

ORIGINAL ARTICLE

Prevalence of Association of Dietary Habits with Chronic Energy Deficiency in Ethnic Adult Punjabi Population

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ABSTRACT

Background: Food is a basic thing without which, life is impossible. Without proper food, body will not thrive to its optimum potential and Chronic Energy Deficiency (CED) is the state, where there is a lack of food intake over a prolonged period of time. **Aims & Objectives:** To find the association of dietary habits with CED in ethnic Punjabi population. **Methodology:** The study was a cross-sectional study using simple random sampling technique. Taking the prevalence of CED as 30% in India, the sample size came out to be 336 but, 400 subjects were selected equally from rural and urban areas for convenience. **Results:** Subjects having lesser calorie intake than RDA, developed CED more 62(82.9%) than meeting RDA 13(17.1%). Subjects who skipped meals had higher CED rates. Pure vegetarians had higher rates of CED 71(93.4%) than non-vegetarians 5(6.6%). People consuming milk or milk products more than once daily developed lesser CED 1(1.3%) than those taking once daily 15(19.7%) and ones taking only once a week 60(79.0%). **Conclusion:** According to the study, persons with adequate calorie intake, who do not skip meals, take some kind of non-vegetarian food, and consume milk on daily basis have lesser tendency to develop CED.

KEYWORDS

Chronic Energy Deficiency; Body Mass Index; Basal Energy Expenditure

INTRODUCTION

Malnutrition is a worldwide problem which results from a deficiency or excess of one or more of nutrients.(1) Of 821 million people, one in nine go to bed on an empty stomach each night.(2)

Food is our basic necessity which provides us nutrients. Nutrients provide materials for

growth and repair of the body, and for keeping the immune system healthy.(3) All body functions, metabolic, hormonal, mental, physical, or chemical are performed by the body with proper nutritive food.(4) When there is an energy imbalance, it leads to marked changes in the body. If energy imbalance is severe enough and prolonged

over a long enough period of time, leisure and socially desirable activities are affected.(5)

In CED there is lesser intake of energy over a long period of time. Individual suffering from CED has low body weight due to decreased energy sources and thus has limited physical activity and performance.(6)

Most of research work in Punjab is on obesity but there a few studies on CED. According to NFHS, prevalence of CED is around 13% in Punjab. This is the reason why this study was planned.

Objectives: To determine the association of dietary habits with CED in ethnic adult Punjabi population.

MATERIAL & METHODS

Study Type and Study Design: The study was a cross-sectional type of study using simple random sampling technique.

Study Setting: The study was done in both rural and urban areas of Amritsar.

Study Population: The study subjects were in the age group of 20-60 years who were ethnic Punjabis chosen randomly from the baseline registers maintained at Rural and Urban Health Training Centres.

Study Duration: The study duration was the time period from start of the study, till the target sample size of 400 was met.

Sample Size Calculation: The prevalence of CED in India is approximately 30% as per the available literature. The value of z is 4, and the sample size calculated came out to be 336. However, for ease of convenience, 400 study subjects were chosen for the study. For the purpose of comparison, 200 subjects were taken from rural areas and 200 were taken from urban areas.

The sample size of the study was calculated using the formula as follows;(7)

$$n = \frac{Z^2 P(1 - P)}{d^2}$$

n = sample size

z = statistic for the level of confidence

p = expected prevalence or proportion

d = precision

Inclusion Criteria: Ethnic adult Punjabi population aged 20 to 60 years.

Exclusion Criteria:

- Refusal to participate

- Non-cooperative individuals
- Inability to participate due to gross physical and mental disability
- Non-Punjabi migrant population
- Subjects below 20 years of age
- Subjects above 60 years of age
- Pregnant women

Anthropometric measurements such as height, weight, waist circumference, and waist-hip ratio were noted down and BMI was calculated for each individual. Nutritional intake was taken besides a general physical examination.

Anthropometric measurements are well established and are widely used as indicators of health and nutritional status in both children and adults. It is the single most portable, easily applied, inexpensive, and non-invasive method of assessing body composition.

The height of the subjects was measured using a narrow, flexible non-stretchable, metal measuring scale. Weights of the subjects were measured using a standard weighing machine with a total weighing capacity of 200 kg.

