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Original Research Article

Determinants of malnutrition among the tea garden workers of Darjeeling district in 2021: an ordinal regression analysis

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ABSTRACT

Background: Due to increasing lifestyle changes and poverty, double burden of malnutrition is becoming more and more severe, especially in the underserved areas like tea gardens. Food security is also a major issue not only in underdeveloped countries but also in developing countries like India. The study aims to estimate the prevalence of malnutrition among the tea garden workers and to find out the associated factors with malnutrition among the tea garden workers of Darjeeling district.
Methods: 200 people were selected from 10 tea gardens of Darjeeling district by cluster sampling method. They were interviewed using a structured questionnaire to find out the associated factors with malnutrition. Weight and height was measured using standard measuring tools and then BMI was calculated. To find out the determinants of nutritional status, an ordinal regression analysis was done with the help of SPSS software.
Results: The prevalence of under nutrition and obesity was 25% and 20.5% respectively. The ordinal regression model showed that the odds of higher BMI was found with increasing age, male gender, being a permanent garden employee and higher educational status. Household food insecurity increased the odds of undernutrition, as individuals from food secure households had significantly higher odds of getting higher BMI.
Conclusions: Nutritional status is closely associated with socio-economic and demographical variables and household food security. To ensure the health and nutrition of the tea garden workers, a more comprehensive strategy to addressing socio-demographic issues and household food security is required.

Keywords: Malnutrition, Under nutrition, Obesity, Food security, Tea gardens, Ordinal regression

INTRODUCTION

Nutrition is defined as a process in which the consumed food is used for nourishing the body. When a person does not receive adequate nutrition, there is a risk of aberrant development, as well as the possibility of organ malfunction or disease. Malnutrition may also have an impact on his mental and social well-being. Hence, good food consumed in sufficient quantity is required for good health.[1] The World Health Organization (WHO) estimates that 462 million adults are underweight and 1.9 billion adults are overweight or obese. It is a major public health issue worldwide, particularly in South-East Asia and Sub-Saharan Africa, where the prevalence of stunting is 24.7%, higher than the global average of 21.3%.[2]

For a long period of time malnutrition remained a dark force in human society. Food security was brought to the

forefront of the 1996 World Food Summit as both a cause and an effect of poverty and slow growth.[3] Food security can be defined as physical and economic access to all people at all times to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life. World Health Organisation has recognised the global food insecurity crisis and rising food prices as major problems.[4]

According to the Global Nutrition Report 2018, 46.6 million children in India are stunted, which is a third of the world's total. Undernutrition is the main cause of nearly half of all under-5 child mortality in India. India is facing a dual burden of malnutrition, underweight and obesity. Undernutrition and micronutrient deficiencies are major public health problems in India, while overnutrition and obesity are emerging public health problems.[5]

Despite being one of the nations with abundant food grain production, a large number of Indians lack food security due to weaknesses in the public distribution system's (PDS).[6] In 1997, the Indian Government introduced targeted PDS, which failed to reach many people who actually needed it. Since then, many laborers have been forced to work in very poor and marginalized conditions, leading to widespread malnutrition.[7]

Between 2000 and 2015, almost 1400 people have died in 17 tea Gardens in the North Bengal. Severe malnutrition has been attributed as the main cause of death in these estates.[8] To date, very limited research has been done on the socio-economic conditions and food security of tea garden workers in general and Darjeeling District in particular. In a study conducted by Bhar et al, it was found that 29.1% of the population in Darjeeling District suffers from malnutrition, twice the prevalence among men.[9] In this study, the objective was to estimate the prevalence of malnutrition among tea garden workers in Darjeeling and find out the associated factors with malnutrition.

METHODS

It was a cross-sectional, observational community-based study done in the tea gardens located in the Darjeeling district and the employees (both temporary and permanent) of these gardens served as the study population. Unwilling and seriously ill participants were excluded.

