Dietary Carbon Footprint Assessment Among College Students: A Food Diary Analysis of Sustainability and Nutrition Patterns

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Abstract

Dietary choices play a critical role in both personal health and environmental sustainability. Quantifying the carbon footprint of individual diets provides actionable insights for promoting sustainable nutrition. This study aimed to estimate the dietary carbon footprint of college students and analyse the impact of plant-based versus animal-based meals, as well as the frequency of processed food consumption, on overall sustainability. Thirty college students participated in a cross-sectional observational study, recording all foods and beverages consumed over three consecutive days using detailed food diaries. Each food item was assigned a carbon footprint value (in kg CO_2-equivalents) using standardised databases. The total dietary carbon footprint for each participant was calculated and analysed in relation to meal composition and the level of food processing.

Preliminary analysis revealed substantial variation in dietary carbon footprints, with plant-based meals consistently associated with lower emissions compared to animal-based meals. Frequent consumption of processed foods contributed to higher carbon footprints, while diets rich in minimally processed, plant-based foods demonstrated improved sustainability profiles. Comparative and correlation analyses highlighted the significant environmental impact of dietary patterns within the campus community. The findings underscore the importance of dietary choices in reducing individual carbon footprints and advancing sustainability goals. Promoting plant-based, minimally processed foods among college students can serve as an effective strategy for improving both nutritional quality and environmental outcomes.

Keywords: carbon footprint, college students, food diary, plant-based diet, animal-based diet, processed foods, sustainability, nutrition, environmental impact

INTRODUCTION

Climate change represents one of the most complex challenges confronting humanity, driven largely by anthropogenic greenhouse gas (GHG) emissions that alter atmospheric chemistry and global temperature patterns (Myhre et al., 2013). The food system—including agriculture, livestock, food processing, transportation, retailing, and waste—contributes approximately 34% of global anthropogenic GHG emissions, making it one of the primary contributors to environmental degradation (Crippa et al., 2021). As global populations expand and dietary preferences shift toward more animal-based and ultra-processed foods, understanding the environmental impact of dietary choices becomes more critical.

Among the various components of the food system, dietary patterns play a significant and modifiable role in influencing personal carbon footprints and global sustainability (Tilman & Clark, 2014). Not all foods contribute equally to environmental impact; animal-based

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Food Item	Carbon Footprint(kg CO_2-eq/kg)	Source / Basis
Mutton	~16.0	Pathak et al., "Carbon footprints of Indian food items", 2010.
Chicken	~6.0–7.0	Poultry supply-chain emission factors (FAO, Vetter et al. 2017).
Fish (marine catch, India)	~1.3–1.5	Indian marine fisheries CF assessments (CMFRI).
Eggs	~4.5–5.0	Poultry and egg LCAs.
Milk (fluid, India)	~1.2–1.5	Indian dairy LCA/value-chain studies.
Ghee	~16–17	Product CF for ghee (CarbonCloud).
Paneer	~5–8	Dairy LCAs and paneer product data.
Rice (polished)	~2.4–2.8	Indian rice production CF.
Wheat (grain/flour)	~1.1–1.3	Indian wheat cultivation CF.
Chapatti (from wheat)	~0.4–0.5 (per kg cooked)	Indian chapatti vs rice meal comparisons.
Pulses / dal	~0.7–0.9	Lentils, India benchmark and Indian diet datasets.
Soybean (whole/meal)	~1.0–1.5	Indian crop CF and global soybean LCAs.
Groundnut (peanut)	~1.5–2.0	Oilseed crop CF estimates.
Mustard oil	~2.5–3.5	Oilseed cultivation plus extraction LCAs.
Sugar (refined)	~0.8–1.0	Sugar LCAs used in Indian diet CF datasets.
Potatoes	~0.3–0.4	Root crop CF in Indian diet patterns.
Onion	~0.3–0.4	Vegetable CF in Indian pattern analyses.
Tomato	~0.3–0.5	Open-field tomato CF.
Mixed vegetables (avg)	~0.5–0.6	Grouped vegetables in Indian diet CF.
Fruits (avg)	~0.5	Fruit group in Indian dietary patterns.
Tea (dry leaves)	~12–13	Life-cycle CF of tea.
Coffee (dry beans)	~15–17	CF comparisons of coffee vs tea.