BMI was calculated using height and weight of subjects and it was categorized into different grades as follows;(8)

- Grade III CED <16.0
- Grade II CED 16.0–16.9
- Grade I CED 17.0–18.4
- Normal 18.5–24.99
- Overweight >25.0

Observations and epidemiological correlates of all 400 individuals were recorded. The results were analysed using Microsoft Excel and SPSS statistical software version 26.

Nutritional Requirements: The energy intake was determined according to the Basal Energy Expenditure (BEE) calculated by Harris Benedict's Equation. To this BEE, 6% was added to cover dietary induced thermo genesis and, 30, 50 and 100% was added for sedentary, moderate, or strenuous activity respectively.(9)

BEE (women) $655 + (9.5 \times w) + (1.8 \times h) - (4.7 \times a) =$

BEE (men) $66 + (13.7 \times w) + (5.0 \times h) - (6.8 \times a) =$

where 'w' is weight in kilograms, 'h' is height in centimetres and 'a' is age in years.

Dietary intake and adequacy of diet consumed was determined by the three-day dietary recall

method. Total caloric intake was calculated according to standard food composition table developed by National Institute of Nutrition, Hyderabad.

Ethical issues & Informed Consent: Ethical clearance was duly taken from the Ethical Committee of our institute. Each individual was explained the purpose of the study in vernacular language and signature and thumb impression of each subject was taken after he/she agreed to be part of the study.

Data Analysis: The results were compiled using Microsoft Excel 2019 and SPSS Software version 27.

RESULTS

Table 1 shows the distribution of study subjects according to parameters of age, sex, rural/urban area, religion caste and marital status.

Table 1 – Distribution of subjects according to their socio-demographic features

Parameters	Frequency n = 400	Percent age %
Age (In years)	20-29	108 27.0
	30-39	70 17.5
	40-49	78 19.5
	50-60	144 36.0
Sex	Male	183 45.8
	Female	217 54.2
Area	Rural	200 50.0
	Urban	200 50.0
Religion	Sikh	215 53.6
	Hindu	165 41.3
	Muslim	14 3.5
	Christian	3 0.8
	Others	3 0.8
Caste	Upper Caste	210 52.5

Marital Status	Scheduled Caste	142	35.5
	Scheduled Tribe	2	0.5
	Backward Class	46	11.5
	Never Married, Widowed, Separated	46	11.5
	Married	354	88.5

Table 2 shows the distribution of study subjects according to their BMI status. There were 400 subjects taken for the study and out of them, CED was found in 76 (19%) respondents.

Table 2 – Table showing the distribution of study subjects according to Body Mass Index (n=400)

Category	BMI (Kg/m ²)	Number	Frequency (%age)
CED-III	<16.0	13	3.25
CED-II	16-16.9	13	3.25
CED-I	17.0-18.4	50	12.5
	18.5-24.9	203	50.75
Overweight	>25	121	30.25
Total		400	100

Table 3 shows association of regularity with which meals were taken with CED. Statistically significant results were found by association of habit of skipping meals with CED in a week ($\chi^2 = 106.714$, df = 3, p value = 0.000) and type of meal skipped during the day (*Fisher Exact Test* = 84.387, df = 3, p value = 0.000).

Table 3 – Distribution of subjects according to their habits of taking meals

Parameter		CED		Total	Significance
		Present	Absent		
Meals at a fixed time	Regularly	72 (18.5%) [94.7%]	317 (81.5%) [97.8%]	389 (100.0%) [97.2%]	<i>Fisher Exact Test</i> = 2.216, df = 1, p value = 0.137
	Occasionally	4 (6.4%) [5.3%]	7 (63.6%) [2.2%]	11 (100.0%) [2.8%]	
Frequency of Meal Skipped	Daily	2 (66.7%) [2.6%]	1 (33.3%) [0.3%]	3 (100.0%) [0.8%]	$\chi^2 = 106.714$, df = 3, p value = 0.000
	More than once a week	46 (57.5%) [60.5%]	34 (42.5%) [10.5%]	80 (100.0%) [20.0%]	
	Once a week	8 (20.5%) [10.5%]	31 (79.5%) [9.7%]	39 (100.0%) [9.8%]	
	Never	20 (7.2%)	258 (92.8%)	278 (100.0%)	