With the assumptions of 29.1% prevalence of undernutrition[9], 95% level of Confidence, 10% absolute precision, 10% non-response rate and multiplication factor of 2 for study design effect the final sample size was calculated as 200 using Cochran's formula.

$$n= Z^2_{(1-\alpha/2)}p(1-p)/d^2$$

where, n= Sample size, $Z_{(1-\alpha/2)}$ = 1.96 (at 95% confidence interval), P = anticipated 29.1% prevalence of undernutrition[9], d = 10% absolute precision. The final sample size calculated was 176, which was rounded up to 200 to ease up the data collection.

The study population was selected by Cluster sampling method, where tea gardens acted as clusters and the cluster size was calculated as 20 (200/10). A list of tea gardens was compiled and ten clusters (tea gardens) were chosen at random from this list using a straightforward random cluster sampling technique. With the assistance of local health professionals, a list of qualified tea garden workers in each identified cluster was created, according to inclusion and exclusion criteria, and served as the sample frame and finally 20 tea garden workers were chosen at random from the sample frame of tea garden employees in each cluster.

Data collection

Data were collected using a pre-designed, pre-tested standard close ended questionnaire, designed to capture information about socio-economic, demographic, and sanitation related variables. It also contained questions pertaining to food habits and access to health care. The final section of the questionnaire contained food security related variables. There were 11 questions; 10 questions were assigned to a score between 1 to 5 according to response. 1 question had yes/no response. Then the total score was calculated to obtain food security score. Out of total score 44, 30 was taken as a cut-off mark for food security and two groups were created. First group, 0-29 score was considered to be participant with food insecurity and Second group with score 30 or more was considered to be with food security.

The questionnaire was uploaded in Epicollet5 server for data collection with project heading Malnutrition NB and data was collected by interview method using Epicollect5 app in mobile phone.

Statistical analysis

Collected data were entered in MS Excel and checked for consistency. Then those cleaned data were analysed by IBM SPSS software (version 25). Pie chart, Bar diagram and Scatter plot diagram was drawn where ever necessary. Chi Square test was done and a p value less than 0.05 was taken for statistical significance. Ordinal logistic regression analysis was used to model the relationship between the ordinal response variable of BMI categories (BMI <18.5 kg/m^2, 18.5-24.9 kg/m^2 and ≥25 kg/m^2) and other explanatory variables (age, gender, education, occupation, addiction to tobacco and alcohol and household food security).

Operational definitions

Malnutrition is a subacute or chronic state of nutrition in which a combination of varying degrees of over-or

undernutrition and inflammatory activity has led to a change in body composition and diminished function.[10]

Underweight is defined by Body Mass Index (BMI) <18.5 kg/m[11].

Overweight was defined by body mass index (BMI) ≥25 kg/m^2 and obesity as BMI ≥30 kg/m^2.[11]

Food security is defined as physical and economic access to all people at all times to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life.[4]

Public distribution system (PDS) is a poverty alleviation programme where essential commodities like rice, wheat, sugar, kerosene and the like are supplied to the people in reasonable price.[12]

Tobacco addiction was defined by consumption of any form of tobacco in a regular or occasional basis.

Ethical issues

Informed consent

The study was fully voluntary. The participants were fully informed about the study priorly and informed consent form was signed. Name or other particulars regarding identity was not mentioned anywhere. Only willing participants was included in the study.

Ethical committee clearance

Ethical clearance was taken from Institutional Ethics Committee of Institution of Public Health, Kalyani.

RESULTS

The study was conducted among 200 people currently residing in tea-gardens of Darjeeling. Most of the study population belong to the 18-39 years age group, with a minimum age of 18 years and a maximum age of 64 years. The mean age of the study population is 38.41± 11.85 years. Majority of the study population were females, educated up to primary level and were permanent garden employees. Regarding the behavioral patterns, almost half of the participants were addicted to tobacco and alcohol whereas more than half had the practice of having unhealthy diet. Almost two thirds of the participants belonged to food secure households.

