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Dietary quality assessment with the help of Dietary Diversity Scores in Homeless Individuals from Worcester County, Massachusetts.

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Abstract

Homeless individuals are more likely to experience poor health, and inadequate dietary quality significantly contributes to this poor health. To assess the dietary quality in homeless individuals, Individual Dietary Diversity Score (IDDS) can be used as a proxy tool. A cross-sectional study was conducted in homeless individuals with the help of IDDS as a tool with 94 homeless participants. After data collection and cleaning, the mean total diversity scores for this sample and some demographic variables, univariate statistics from the sample were calculated and multiple linear regression was done to identify the association between variables like Electronic Benefits Transfer (EBT) card, sex, age and Body Mass Index (BMI) and their IDDS. Logistic regression was done for a high number of dental caries observed in the sample, and the association with variables like sweets and candies. The sample of homeless individuals shows low dietary diversity scores, with the mean total diversity score being 6.97 (6.46-7.47), with males having slightly higher IDDS compared to females. Individuals having an EBT card showed significantly higher scores when compared with no EBT card. Individuals consuming high-calorie foods such as sweets and candies showed a significant association with dental caries. The study shows dietary diversity scores are low in homeless individuals, along with a higher prevalence of dental caries. There is a need for further research and interventions to improve the dietary quality in homeless individuals.

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Introduction

Homelessness creates an important public health problem with higher morbidity and mortality in homeless people in the United States of America (USA) and around the world.[1] As per USA estimates, 1.5 to 2.5 million people experience homelessness in a year, and half a million people are homeless each night in the USA.[2] Living in unfavorable conditions, such as on the streets, in unattended buildings, and crowded shelters, makes homeless individuals more susceptible to communicable diseases, violence, extreme weather, and malnutrition.[3]

Malnutrition is more prevalent in homeless individuals, and it will make them more prone to ill health. Quantitative assessment of diet for homeless individuals is a difficult task[4] because of their varied access to food day to day from free meals providers, shelters, and their access to adequate finances to buy food from local markets.

Dietary diversity is a qualitative measure of food consumption that reflects an individual's access to a variety of foods, and is also a proxy for nutrient adequacy of the diet of individuals.[5] The validity of IDDS as a proxy to an individual's intake of macronutrients and micronutrients is demonstrated in several studies conducted in vulnerable populations.[6] The dietary diversity questionnaire represents a rapid, user-friendly, and easily administered low-cost assessment tool[7] with scores ranging from 0 to 17. Therefore, this cross-sectional study employs the dietary diversity score as a tool to qualitatively assess the diet of homeless individuals and represent it quantitatively.

Although the Dietary Diversity score is only a qualitative instrument that assesses dietary habits without measuring food quantity or accounting for seasonal and local variations, it serves as a tool to detect the prevalence of inadequate dietary diversity, which public health personnel can use to design interventions aimed at improving dietary diversity.[8] This study focused on the quality of the homeless diet to create an intervention for their health for future research.

Materials and Methods

The study was done as a cross-sectional study with the help of a dietary diversity score questionnaire and some questions about the demography of the participants, in collaboration with ACTION Community Health and Urgent Care Center, Fitchburg, Massachusetts. The questionnaire was devoid of any personal identifiers and consisted of the Individual Dietary Diversity score, the Possession of an EBT card through which the Department of Transitional Assistance in Massachusetts provides food and economic assistance, and various food sources for the homeless.

Location and participants: The data of IDDS from homeless individuals collected by IDDS questionnaire from of 2017-18, at Riverfront Park in Fitchburg City, Worcester County, Massachusetts (MA) where free snacks and breakfast for the homeless was provided by ACTION Community Health and Urgent Care Center and continued later on at some of the shelters and free meals providers.

Sample

Fitchburg city in Massachusetts has about a 51,000 population, and with a confidence interval of 5 and confidence level 95%, and the homeless prevalence in the state is about 3.1% it was determined that 47 participants were needed to complete the study. About 94 participants were interviewed starting from the Fall 2017 season in Fitchburg. During the interview period, all participants were homeless, and the interviews focused solely on individuals. Families and children were not seen where the interviews were conducted and were excluded from the study. Individuals who are not homeless were excluded from the study.

Data Collection

The data was collected by one investigator while the homeless individuals were either eating their breakfast or lunch, by a convenient sampling method. The questionnaire was devoid of any personal identifiers and consisted of IDDS questions, Possession of an EBT card, Food sources for the homeless, and some demographic information.