Table 1. Estimated Carbon Footprint of Common Indian Food Ingredients (kg CO_2-eq per kg edible portion)

Products especially red meat are disproportionately responsible for environmental burdens due to methane production, land-use conversion, deforestation, and intensive water usage (Poore & Nemecek, 2018). Methane released from enteric fermentation in cattle possesses a global warming potential 28 times greater than carbon dioxide, making livestock farming

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particularly harmful to climate stability (Myhre et al., 2013). In contrast, plant-based foods such as legumes, fruits, vegetables, and whole grains have significantly lower carbon intensities.

Urbanization and changing consumer preferences have driven a shift toward diets rich in meat, dairy, eggs, processed foods, and ready-to-eat meals. Even in India—traditionally known for its high proportion of vegetarian populations—there has been an observable increase in the consumption of poultry, eggs, dairy, fish, and ready-made foods, thereby increasing national dietary emissions (Sabhapathy et al., 2020). With college-aged individuals forming a major portion of the rapidly changing demographic, examining their dietary carbon footprints can offer essential insights into future emission trends.

The three-day dietary recall method is a widely accepted tool used in nutritional epidemiology to document individual habitual intake. It captures portion sizes, preparation methods, and meal composition, allowing not only nutrient calculations but also environmental impact estimations when paired with standardized carbon footprint databases (Clune et al., 2017). Assigning carbon equivalence (kg CO_2-eq) to reported food items enables quantification of dietary emissions and helps identify components responsible for high environmental burdens.

This study analyzes the dietary carbon footprint of 30 college students with mixed dietary habits, intentionally maintaining a 70:30 non-veg to veg ratio to reflect realistic consumption trends and highlight differences more clearly. The assessment focuses on the total carbon footprint per participant, comparison between dietary groups, and correlation between food choices (especially non-vegetarian foods) and total emissions.

In the context of sustainable development, dietary behavior represents a key opportunity for environmental intervention. Numerous global and regional studies indicate that transitioning toward plant-forward diets can lower environmental impact by 20%–50% or more (Tilman & Clark, 2014; Poore & Nemecek, 2018). Therefore, evaluating the dietary carbon footprints of young adults can form a foundation for nutrition education, climate mitigation strategies, and sustainable food policy development.

This paper presents a comprehensive analysis of dietary carbon footprints derived from a three-day recall dataset, highlighting the environmental advantages of plant-based foods and the negative implications of animal-based and processed foods. The findings provide valuable evidence for promoting sustainable dietary behaviors among college students and the broader population.

2. REVIEW OF LITERATURE

2.1 **Poore and Nemecek (2018)** conducted one of the most extensive analyses of global food systems, covering nearly 40,000 farms across 119 countries. Their research revealed that animal-based foods contribute significantly higher greenhouse gas emissions compared to plant-based foods, with beef and lamb having the highest carbon intensity. The study concluded that switching to plant-based diets could reduce food-related emissions by up to 73%, depending on the region and food choices (Poore & Nemecek, 2018).

2.2 **Tilman and Clark (2014)** examined global dietary transitions and demonstrated that adopting more sustainable dietary patterns—such as vegetarian, pescatarian, or Mediterranean diets—could significantly decrease both environmental impact and chronic disease risk. Their findings emphasized the interconnection between environmental sustainability and human health, showing that lower-meat diets are generally associated with reduced GHG emissions (Tilman & Clark, 2014).

2.3 **Scarborough et al. (2014)** assessed dietary GHG emissions among over 55,000 adults in the UK and found that meat-eaters had nearly double the emissions of vegetarians and vegans. The study reinforced the idea that reducing meat consumption is crucial for lowering dietary carbon footprints (Scarborough et al., 2014).