Parameter	CED		Total	Significance	
	Present	Absent			
Type of Meal Skipped	Breakfast	3 (30.0%) [26.4%]	7 (70.0%) [79.5%]	10 (100.0%) [69.5%]	<i>Fisher Exact Test</i> = 78.61, df = 3, p value = 0.000
	Lunch	48 (47.1%) [63.2%]	54 (52.9%) [16.7%]	102 (100.0%) [25.5%]	
	Dinner	5 (50.0%) [6.6%]	5 (50.0%) [1.5%]	10 (100.0%) [2.5%]	
	Never Skipped	20 (7.2%) [26.3%]	258 (92.8%) [79.6%]	278 (100.0%) [69.5%]	
Calorie Intake	Meeting RDA	13 (4.0%) [17.1%]	309 (96.0%) [95.4%]	322 (100.0%) [80.5%]	$\chi^2 = 240.2$ df = 1 p value <0.000
	Below RDA	63 (80.8%) [82.9%]	15 (19.2%) [4.6%]	78 (100.0%) [19.5%]	

Table 4 shows the association between non-vegetarians and pure vegetarians and milk intake with CED. Of all 76 subjects suffering from CED, there were only 5 non-vegetarians. On comparing, vulnerability to develop CED was higher amongst people consuming only a vegetarian diet and the difference was found to be statistically highly significant. (Chi square = 48.16, df = 1, p value < 0.0001).

Table also shows an association between frequency of non-vegetarian food intake and CED in a whole week and this association was also found to be highly significant statistically

(Fisher Exact Test = 24.79, df = 3, p value = 0.000).

Table 4 shows the association of milk intake habits with CED and it shows that people who take milk on a regular basis have a lower tendency to develop CED as compared to those who take it less frequently. Amongst the subjects found to be suffering from CED, only one was found to be suffering from CED who was taking milk more than once daily. This shows that a higher frequency of milk intake decreases the chances of CED and it was also found to be statistically highly significant. (Chi square = 130.6, df = 2, p value < 0.0001).

Table 4 – Table showing association of CED with Non-vegetarian food intake and Milk intake

Parameter	CED		Total	Significance	
	Present	Absent			
Non-Vegetarian Food Intake	Non -Vegetarians	5 (3.5%) [6.6%]	139 (96.5%) [42.9%]	144 (100.0%) [36%]	$\chi^2 = 48.16$ df = 1 p value <0.0001
	Pure Vegetarians	71 (27.7%) [93.4%]	185 (72.3%) [57.1%]	256 (100.0%) [64%]	
Frequency of Non-Vegetarian Food	Daily	1 (1.9%) [1.3%]	52 (98.1%) [16.0%]	53 (100.0%) [13.3%]	<i>Fisher Exact Test</i> = 24.79 df = 3 p value <0.000
	Once a week	3 (4.3%) [3.9%]	67 (95.7%) [20.7%]	70 (100.0%) [17.5%]	
	More than once a week	1 (4.8%) [1.3%]	20 (95.2%) [6.2%]	21 (100.0%) [5.3%]	
	Not Applicable	71 (27.7%) [93.4%]	185 (72.3%) [57.1%]	256 (100.0%) [64.0%]	
Milk Intake	More than once daily	1 (2.8%) [1.3%]	35 (97.2%) [10.8%]	37 (100.0%) [9.0%]	$\chi^2 = 130.66$ df = 2 p value <0.0001
	Once daily	15 (5.8%) [19.7%]	242 (94.2%) [74.7%]	257 (100.0%) [64.3%]	
	Once/twice a week	60 (56.1%) [79.0%]	47 (43.9%) [14.5%]	107 (100.0%) [26.8%]	

DISCUSSION

The present study is a cross-sectional study conducted in the rural and urban field practice area of Department of Community Medicine, Sri Guru Ram Das Institute of Medical Sciences and Research, Amritsar. The study was conducted using simple sampling technique. The prevalence of CED was found using well-known and well-documented anthropometric techniques. Observations were recorded and the epidemiological correlates were noted of all the 400 individuals in the study. The results were analysed using Microsoft Excel and SPSS statistical software.

Distribution of study subjects according to socio-demographic factors is shown in table one. It shows that there were 183 (45.8%) males and 217 (54.2%) were females. Almost similar results were reported by the NFHS-3 report by Government of India.

