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## A STUDY ON ASSOCIATION BETWEEN PLANT-BASED DIET INDICES AND MENTAL HEALTH AMONG YOUNG ADULTS

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### Abstract

Plant-based diets are often associated with various health benefits. Depression, anxiety and stress are currently the most common mental health issues among young adults. The present study was conducted- (i) to assess the awareness and perceptions of young adults on plant-based diet (ii) to determine the association of the 3 plant-based diet indices i.e., Overall plant-based diet index (PDI), Healthful plant-based diet index (hPDI) and Unhealthful plant-based diet index (uPDI) with depression, anxiety and stress and (iii) to assess the willingness and intentions to adopt a plant-based diet post-intervention. In this study, a validated semi-quantitative food frequency questionnaire (FFQ) was used to assess the dietary intake and Depression, Anxiety and Stress Scale – 21 (DASS-21) was used to assess the mental health status. Plant-based diet indices were significantly associated with stress and anxiety.

**Keywords:** Diet Index, Food Frequency, Mental Health, Nutrition and Plant-Based Diet.

### Introduction

Over the last few years, plant-based diets have gained huge popularity for both their health benefits and environmental benefits. Consuming more of plant derived foods with minimal consumption of animal foods is beneficial for health as well as the planet. A plant-based diet is – “A healthy diet that encourages consumption of plant-derived foods like fruits, vegetables, whole grains, peas, lentils, nuts and seeds in large quantities while minimizing the consumption of processed foods and animal foods (including dairy products)”.

The health benefits of a plant-based diet include decreased risk of- diabetes <sup>[1]</sup>, heart diseases <sup>[2]</sup>, mortality <sup>[3]</sup>, weight loss <sup>[4]</sup>, cancer <sup>[5]</sup> and increased immunity <sup>[6]</sup>. The health benefits are mainly attributed to lower consumption of animal foods as consuming a plant-based diet results in a low-fat diet when compared to meat eaters. Plant-based diets when compared to diets rich in animal products are considered to be more sustainable as they require less land, water and energy resources, and produce fewer greenhouse gas emissions than animal-based products, hence less taxing on the environment <sup>[7,8]</sup>.

### Review of Literature

A study conducted by Pramil N Singh et.al., (2003) reveals that Lifestyle pattern that includes a very low meat intake is associated with greater longevity. Findings raise the possibility that meat intake, particularly processed meats, is a dietary risk factor for diabetes (Arnold Vang et.al., 2008).

Peter S et.al., 2014 reveal that dietary greenhouse gas emissions in self-selected meat-eaters are approximately twice as high as those in vegans. It is likely that reductions in meat consumption would lead to reductions in dietary GHG emissions. Studies also reveal that higher adherence to healthy plant-based diets and a vegetarian diet was associated with favourable kidney disease outcomes. (Hyunju Kim et.al., 2019) and diets higher in plant foods and lower in animal foods were associated with a lower risk of cardiovascular morbidity and mortality in a general population (Hyunju Kim et.al., 2019).

### Hypothesis

- Hypothesis 1 (H1)- Each Plant-based diet score differs significantly with the mental health status.
- Hypothesis 2 (H2) - Each Plant-based diet score differs significantly with BMI.
- Hypothesis 3 (H3)- Awareness and perceptions on plant-based diet change significantly post-intervention.

### Relevance of The Study

The environmental degradation and climate change happening at global level is ground-shaking. Studies have revealed that there's a strong correlation between climate change and the production of animal-based foods. One of the effective ways to slow down environmental hazard is to lead a more sustainable lifestyle of which diet plays a crucial role. Switching to a plant-based diet can decrease water footprint, animal exploitation, preserve natural resources, reduce food-related emission of greenhouse gases by up to



70% and most of all improve health. This study was conducted to check if there is any association between a plant-based diet and mental health status.

**Methodology**

**Study design:**This study is an observational-intervention study. The data on awareness, perception and mental health status was collected using the respective questionnaires. Intervention was conducted online, which included a detailed explanation on plant-based diet, health benefits, environmental benefits, plant-based food pyramid, nutrients to consider and kitchen replacements. As part of the intervention a self-designed plant-based diet guide was given to participants with detailed information on Plant-based diet, do’s and don’ts, tips to start a plant-based diet along with 30 simple plant-based recipes. The participants who attended the intervention were asked to fill-in the awareness and perception questionnaire again post intervention to evaluate the change.

**Study population:**Data for the current study is obtained data from a total of 260 young adults comprising of 168 female and 92 male participants aged 18-35 years. 80 participants were part of the intervention.

**Study instrument:** A validated FFQ was used to collect dietary data, DASS-21 scale was used to collect data on mental health status. A self-designed pre-tested questionnaire was used to collect data on awareness and perceptions on plant-based diet. A self-designed Plant-based diet guide was given as handout post-intervention.