Statistical Analysis

Statistical analysis was done with the help of SAS software version 9.4 (SAS Institute, Cary, NC, USA). Univariate statistics for the mean total diversity scores and demographic variables were calculated for the sample. Multiple linear regression was done to identify if there is any association between EBT card, sex, age, and BMI as independent variables

and the IDDS as the dependent variable. Logistic regression was done for a high number of dental caries observed in the sample and the association with score variables like sweets and candies, EBT card, sex, age, and BMI. The p-value was considered significant at < 0.05.

Results

Out of 94 participants who were interviewed regarding their diet, the total mean dietary diversity score is 6.97(cl 6.46-7.47), with a minimum score recorded was 2 and a maximum score of 11, with a standard deviation of 2.47 for the score as shown in Table 1. The mean diversity score of 6.97 is low compared to the highest possible score of 17. The mean BMI recorded was 26.2 with a minimal BMI of 19.66 and a maximal BMI of 34.75 kg/m^2, which shows that obesity is significant even in homeless individuals.

The other significant results are, 57 homeless individuals were actively using their EBT cards, and the other 37 individuals were not using their cards. 46 individuals mentioned that they have dental problems, mainly dental caries.

Table 1: IDDS scores and demographic characteristics.

Variable	Statistics (N=94)
Total Dietary Diversity Score	
Mean (cl)	6.97 (6.46-7.47)
Minimum, Maximum	2, 11
Standard deviation	2.47
Age (Years)	
Mean (cl)	41.3 (39.6 -43)
Minimum, Maximum	28, 57
Standard deviation	8.23
Sex	
Male	68
Female	26
Race	
Caucasian	47
African American	30
Hispanic	17
Weight	
Mean (cl)	80.2 (77.8 – 82.6)
Minimum, Maximum	63.5, 104.2
Standard deviation	11.8
Height (feet and inches)	
Mean (cl)	5’9” (5’83”- 5’95”)
Minimum, Maximum	5’2”, 6’1”
Standard deviation (Inches)	2.8
BMI	
Mean (cl)	26.2 (25.44-26.96)
Minimum, Maximum	19.66, 34.75
Standard deviation	3.71
EBT card	
Yes	57
No	37
Dental problems (caries)	
Yes	46
No	48

Table 2 shows the total IDDS by subgroups. Our subgroup analysis shows a high number of participants are between 30-50 years age (n=68) and a high mean dietary score of 7.93(cl 7.19-8.67) observed in the>50 years age group. No significant difference between different race groups for their mean IDDS. A higher mean IDDS of 8.07 (cl 7.63-8.53) was observed in individuals having an active EBT card. Males were observed to have had higher mean IDDS of 7.2 (cl 6.68-7.72) compared to females.

Table 2: IDDS scores by subgroups.

Variable		Statistics	
Total IDDS	**n**	**Mean (cl)**	**Standard Deviation**
By age group			
Below 30 years	11	4.18 (3.24-5.12)	1.4
30-40	33	7.54 (6.63-8.54)	2.56
40-50	35	6.88 (6.04-7.72)	2.43
>50	15	7.93 (7.19-8.67)	1.33
By race			
Caucasian	47	7.02 (6.23-7.8)	2.66
African American	30	6.83 (5.92-7.73)	2.42
Hispanic	17	7.05 (5.99-8.12)	2.07
By EBT			
No	37	5.27 (4.44-6.09)	2.47
Yes	57	8.07 (7.63-8.53)	1.74
By sex			
Male	68	7.2 (6.68-7.72)	3.11
Female	26	6.34 (5.08-7.6)	2.15

Table 3 shows multiple regression analysis for total IDDS as the dependent variable with independent variables as EBT card, age, race, sex, and BMI. The analysis shows a significant difference between individuals having an active EBT card and individuals with no active EBT card, with an F value being 28.58 and a significant p value (<0.0001) showing the importance of financial resources on dietary diversity. Age, race, Sex, and BMI have no significant effect on the total IDDS.

Table 3: Multiple regression analysis for IDDS (outcome variable).

Analysis Variable	F Value	p value
EBT	28.58	<.0001
Age	0.59	0.4444
Race	0.31	0.5794
Sex	0	0.9486
BMI	0.01	0.9176

Table 4: Adjusted odds ratios for dental caries.

Analysis variable (Yes/No)	AOR* (cl)	p value
Sweets' consumption	42.5 (7.24 -250.40)	<0.0001
Vitamin A rich fruit	9.3 (0.67 -128.95)	0.097
Other fruits: yes vs no	2.3 (0.51 -10.04)	0.2787
Milk products	0.6 (0.13 -2.71)	0.5044
Beverages, spices, condiments (coffee, tea)	0.95 (0.057 -15.82)	0.9728

*AOR= Adjusted Odds Ratio; adjusted for Age, sex, race, BMI

Table 4 shows that the higher number of dental caries observed in the sample is significantly associated with consumption of high-calorie sweets like candies or chocolates with an Adjusted Odds Ratio (AOR) of 42.5 (cl 7.24-250.40) and a significant p value (<0.0001).