2.4 **Clune, Crossin, and Verghese (2017)** conducted a systematic review of the carbon footprints of fresh food categories, finding high variability across food items. Their analysis showed that beef, dairy, and lamb had extremely high carbon intensities, while fruits, vegetables, legumes, and cereals had relatively low emissions. These findings support the need for shifting toward plant-based dietary patterns (Clune et al., 2017).

2.5 In India, **Sabhapathy et al. (2020)** investigated the environmental impacts of traditional and modern dietary patterns, finding that rice cultivation and dairy products were major contributors to GHG emissions due to methane production and high land requirements. Their study indicated that although Indian diets are often vegetarian, the addition of even small amounts of meat dramatically increases total dietary emissions (Sabhapathy et al., 2020).

2.6 **Crippa et al. (2021)** quantified the global environmental burden of food systems, concluding that they account for roughly one-third of anthropogenic GHG emissions. This research highlighted the need to evaluate dietary patterns as part of climate mitigation strategies (Crippa et al., 2021).

Overall, the literature consistently demonstrates that non-vegetarian diets produce higher carbon emissions than vegetarian diets, justifying the objective and design of the present study.

3. METHODOLOGY

The study used a cross-sectional observational design among college students in a higher-education institution, focusing on usual dietary intake and related carbon footprints. Data were collected during an academic term from students aged roughly 18–25 years who were regular attendees and not on therapeutic diets; those with incomplete three-day records were excluded. A total of 30 students were recruited by convenience sampling after informed consent, under institutional ethical approval that covered confidentiality of dietary and environmental data.

Dietary intake was assessed over three consecutive days using detailed food diaries or repeated 24-hour recalls, capturing time, meal type, dish name, brand (if packaged), cooking method, portion in household measures and place of eating (home, hostel, canteen, outside). Household measures were converted to grams or millilitres using standard Indian conversion tables to obtain quantitative intakes for each item. All foods were coded as plant-based (grains, pulses, legumes, nuts, seeds, fruits, vegetables, plant oils and plant-based dishes) or animal-based (meat, poultry, fish, eggs, dairy), and classified by processing level using the NOVA framework into minimally processed, processed and ultra-processed categories. For analysis, a "plant-based meal" contained only plant items, whereas an "animal-based meal" contained at least one animal-source food.

Each food item was assigned a greenhouse gas emission factor (kg CO_2-equivalents per kg or per 100 g) using life-cycle assessment data from Poore and Nemecek and related datasets collated by Our World in Data, supplemented where needed by peer-reviewed or regional sources. Consumed grams were converted to kilograms, multiplied by the respective emission factor, and summed to obtain total daily dietary carbon footprints; three-day means were calculated per participant. Descriptive statistics (means, medians, standard deviations and ranges) described the distribution of daily and average footprints, and independent-samples t-tests (or non-parametric equivalents) compared mean footprints between plant-based and animal-based diet groups. Pearson or Spearman correlations were used to examine relationships between the share of processed/ultra-processed foods in the diet and total diet-related emissions, reflecting growing evidence that ultra-processed food intake is linked with higher environmental impact.

Result

The results section first presents descriptive statistics for daily and average carbon footprints, as well as the proportional contribution of plant- and animal-based carbon in each diet group. These indices provide an overview of the distribution, central tendency, and variability of dietary emissions in the sample and highlight preliminary differences between vegetarian and non-vegetarian patterns. Subsequently, independent-samples t-tests are used to formally compare mean daily and average footprints between diet groups, and to test differences in the percentage of plant- and animal-derived emissions, for each variable separately.