**Statistical analysis:**Mean with the respective Standard Deviation (SD) and percentages were used wherever necessary. The analysis was performed using IBM SPSS 25.0 If data is normal, tests like Student’s t-test and ANOVA were used as required and for non-normal data, non-parametric tests were used (Wilcoxon Signed Ranks Test, Mann-Whitney Test) were used as required. The level of significance was P < 0.05.

**Results**

Awareness and perception pre- and post-intervention (Fig 1)

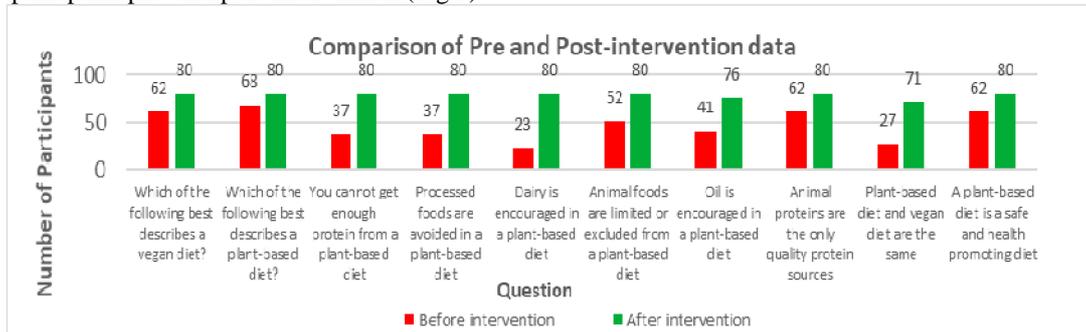


Fig 1: Comparison of Pre and Post intervention awareness and perception  
Table 1: Comparison of change in awareness and perception on a plant-based diet

|                   | Median (range) | p-value |
|-------------------|----------------|---------|
| Pre-intervention  | 6 (2-10)       | 0.000   |
| Post-intervention | 10 (8-10)      |         |

As the p value is 0.00 (≤ 0.05) we can conclude that there is a significant change in awareness and perception on plant-based diet.

Table 2: Significance between plant-based diet indices, baseline characters and mental health

|        | N           | Overall plant-based diet index (PDI) |               | Healthful plant-based diet index (hPDI) |               | Unhealthful plant-based diet index (uPDI) |               |       |
|--------|-------------|--------------------------------------|---------------|---|---------------|---|---------------|-------|
|        |             | Mean (SD)                            | p-value       | Mean (SD)                               | p-value       | Mean (SD)                                 | p-value       |       |
| Gender | Male        | 92                                   | 58.05 (2.588) | 0.64                                    | 51.47 (0.263) | 0.441                                     | 41.75 (0.806) | 0.712 |
|        | Female      | 168                                  | 57.97 (2.589) |   | 51.46 (0.278) |   | 41.74 (0.793) |       |
| Age    | 18-23 years | 219                                  | 58.03 (2.588) | 0.911                                   | 51.47 (0.272) | 0.858                                     | 41.75 (0.795) | 0.939 |
|        | 24-29 years | 29                                   | 57.87 (2.709) |   | 51.44 (0.286) |   | 41.70 (0.860) |       |
|        | 30-35 years | 12                                   | 57.74 (2.374) |   | 51.43 (0.259) |   | 41.68 (0.700) |       |
| BMI    | Normal      | 123                                  | 57.84 (2.624) | 0.309                                   | 51.46 (0.276) | 0.422                                     | 41.70 (0.804) | 0.37  |
|        | Overweight  | 72                                   | 58.39 (2.648) |   | 51.50 (0.284) |   | 41.86 (0.822) |       |