According to religion, the study shows the Sikh population to be 53.6%, the Hindu population to be 41.3% and Muslims to be 3.5%. Almost similar results were found according to the NFHS-4 statistics of Punjab, Sikh population stands at 60%, Hindu population at 37%, Muslim at 2% and others are at 1%.⁽¹⁰⁾

The study conducted shows that according to caste-wise distribution, the number of upper castes stands at 52.5% while scheduled castes at 35.5%, backward class at 11.5% and scheduled tribes at 0.5%. Similar results were reported by NFHS-3 Punjab statistics which report the upper castes are at 56%, scheduled castes at 32%, backward castes at 9.5% and scheduled tribes 0.1%.

Second table shows association of CED with frequency of meals skipped. A maximum number of study subjects, 46 (60.5%) found to be suffering from CED were missing their meals more than once a week, 8 (10.5%) skipped it once a week, and 2 (2.6%) skipped the meals daily. It shows that the presence of CED was higher in individuals who used to skip meals. Similar results were obtained from a study done in Kunama women in Ethiopia where it was found that women who had two meals per day were two times more undernourished as compared to others having three meals per day.⁽¹¹⁾

Table also shows association of CED with type of meals skipped during the day. Of all the individuals found to be suffering from CED, 48 (63.2%) used to skip lunch during the day. Hence this study shows that lunch is an important meal of the day and thus should not be skipped.

This table also shows association of calories taken with CED. Of all 76 subjects found with CED, majority of them, 63 (82.9%) had having daily calorie intake less than the recommended daily allowance. Hence this study suggests that the adequate amount of daily recommended allowance of diet should be taken by undernourished subjects studied to avoid CED. Third table shows the association of CED with non-vegetarian food intake habits. Higher CED levels were seen in individuals who did not take any non-vegetarian food than those who took it in any form. There were 71 (93.4%) CED cases who were pure vegetarians while there were only 5 (6.4%) non-vegetarians. A study conducted by D Singh, S Goli, and TV Sekher shows that intake of non-vegetarian food was an important factor in preventing CED in an individual. Respondents who have non-vegetarian food on a daily/weekly basis have a higher BMI deviation than others.⁽¹²⁾ On comparing our results with above study, the results were similar with higher prevalence of CED in vegetarian individuals.

The table also shows the association of CED with the frequency of non-vegetarian food consumed. CED in vegetarians was found in 71 (93.4%) while in non-vegetarians it was found in 5 (6.6%). This shows that there is a higher tendency to develop CED in vegetarians than in non-vegetarians.

Fourth table depicts the association of milk intake habits and CED. Of all the CED cases found in the study, there were 60 (79.0%) cases in which the respondents used to consume milk once or twice a week as compared to 15 (19.7%) who consumed milk on daily basis and only 1 (1.3%) who consumed milk more than once daily. Since milk is considered to be a complete food having all the essential nutrients including proteins, its regular consumption leads to a good nutritional status. This was proven by a study that says that women who consume milk/curd

every day in the study area are less likely than others to have CED. It was found that a daily or weekly intake of milk as opposed to an occasional or no intake has a positive effect on the body mass index. Similar results were also reported in study by Singh, Goli, and Sekher. It shows that mean BMI is highest among respondents who consume milk or curd daily followed by those who have it every week and lowest among those who never consume of them.(12) On comparing our results with above studies, the results were similar with a higher prevalence of CED in people who consumed a lower quantity of milk. Similar results were reported in a study by Maithili Ramachandran, et al that regular consumption of milk has a positive impact on the risk to of CED.(8) Similar impacts of milk intake were also demonstrated in the study done by K Venkaiah, GNV Brahmam, and K Vijayaraghavan in India.(13)

CONCLUSION

To conclude it was found that the phenomenon of CED is a multidimensional one. CED depends on many factors like education, occupation, income, housing characteristics, availability of utilities, food intake habits, milk and non-vegetarian intake habits etc.

RECOMMENDATION

Keeping in view the findings of present study, following recommendations can be made;

- Judging the burden of CED, special public health programs are needed that can address the situation.
- CED can be prevented by making the communities aware about the importance of education, occupation, housing characteristics, utilities, eating habits, avoiding food faddisms.
- The prevention of CED in individuals should be strengthened by IEC (Information, Education and Communication) activity including promoting awareness that CED is preventable by taking adequate amounts of food along with the proper nutrients.