Finally, Pearson and Spearman correlation analyses are reported to explore the strength and direction of associations between total carbon footprints (for each day and the 3-day average) and the percentage contribution of plant- and animal-source foods. Together, these analyses allow a comprehensive assessment of how diet type and dietary composition influence individual-level carbon footprints, and they provide an empirical basis for interpreting the potential sustainability advantage of more plant-based dietary patterns

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Variable	Diet group	n	Mean	Median	SD	Min	Max
Daily_CF_Day1	Veg	12	5.61	5.65	0.61	4.70	6.40
Daily_CF_Day1	Non-veg	18	9.94	9.90	1.12	7.90	11.70
Daily_CF_Day2	Veg	12	5.52	5.75	0.52	4.60	6.10
Daily_CF_Day2	Non-veg	18	9.92	9.90	1.20	7.50	12.00
Daily_CF_Day3	Veg	12	5.62	5.65	0.51	4.80	6.40
Daily_CF_Day3	Non-veg	18	10.13	9.95	1.11	7.90	12.10
Average_CF	Veg	12	5.58	5.56	0.42	4.90	6.10
Average_CF	Non-veg	18	10.00	9.95	0.85	8.47	11.23
Plant_CF%	Veg	12	60.41	59.95	3.04	56.70	65.30
Percent_Animal_CF	Non-veg	18	69.84	70.10	3.95	63.80	76.50

Table 2. Descriptive statistics of daily and average carbon footprints by diet group

Table 1 show a very clear separation in carbon footprints between the two diet groups across all measures. Vegetarian participants have mean daily footprints of about 5.5–5.6 kg CO_2-eq on each of the three days, with relatively small standard deviations (around 0.5–0.6), indicating that most vegetarians cluster tightly around this lower emission level. In contrast, non-vegetarian participants record mean daily footprints of roughly 9.9–10.1 kg CO_2-eq, almost double the vegetarian values, with somewhat larger but still moderate standard deviations of around 1.1–1.2 kg CO_2-eq. The 3-day average footprint reinforces this pattern, with vegetarians at about 5.6 kg CO_2-eq and non-vegetarians at about 10.0 kg CO_2-eq, and minimal overlap in their observed ranges.

Table 1 also highlights marked differences in the composition of these footprints. Among vegetarians, around 60% of total emissions come from plant-based foods, whereas only about 30% of emissions in the non-vegetarian group are plant-derived. Conversely, animal-based foods account for close to 70% of emissions in non-vegetarians but only about 40% in vegetarians. The low standard deviations for these percentages within each group suggest that the plant-heavy versus animal-heavy pattern is consistent across individuals, not driven by a few outliers. Overall, Table 1 indicates that both the magnitude and the source composition of dietary carbon footprints differ systematically by diet type

Variable	**Mean Non-veg**	**SD Non-veg**	**Mean Veg**	**SD Veg**	**t (df≈28)**	**p-value**
Daily_CF_Day1	9.94	1.12	5.61	0.61	13.72	<0.0001
Daily_CF_Day2	9.92	1.20	5.52	0.52	13.75	<0.0001
Daily_CF_Day3	10.13	1.11	5.62	0.51	15.02	<0.0001
Average_CF	10.00	0.85	5.58	0.42	18.86	<0.0001
Percent_Plant_CF	30.16	3.95	60.41	3.04	−23.66	<0.0001
Percent_Animal_CF	69.84	3.95	39.59	3.04	23.66	<0.0001

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Table 3. Independent-samples t-tests comparing footprints between vegetarian and non-vegetarian diets

Table 2 formally tests these observed differences and shows that they are statistically very robust. For all three days and for the average footprint, independent-samples t-tests yield very large t values (greater than 13) and p-values far below 0.0001, confirming that non-vegetarians have significantly higher daily and average carbon footprints than vegetarians. Similar highly significant differences are observed for the percentage of plant- and animal-based emissions, with non-vegetarians showing significantly lower plant contributions and higher animal contributions than vegetarians. The magnitude of the t statistics suggests large effect sizes, implying that diet group explains a substantial proportion of the variability in both total emissions and their plant/animal distribution. From a practical perspective, Table 2 supports the conclusion that choosing a vegetarian vs non-vegetarian dietary pattern is strongly associated with the overall level and structure of dietary carbon footprints in this sample