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|            |                      |     |               |       |               |       |               |       |
|------------|----------------------|-----|---------------|-------|---------------|-------|---------------|-------|
|            | Obese                | 65  | 57.87 (2.424) |       | 51.44 (0.251) |       | 41.70 (0.748) |       |
| Are you a  | Vegetarian           | 55  | 57.71 (2.568) | 0.34  | 51.46 (0.285) | 0.488 | 41.67 (0.791) | 0.508 |
|            | Non-vegetarian       | 167 | 58.16 (2.577) |       | 51.47 (0.271) |       | 41.79 (0.798) |       |
|            | Ovo-lacto vegetarian | 34  | 57.83 (2.750) |       | 51.44 (0.276) |       | 41.69 (0.838) |       |
|            | Vegan                | 4   | 56.53 (1.004) |       | 51.34 (0.078) |       | 41.40 (0.260) |       |
| Anxiety    | Normal               | 111 | 58.05 (2.514) | 0.001 | 51.47 (0.263) | 0.108 | 41.76 (0.768) | 0.002 |
|            | Mild                 | 13  | 57.80 (2.562) |       | 51.45 (0.297) |       | 41.69 (0.772) |       |
|            | Moderate             | 54  | 56.95 (2.331) |       | 51.36 (0.233) |       | 41.42 (0.725) |       |
|            | Severe               | 23  | 58.64 (2.610) |       | 51.53 (0.260) |       | 41.93 (0.787) |       |
|            | Extremely severe     | 59  | 58.64 (2.700) |       | 51.54 (0.297) |       | 41.94 (0.848) |       |
| Depression | Normal               | 126 | 57.75 (2.474) | 0.105 | 51.43 (0.261) | 0.313 | 41.67 (0.760) | 0.123 |
|            | Mild                 | 32  | 57.40 (2.468) |       | 51.40 (0.240) |       | 41.55 (0.763) |       |
|            | Moderate             | 50  | 58.59 (2.752) |       | 51.54 (0.300) |       | 41.93 (0.857) |       |
|            | Severe               | 19  | 58.82 (2.914) |       | 51.55 (0.309) |       | 41.97 (0.912) |       |
|            | Extremely severe     | 33  | 58.13 (2.510) |       | 51.48 (0.256) |       | 41.77 (0.756) |       |
| Stress     | Normal               | 106 | 57.89 (2.537) | 0.328 | 51.45 (0.270) | 0.002 | 41.71 (0.781) | 0.338 |
|            | Mild                 | 69  | 57.64 (2.306) |       | 51.42 (0.230) |       | 41.63 (0.702) |       |
|            | Moderate             | 42  | 58.23 (3.233) |       | 51.50 (0.344) |       | 41.81 (1.017) |       |
|            | Severe               | 33  | 58.60 (2.360) |       | 51.53 (0.256) |       | 41.92 (0.722) |       |
|            | Extremely severe     | 10  | 58.61 (2.520) |       | 51.55 (0.258) |       | 41.93 (0.736) |       |

High PDI is associated with lower anxiety levels (p-value 0.001 [ $\leq 0.05$ ]). High hPDI is associated with lower stress levels (p-value = 0.002 [ $\leq 0.05$ ]). High uPDI is associated with lower anxiety levels (p-value = 0.002 [ $\leq 0.05$ ]).

#### Willingness and intentions to adopt a plant-based diet post-intervention:

- 80% (i.e., 64 out of 80 participants) showed their willingness to adopt a plant-based diet.
- 80% (i.e., 64 out of 80 participants) showed their willingness to reduce meat consumption.
- 70% (i.e., 56 out of 80 participants) were intended to reduce meat consumption in the next 6 months.
- 67.5% (i.e., 54 out of 80 participants) were intended to follow a plant-based diet in the next 6 months.

#### Discussion

In this study, higher overall plant-based diet scores (PDI) and Unhealthful plant-based diet scores (uPDI) were associated with low levels of anxiety and higher healthful plant-based diet scores (hPDI) were associated with low levels of stress.

Greater adherence to PDI represents greater consumption of all plant foods including both- healthy plant foods and less healthy plant foods. Greater adherence to hPDI leads to diet that is high in dietary fibre, unsaturated fats, antioxidants and micronutrient content, all of which are associated with low levels of stress, anxiety and depression<sup>[7,8]</sup>. On the other hand, greater adherence to uPDI, leads to diet with higher glycaemic load and index, added sugar and lower levels of dietary fibre, unsaturated fats, antioxidants and micronutrient content. Studies suggests that greater glycaemic load is related to lower risk of mental disorders, depression, and psychological distress<sup>[9]</sup>. Greater adherence to all 3 plant-based diet indices i.e., PDI, hPDI, uPDI represents lower consumption of animal foods and their products, which could play a potential role in reducing the risk of stress, depression and anxiety<sup>[10]</sup>. There was no significant association between PDI, hPDI and uPDI with depression, the reason for which should be studied further.

Hypothesis-1(H1)- PDI differed significantly with anxiety, hPDI differed significantly with stress and uPDI differed significantly with anxiety.

Hypothesis 2 (H2) - The plant-based scores (PDI, hPDI and uPDI) did not differ significantly with BMI.

Hypothesis 3 (H3)- There was a significant change in participants awareness and perceptions on plant-based diet post-intervention.

#### Conclusion

From the findings of the present study, we conclude that higher consumption of plant foods like whole grains, fruits, vegetables, legumes, nuts and seeds with minimal or no intake of animal food groups were associated with lower levels of stress and anxiety.



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**Future Line of Work**

- Awareness should be created on environmental and health merits of shifting to plant-based diet among general population.
- General population should also be educated on benefits of plant-protein as for millennia, animal meat is deeply engrained as the paramount source of protein in large segments of the world’s population.
- Policies should be designed to reduce animal agriculture as it is a major contributor to accelerated climate change. Reducing or banning animal agriculture can save trillions of animals each and every year around the globe and also results in conservation of natural resources like land and water.

**Author Contributions**

**Author 1:** Concept selection, designing, planning, formulating and implementation of the project. Conducting the study, intervention and collection of data. Wrote the article.

**Author 2:** Project guide helped in designing, planning, formulating and implementation of the project.

**Author 3:** Performed statistical analysis.

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