented in this article are not readily available because there are restrictions on data access in line with the Rhodes University ethics protocol. Requests to access the datasets should be directed to janet.hayward@ru.ac.za.

Ethics statement

The studies involving humans were approved by Rhodes University Human Research Ethics Committee. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written and oral informed consent to participate in this study. Written and oral informed consent was obtained from the individual(s) for the publication of any potentially identifiable images or data included in this article.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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