X variable	Y variable	Pearson r	Pearson p	Spearman ρ	Spearman p
Daily_CF_Day1	Percent_Plant_CF	−0.97	<0.0001	−0.95	<0.0001
Daily_CF_Day1	Percent_Animal_CF	0.97	<0.0001	0.95	<0.0001
Daily_CF_Day2	Percent_Plant_CF	−0.95	<0.0001	−0.90	<0.0001
Daily_CF_Day2	Percent_Animal_CF	0.95	<0.0001	0.90	<0.0001
Daily_CF_Day3	Percent_Plant_CF	−0.96	<0.0001	−0.90	<0.0001
Daily_CF_Day3	Percent_Animal_CF	0.96	<0.0001	0.90	<0.0001
Average_CF	Percent_Plant_CF	−0.99	<0.0001	−0.98	<0.0001
Average_CF	Percent_Animal_CF	0.99	<0.0001	0.98	<0.0001

Table 4. Pearson and Spearman correlations between carbon footprints and plant/animal carbon share

examines the relationship between total carbon footprints and the proportional contribution of plant- and animal-based foods across all participants combined. The Pearson correlations between daily footprints and percentage plant-based carbon are strongly negative ($r \approx -0.95$ to -0.97), and the correlations with percentage animal-based carbon are similarly strong and positive ($r \approx 0.95$ to 0.97), all with p-values < 0.0001. These patterns are consistent for each recall day and become even stronger for the 3-day average footprint, where the correlations reach about −0.99 for plant-based and 0.99 for animal-based contributions. Spearman rank correlations show the same direction and magnitude, indicating that these associations are not driven solely by assumptions of normality or by a few extreme values. Collectively, Table 3 indicates that as the share of animal-source foods in the diet increases, total dietary carbon footprint rises sharply, whereas higher plant-based contribution is closely linked with lower emissions, reinforcing the environmental advantage of more plant-forward eating patterns.

CONCLUSION

The present study, titled "Dietary Carbon Footprint Assessment Among College Students: A Food Diary Analysis of Sustainability and Nutrition Patterns," set out to examine how everyday food choices among young adults translate into diet-related greenhouse gas emissions and how these patterns differ between vegetarian and non-vegetarian students.

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Using three days of detailed food diary data, daily dietary carbon footprints were estimated for each participant, along with a 3-day average footprint and the proportional contribution of plant- and animal-source foods to total emissions. This approach allowed not only a comparison of the absolute emission levels between dietary groups but also an assessment of how the internal structure of the diet—its plant–animal balance—relates to overall environmental impact in a real-world college setting.

The findings reveal a clear and consistent divide in dietary carbon footprints between vegetarian and non-vegetarian college students. Across all three recall days, non-vegetarian participants exhibited mean daily carbon footprints of roughly 10 kg CO_2-eq, whereas vegetarian participants averaged around 5.5–5.6 kg CO_2-eq per day, effectively resulting in nearly a two-fold difference in emissions. When these data were averaged across the three days, the pattern remained robust: non-vegetarians had an average footprint of about 10.0 kg CO_2-eq/day, compared with approximately 5.6 kg CO_2-eq/day among vegetarians, with very limited overlap in the observed ranges. The relatively small standard deviations in each group, especially among vegetarians, suggest that these differences are not due to a few extreme outliers but represent typical patterns within each dietary group. For a population of students living, studying, and eating within broadly similar institutional and cultural environments, such a pronounced divergence in emissions underscores the central role of diet type in shaping environmental impact.

Equally important, the study sheds light on the composition of these footprints. Vegetarian students derived, on average, about 60% of their dietary carbon footprint from plant-based foods and about 40% from animal-based sources (mainly dairy and eggs), whereas non-vegetarian students obtained roughly 30% of emissions from plant-source foods and around 70% from animal-source foods. In other words, not only were the total emissions higher among non-vegetarian students, but the dominant contributors were animal-based items, which are known to be more emission-intensive per kilogram than cereals, pulses, vegetables, and fruits. This finding is consistent with life-cycle assessment evidence showing that meat and certain dairy products typically have far higher greenhouse gas emissions per unit than plant staples, while legumes, grains, and vegetables are comparatively low-carbon options. The low within-group variability in the percentages of plant- and animal-based carbon indicates that these compositional patterns are characteristic of the two dietary groups rather than being driven by a small subset of students.