Discussion

Homeless individuals are vulnerable populations and they are susceptible to be in difficult situations due to multiple social, financial, and health determinants.[9] When compared with the general population, homeless people have poor health, and a lack of proper nutrition plays an important role, along with exposure to infections in crowded areas and exposure to extreme weather conditions.[10] Homeless individuals usually get their meals from free meals provided by voluntary organizations, food banks, shelters, churches, family and friends, and sometimes by using food coupons from local markets and EBT cards.[11] While the quality or quantity of diet consumed by homeless individuals is determined by many factors most of the time, the homeless are helpless in determining these diet qualities.[12] As the homeless individuals stay at different places in different parts of the day, the quantity of diet consumed changes from day to day, and according to the time of the day, and is extremely unpredictable.[13] But the quality of diet, as assessed by dietary diversity score, can be an important proxy and can be taken as the prevalence of dietary quality in homeless individuals, which can be used to improve food quality.

Even though homelessness is both a cause and effect of several social, psychological, and health factors, exploring those determinants is beyond the scope of this study. Our study estimates the prevalence of dietary quality with the use of IDDS as a tool in Fitchburg, Worcester County, MA in the USA. Our study sample shows that the mean dietary diversity score for homeless individuals is very low. These results are comparable to the studies that were done in the past.[14-16] Having an EBT card enabled some homeless individuals to buy their food from local markets, but food awareness becomes an important determinant in these situations. While getting free meals is an important option, homeless individuals have no say in either the quality or quantity of the diet consumed through free meals.

Our study observes a higher mean for total IDDS in homeless individuals having an EBT card, but the mean IDDS for individuals in this group is still low. As we have interviewed individuals, categorizing the IDDS into food groups was not done, as there is no general consensus about food group categories for IDDS.

Our study also observes a higher number of dental caries associated with sweets and high-calorie food consumption. These results are comparable to the previous studies done in the field[17-19] Sweets, candies, and chocolates are high-calorie foods that can be carried easily by the homeless compared to other foods, and a lack of options for maintaining dental hygiene, along with a lack of dental health care[20] will make the homeless individuals prone to dental caries.

Strengths and Limitations

Our study tried to address the important problem of dietary quality in vulnerable populations like homeless individuals by noting the dietary diversity scores for homeless individuals in Worcester County, Massachusetts and paves a pathway for future research in this region regarding the homeless population and the ways to improve their dietary quality by interventions.

Our study has limitations compared to any cross-sectional study. As the study is cross-sectional, the cause-and-effect association cannot be determined by this study. This study only points to the current state of dietary diversity among the homeless and paves a pathway for future research in the region. The sample we chose was based on the prevalence of the homeless population in Massachusetts, but not particular to the city where the study was conducted. So, there is a chance that the prevalence of the homeless population is high or low in the city of Fitchburg compared to MA state. The IDDS score is based on recollection of the diet the homeless individuals consumed over the previous week, and these kinds of questionnaires are prone to recollection and or measurement bias. Our sampling is also based on a convenient sampling method, so there is also a chance that we did not reach the proper spectrum of participants to detect the exact dietary diversity scores, which can represent the total homeless population in Massachusetts.

Conclusion

Our study aimed to identify the prevalence of dietary quality among homeless individuals by using the Dietary Diversity Score (IDDS) as the assessment tool. Our study shows that the mean IDDS scores are low in homeless individuals, and there is a need for further research with or without a dietary intervention for the homeless. The study also suggests that having an EBT card may improve dietary quality among homeless individuals while simultaneously indicating a higher prevalence of dental problems due to their consumption of high-calorie sweet foods. Even if our study cannot confirm any cause-and-effect associations, future research can be planned in such a way that these associations can be confirmed and interventions can be planned to improve the dietary quality of homeless individuals in the region.

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This research did not involve human participants, animal subjects, or any material that requires ethical approval.

Informed Consent Statement

This study did not involve human participants, and therefore, informed consent was not required.

Clinical Trial Registration

This research does not involve any clinical trials.

Permission to Reproduce Material from Other Sources

Not Applicable.

Author Contributions

- **Srinivas Divakaruni:** Conceptualization, Methodology, Writing – Original Draft, Data Collection, Analysis
- **Madhavi Medipally:** Writing – Review & Editing, Supervision, Project Administration, Resources
- **Satya Divakaruni:** Online research, Reference work, Writing – Review & Editing

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