- BCC (Behaviour Change Communication) therapy should be applied for preventing the CED right from childhood.

LIMITATION OF THE STUDY

- We did not take socioeconomic status of the study subject
- We did not include the parameter of micronutrient intake
- Opportunity could have been taken to educate the subjects about proper nutrition

RELEVANCE OF THE STUDY

Punjab being the food cradle of India is highly assumed to be free from CED. Obesity levels in Punjab are over 40%. There is a lot of research work on obesity and diabetes in adults and children of Punjab. While a number of studies have been done on the prevalence CED in adults and females in other parts of India, but there is a very little research on CED in ethnic Punjabi population. According to NFHS reports, 12.75% of Punjabi population has BMI less than normal. The problem of energy deficiency is deeply seeded in all the strata of population in Punjab pertaining to multitude factors and hence this study is planned to provide a light in this direction. Only ethnic Punjabi population will be considered and migrants will not be considered for this study because they will dilute the data on the ethnic Punjabi group.

AUTHORS CONTRIBUTION

All authors have contributed equally.

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Nil.

CONFLICT OF INTEREST

There are no conflicts of interest.

DECLARATION OF GENERATIVE AI AND AI ASSISTED TECHNOLOGIES IN THE WRITING PROCESS

The authors haven't used any generative AI/AI assisted technologies in the writing process.

REFERENCES

1. Singh AP, Singal P, Kaur P, Singh, SP. Assessment of Malnutrition in Punjabi Urban Males According to

- Body Mass Index (BMI) and Weight for Height Criteria. *Anthropologist*. 2003;5(3):189-91.
- World Hunger Statistics [Internet] 2024 June 22, 2023. Available from: <https://foodaidfoundation.org/world-hunger-statistics-2020/>
 - FAO. The Family Nutrition Guide [Internet] [cited 2024 June 20] Available from: <https://www.fao.org/3/y5740e/y5740e04.htm>
 - Montignac M. The History of Man's Eating Habits, official web site of the Montignac Method [Internet]. 2016 [cited 2024 June 20]. Available from <http://www.montignac.com/en/the-history-of-man-s-eating-habits/>
 - Jadhav A. Why Has Food Always Been Important for Human Evolution? [Internet]. 2016 [cited June 19, 2024]. Available from <http://www.buzzle.com/articles/why-is-food-important.html>
 - Shetty PS, James WPT. Body mass index - A measure of chronic energy deficiency in adults [Internet]. Food and Agriculture Organization of the United Nations, Rome; 1994 [cited 2023 June 20]. Available from <http://www.fao.org/docrep/T1970E/t1970e00.htm#TopOfPage>
 - Daniel WW. *Biostatistics: A foundation for analysis in Health Sciences*. New York: John Wiley & Sciences. 1999.
 - Ramachandran M, Kumar KSK, Viswanathan B. Vulnerability to Chronic Energy Deficiency: An Empirical Analysis of Women in Uttar Pradesh, India. *SSRN Electronic Journal*. 2006 January;1-32. DOI: 10.2139/ssrn.875812.
 - Fauci SA, Braunwald E, Isselbacher KJ, Wilson JD, Martin JB, Kasper DL, Hauser SL, Longo DL. *Harrison's Principles of Internal Medicine*. New Delhi; McGraw-Hill. 1998:446.
 - National Family Health Survey (NFHS-4) 2015-16, India: Key Findings. Mumbai: International Institute for Population Sciences (IIPS).
 - Abraham S, Mirtus G, Shumye A. Magnitude of chronic energy deficiency and its associated factors among women of reproductive age group in Kunama population, Tigray, Ethiopia, in 2014. *BMC Nutrition*. 2015;1:12.
 - Singh D, Goli S, Sekher TV. Double burden of nutritional disorder among Indian Women: an assessment of differentials and determinants [Internet]. [cited 2023 April 26]. Available from <http://mpr.ub.uni-muenchen.de/53447/>
 - Venkaiah K, Brahmam GNV, Vijayraghavan K. Application of factor analysis to identify dietary patterns and use of factor scores to study their relationship with nutritional status of adult rural populations. *J Health Popul Nutr*. 2011;(4):327-338.