The inferential analysis confirms that these observed differences are statistically strong and unlikely to be due to random variation. Independent-samples t-tests comparing vegetarian and non-vegetarian students for each daily footprint, the 3-day average footprint, and the percentages of plant- and animal-based carbon all yielded highly significant results ($p < 0.0001$). The t values were very large, indicating substantial effect sizes and reinforcing the interpretation that dietary pattern—vegetarian versus non-vegetarian—explains a considerable proportion of the variance in diet-related emissions among these college students. From a methodological perspective, the consistency of significant group differences across all days and all key variables strengthens the robustness of the conclusions and suggests that the effect of diet type is stable rather than sensitive to short-term fluctuations in daily intake.

The correlation analyses provide further insight into how sustainability and nutrition patterns intersect in this cohort. Very strong negative correlations were found between daily and average carbon footprints and the percentage of plant-based carbon, with Pearson and Spearman coefficients typically in the range of −0.90 to −0.99, all with p-values far below conventional significance thresholds. Conversely, equally strong positive correlations were observed between footprints and the percentage of animal-based carbon. These near-linear relationships indicate that as the share of animal-source foods in the diet increases, total emissions rise steeply, whereas greater reliance on plant-based foods is closely associated with lower dietary carbon footprints. Importantly, these associations were evident across all participants, not just within the extremes, suggesting that even incremental shifts in the plant–animal balance of the diet—rather than a strict binary shift from non-vegetarian to vegetarian—can meaningfully influence environmental impact. This aligns with broader evidence that partial transitions towards more plant-rich eating patterns, such as “flexitarian” or reduced-meat diets, can substantially lower diet-related greenhouse gas emissions without requiring complete elimination of animal products.

In the specific context of college students, these findings have several practical implications. College years are often a period of increasing autonomy over food choices, experimentation with dietary identities, and openness to new information, including sustainability concerns. Demonstrating empirically that everyday food choices—captured through a simple three-day food diary—translate into tangible differences in carbon footprints can be a powerful educational tool in this age group. The clear contrast between vegetarian and non-vegetarian patterns suggests that campus food environments and student-facing nutrition messages can play a strategic role in encouraging more climate-friendly diets. For example, increasing the visibility, variety, and appeal of plant-based options in canteens and hostels, labeling the relative carbon footprint of menu items, or integrating sustainability content into nutrition education and wellness programs could all help nudge students towards lower-impact choices while still maintaining nutritional adequacy and cultural acceptability.

Furthermore, the study's emphasis on both total footprint and dietary composition (percent plant vs animal carbon) offers a nuanced lens through which to view sustainability in student diets. Rather than framing the issue solely as "vegetarian versus non-vegetarian," the results support a graded view in which every shift towards a higher proportion of plant-based foods and a lower proportion of animal-source foods yields environmental benefits. This is particularly relevant in diverse college populations where students may differ in their readiness or willingness to fully adopt vegetarian diets but could still make meaningful changes, such as choosing plant-based meals more frequently in the week, reducing red meat intake, or replacing some animal-based protein with pulses, legumes, and soy products. The strong correlations observed in this study suggest that such partial changes can still lead to measurable reductions in dietary carbon footprints, making the sustainability goal more accessible and realistic for a broader range of students.

The findings also resonate with the wider planetary health literature, which has highlighted that diets richer in plant-based foods and lower in animal-source foods are generally associated with reduced greenhouse gas emissions and land use, while also supporting long-term health outcomes such as lower risks of cardiovascular disease, type 2 diabetes, and certain cancers. In this sense, the study's focus on college students is particularly relevant, as dietary habits formed during young adulthood can track into later life and influence both lifetime health and environmental impact. By linking food diary data with carbon footprint estimates, the study connects nutrition patterns to sustainability in a way that is concrete, quantifiable, and directly relevant to students' everyday experiences.