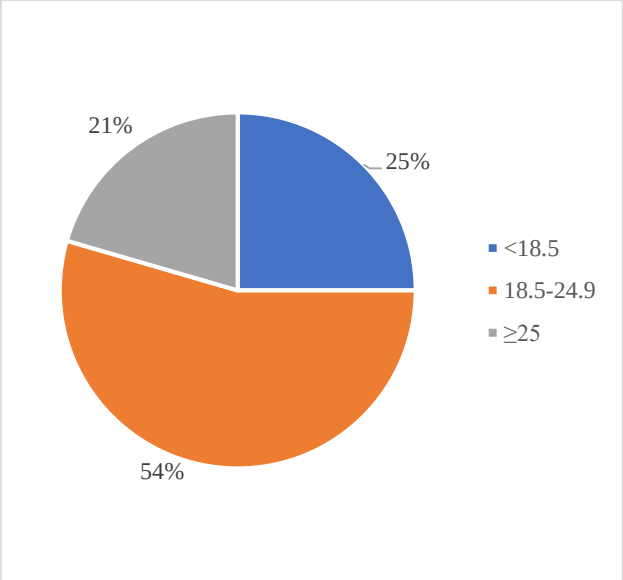

Figure 1: BMI among the study population (n=200).

Table 1: Determinants of nutrition among the study population according to ordinal logistic regression (n=200).

Variables	BMI category (kg/m^2)			Total	AOR (95% CI)
	<18.5	18.5-24.9	≥25		
Age in years (Mean ± SD)	38.2±11.6	38.0±12.6	39.7±10.3	38.41±11.9	1.011 (0.985, 1.037)
Gender of the participant					
Female	36 (30.0%)	59 (49.2%)	25 (20.8%)	120 (60%)	0.68 (0.296, 1.561)
Male	14 (17.5%)	50 (62.5%)	16 (20.0%)	80 (40%)	1 (Referent)
Educational status of the participant					
Upto primary level	46 (30.5%)	76 (50.3%)	29 (19.2%)	151 (75.2%)	0.574 (0.288, 1.141)
Secondary level and above	4 (8.2%)	33 (67.3%)	12 (24.5%)	49 (24.8%)	1 (Referent)
Occupational status of the participant					
Permanent garden employee	21 (17.8%)	70 (59.3%)	27 (22.9%)	118 (59%)	1.623 (0.892, 2.956)
Contractual garden employee	29 (35.4%)	39 (47.6%)	14 (17.1%)	82 (41%)	1 (Referent)
Addiction to tobacco					
No	22 (21.0%)	58 (55.2%)	25 (23.8%)	105 (52.5%)	1.636 (0.796, 3.363)
Yes	28 (29.5%)	51 (53.7%)	16 (16.8%)	95 (47.5%)	1 (Referent)
Addiction to alcohol					
No	26 (25.5%)	54 (52.9%)	22 (21.6%)	102 (51%)	1.05 (0.438, 2.515)
Yes	24 (24.5%)	55 (56.1%)	19 (19.4%)	98 (49%)	1 (Referent)

Continued.

Variables	BMI category (kg/m^2)			Total	AOR (95% CI)
	<18.5	18.5-24.9	≥25		
Type of diet					
Healthy diet	36 (39.1%)	41 (44.6%)	15 (16.3%)	92 (46%)	0.536 (0.287, 1.002)
Unhealthy diet	14 (13.0%)	68 (63.0%)	26 (24.1%)	108 (54%)	1 (Referent)
Household Food security					
Food secure	21 (15.7%)	82 (61.2%)	31 (23.1%)	134 (67%)	1.784 (1.1, 3.536)
Food insecure	29 (43.9%)	27 (40.9%)	10 (15.2%)	66 (33%)	1 (Referent)*
Total	50 (25.0%)	109 (54.5%)	41 (20.5%)	200	

According to Figure 1, it can be seen that 25% of the study population had undernutrition (BMI<18.5 kg/m^2), 20.5% were obese (BMI≥25 kg/m^2) and 54.5% belongs in normal range of BMI (18.5-24.9 kg/m^2).