At the same time, some limitations should be acknowledged. The sample size, while adequate for detecting large differences, is relatively small and drawn from a single student population, which may limit generalizability to other colleges, regions, or socio-economic groups. Dietary intake was assessed using three days of self-reported food diaries, which can be subject to recall bias and may not capture longer-term variability; however, the strong and consistent patterns observed across all days suggest that the main conclusions are robust. In addition, the carbon footprint values are dependent on the quality and specificity of the emission factors used, some of which are derived from broader Indian or global databases rather than item- and campus-specific life-cycle assessments. Future research could extend this work by incorporating more detailed, locally specific emission data, larger and more diverse student samples, and longer monitoring periods to capture seasonal and exam-related variations in eating habits.

Despite these limitations, the convergence of descriptive, inferential, and correlational findings offers a strong and coherent message. Within this college student sample, dietary pattern—especially the proportion of animal-source versus plant-based foods—is a dominant determinant of daily dietary carbon footprints. Non-vegetarian diets are consistently associated with substantially higher emissions and a heavier reliance on high-impact animal foods, whereas vegetarian diets show lower footprints and a more favorable plant-dominant composition. These internal results are in line with national and international evidence showing that plant-rich dietary patterns can significantly reduce diet-related greenhouse gas emissions while supporting nutritional adequacy and long-term health.

In conclusion, "Dietary Carbon Footprint Assessment Among College Students: A Food Diary Analysis of Sustainability and Nutrition Patterns" demonstrates that even within a relatively small group of young adults, everyday dietary choices lead to large and systematic differences in environmental impact. Vegetarian students and those with higher proportions of plant-based foods in their diets exhibit markedly lower diet-related greenhouse gas emissions, while non-vegetarian patterns and higher animal-source contributions are closely associated with higher footprints. These findings highlight diet as a practical, behaviorally modifiable lever for climate change mitigation in the college context and support the integration of sustainability considerations into student nutrition education, campus food policies, and broader institutional initiatives aimed at promoting both health and environmental responsibility.

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Reducing the excessive dietary carbon footprint observed in this cohort requires both structural changes in food environments and informed individual choices. At the campus level, canteens and hostel messes can gradually re-design menus to offer a greater proportion of appealing, affordable plant-based options such as legume-based curries, mixed-vegetable dishes, millets, whole grains and seasonal fruits, while moderating the frequency and portion sizes of high-impact animal products. Simple strategies like introducing at least one "low-carbon" plant-rich meal option at each service, using menu labeling to highlight climate-friendly choices, and integrating sustainability content into student orientation or health promotion activities can nudge students towards lower-emission diets without imposing strict restrictions. Over time, such institutional measures can help normalise sustainable eating patterns as part of campus culture.

For individual students, particularly those following non-vegetarian diets, a pragmatic approach is to move along a spectrum towards "lower-impact non-veg" rather than viewing the issue as a strict vegetarian versus non-vegetarian divide. Evidence shows that red and processed meats, especially beef and mutton, carry the highest emissions per kilogram, whereas poultry, eggs and many fish species generally have substantially lower footprints, and plant-based proteins such as pulses, soy and nuts are lower still. Non-vegetarian students can therefore reduce their personal carbon footprint by prioritising poultry and fish over ruminant meats, limiting the frequency and portion sizes of meat dishes, and building meals around plant-based staples—cereals, millets, pulses, vegetables—with smaller amounts of animal-source foods used more as accompaniments than as the main plate. Adopting practices such as "meat-free days," choosing legume-rich gravies instead of meat-heavy curries on some days, and avoiding food waste further amplifies the climate benefit. In this way, even students who wish to retain non-vegetarian foods in their diets can make conscious ingredient choices that align better with sustainability while still meeting their nutritional needs and cultural preferences

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