The proportional odds model was accepted from the analysis since the test of parallel lines showed not significant results (chi-square = 344.5, p-value = 0.147), so the ordered logit coefficients are equal across the levels of the outcome and the model does not have a differential effect on the ordinal categories of BMI. The above table shows that an increase in age (expressed in years) was associated with an increase in the odds of increasing BMI, with an odds ratio of 1.011 (0.985, 1.037). For female participants, the odds of having higher BMI is 0.68 times that of male participants. Similarly, being a permanent garden employee increased the odds of having higher BMI [1.623 (0.892, 2.956)]. Addiction to tobacco and alcohol had slightly lower odds of getting overweight. Participants consuming unhealthy diets had the higher odds of getting higher BMI and hence overweight and obesity. Household food insecurity increased the odds of undernutrition, as individuals from food secure households had significantly higher odds of getting higher BMI [1.784 (1.1, 3.536)].

DISCUSSION

In adults, malnutrition is a common but under-recognized and undertreated problem. It exists in the population and has the ability to be both a cause and an effect of disease. The vicious cycle of undernutrition, including micronutrient deficiencies and morbidities, along with an unsanitary environment, illiteracy, and poverty, negatively affects the health of tea garden workers, who make up a unique population.[10] It is crucial to prevent malnutrition in this population, hence the functions of nutrition screening and assessment should be thoroughly researched. The numerous factors that contribute to undernutrition in the study population are covered in the paragraphs that follow.

Age

Age is a proven non-modifiable risk factor for malnutrition, including both undernutrition and overnutrition. Age-related physiological changes are linked to increased risk of malnutrition or worsening of it. Age is linked to a rise in abdominal obesity, which is a significant cause of insulin resistance and the metabolic syndrome.[11] In the present study, higher age was found to be associated with higher odds of increasing BMI.

Gender

A key risk factor for the emergence of overweight and undernutrition is gender. Women are more likely than overweight males to experience mortality and to experience physical and psychological comorbidities associated with obesity.[12] Nonetheless, there may be a significant disparity in access to healthy food and diet for women in underprivileged communities like tea gardens. In these populations, women's susceptibility to becoming underweight at any age is a major cause for concern.[13] In the present study, females had a higher odd of having undernutrition, compared to males.

Occupation and education

Permanent employees in tea gardens are individuals hired year-round by plantations and are eligible for benefits such housing, health care, a provident fund, and gratuity, whereas, non-permanent or contractual workers are engaged whenever required for plucking tea leaves.[14] Non-permanent occupation, lower educational status and malnutrition are inextricably tied to one another, creating a vicious cycle with each fueling the other.[15] So, quite expectedly, higher educational status and having a permanent status as an employee had a higher odds of having a higher BMI.

Behavioral risk factors

According to studies, behavioural risk factors like drinking alcohol, using smoke, and eating unhealthily might affect BMI and hence raise the risk of developing other non-communicable diseases.[16] Smoking and obesity have a complicated and poorly understood association, and published research have yielded contradictory findings. While some research found no connection between smoking and body mass index (BMI), others hypothesised that smoking may be linked to a lower BMI and quitting smoking to a higher BMI.[17] In the current study, eating unhealthy foods was linked to a higher risk of being overweight and obese while addiction to alcohol

and cigarettes had somewhat lower odds of becoming overweight.

Household food security

Whether it is a relative change or absolute severity, household food insecurity may increase the risk of malnutrition, which accounts for about 300,000 fatalities annually worldwide.[18] Those who work in tea gardens, for example, are more likely to experience food insecurity, which makes them more likely to consume inadequate diets and suffer from malnutrition.[19] This study has shown that food security is a crucial component and that it significantly affects BMI. Compared to the urban slums of Vellore (42.7%)[20] and Delhi (49%)[21], this study's finding of household food security (67.5%) was higher. According to a study by Shen et al., malnutrition among Chinese elementary school students was linked to food insecurity.[22]

CONCLUSION

This study demonstrated that socioeconomic and demographic factors are closely associated with nutritional status. Also, it has been shown that a person's nutritional state is significantly influenced by the household food security. So, in order to improve nutritional status, the government must adopt a comprehensive strategy that addresses all of these issues as well as nutrition. Finally, a far larger study on food security and malnutrition is required to fully understand the situation. Additionally, qualitative research is required in these fields to address the issues more comprehensively, and difficulties must be overcome pragmatically to ensure the health and nutrition of tea garden employees.

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