



Undernutrition and its determinants among daily laborers working in Cobblestone project in Ethiopia

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ABSTRACT

Background

Undernutrition is among the most significant public health problems in the world. It is an important underlying cause of illness and death in Africa and imposes a huge cost both in human and economic terms. The aim of this study is to assess the level of undernutrition and its determinants among daily laborers working in cobblestone projects, Yeka Sub City, Addis Ababa, Ethiopia.

Methods

A workplace-based cross-sectional study was conducted among 423 cobblestone daily laborers from February 20 to April 1, 2015. Systematic random sampling method was employed (with proportional allocation) in three cobblestone project sites. An interviewer-administered questionnaire and anthropometric measurements (weight and height) were used to collect the data. The data was entered by Epi Info version 3.5.3 then transferred to SPSS version 20 for data analysis.

Results

Overall, 423 respondents (of which 300, or 71%, were male) participated in this study, making the response rate 100%. Among the study participants, 141 (33.3%; 95% CI: 28.8 - 38.0) were underweight (BMI<18.50). Males were more likely to experience underweight than their female counterparts: 112 (37.3%) versus 29 (23.6%). Educational status, family size, income, dietary diversity and smoking had statistical significance with undernutrition in multivariate analysis. Study participants who had no education were significantly more likely to be undernourished [AOR = 7.83; 95% CI (3.78, 16.22)] compared with those above secondary level education. Daily laborers with a larger family size (≥ 3) were three times [AOR=2.88; 95%CI; 1.54-5.40] more likely to be undernourished compared to low family size (≤ 2). Daily laborers who had low monthly income (<1500 ETB) were significantly more likely to be undernourished [AOR= 9.77; 95%CI (4.92, 19.39)] than those with high income (≥ 2500 ETB). Daily laborers who smoke were significantly more likely to be undernourished [AOR = 2.02; 95% CI (1.06 – 3.87)].

Conclusion

The study revealed that one-third of daily laborers in the cobblestone project were undernourished. Significant determinants of undernutrition include: lower educational level, larger family size, lower monthly income, and smoking. Based on the findings of the study, it is important to prioritize such groups of daily laborers for targeted nutrition programs (screening, food fortification, dietary approach), to reduce the burden of undernutrition and contribute to their productivity.

GJMEDPH 2016; Vol. 5, issue 2

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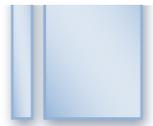
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Conflict of Interest—none

Funding—none



Keywords: Undernutrition, Daily Laborers, Cobblestone Workers

INTRODUCTION

Undernutrition occurs when people do not consume (or absorb) enough food (nutrients) to cover their needs for energy, growth, and maintenance of a healthy immune system.¹ Undernutrition is among the most significant public health problems worldwide, affecting more than 900 million individuals,² and an important underlying cause of illness and death in Africa.¹ Economy is also impacted by undernutrition; directly, through reduced productivity due to poor physical condition, and indirectly, due to poor cognitive function and learning abilities. Furthermore, undernutrition increases health expenses.³

For many countries, the current rate of expansion of urban agglomerations has brought about severe challenges to food and nutrition security. There is a need to focus on the factors specific to life in urban environments, which affect level of undernutrition in urban populations. The nutritional status of adults is vital, considering their role in the economic support system.⁴

Good nutrition provides individuals a better chance to reach full intellectual capacity, economic productivity, and enjoyment of an adequate quality of life. Yet despite this knowledge, under-nutrition remains among the most devastating problems facing the world's poor.⁵ Because individuals with low body mass index (BMI) are at a physical disadvantage, the stress imposed upon their bodies by manual labor requiring body mass (such as carrying loads, digging earth, or coal or stone splitting) is further exacerbated.⁶

Undernutrition imposes a huge cost both in human and economic terms worldwide, resulting in billions of dollars in lost productivity and avoidable health care spending.⁷ Every year, US \$1.4-2.1 trillion, or 2-3% of global Growth Domestic Product (GDP), is lost due to under-nutrition. In Ethiopia, the cost of undernutrition is up to 16.5% of GDP, and it is primarily the poor who experience these economic losses. Addressing undernutrition means putting more money in poor people's pockets.⁸

Undernutrition of children, pregnant women, and lactating mothers typically receives the most

attention of investigators, while undernutrition of daily laborers in developing countries is poorly addressed.⁹ Studies shows that daily laborers are more likely to be higher alcohol consumer and to miss breakfast.¹⁰ They are also more likely to experience job stress and long working hours, which may cause them to seek out convenient food options such as street vending, which is less healthy than food prepared at home.¹¹

In Ethiopia, migrants to the capital city of Addis Ababa constitute a large share of the city's population (37%). A substantial segment of migrants are involved in daily labor, many of whom are disadvantaged, vulnerable, face reduced quality of life, and have few opportunities to overcome the challenges.¹² Cobblestone work is one of the emerging enterprises that involve a large number of daily laborers with various socio-demographic characteristics in Ethiopia. However, there is a paucity of data on the nutritional status of daily laborers in Ethiopia. To best of the investigators' knowledge, there is no research report on the level of undernutrition of daily laborers working in cobblestone projects in Ethiopia.

METHODS

Study Settings, Period and Study Design

Vocational training of cobblestone technology was introduced to Ethiopia by the mayor of the eastern Ethiopian town of Dire Dawa following a visit to France. More than 20 towns in Ethiopia, including Addis Ababa, have now institutionalized cobblestone-paving construction.¹³ With an urbanization rate of approximately 4% per annum, Ethiopia has one of the fastest growing urban populations in Africa. Given that an estimated 12 million people are residing in urban areas, with youth constituting the highest proportion of the unemployed, the cobblestone initiative can make a difference.¹³

This study was conducted in Addis Ababa which is the capital city of Ethiopia with total population estimation of 3 million.¹⁴ Administratively Addis Ababa is divided into ten sub cities and 112 districts. Yeka sub city was purposively selected among other sub cities as the number of cobblestone project was relatively higher. Six thousand six hundred fifteen



(6,615) cobblestone workers were found in cobblestone projects registered as daily laborers. A worksite-based cross-sectional study design was employed to collect the data from February 20 to April 1, 2015.

Study Variables

The dependent variable for this study was undernutrition. Cobblestone worker with BMI < 18.5% Kg/m² were considered to have undernutrition. The measurement of weight and height was described below in sampling procedure. The predictor variables were socio-demographic variables, working condition of cobblestone workers, individual dieting habit, behavioral factors and accessibility & availability of food.

Sample Size and Sampling Procedures

Cobblestone workers were systematically selected from the project sites and included in the study with inclusion criteria of age (greater than 18) and work experience as a cobblestone worker greater than 6 months. Exclusion criteria included any illness and confirmed by data collectors, diagnosis of chronic illness prior to cobblestone work, and lactating or pregnant women.

The sample size was calculated for level of undernutrition (using single population proportion formula) and for determinant factors of undernutrition (double population proportion formula). Since the sample size of the level of undernutrition yields a higher sample size than the determinant factors of undernutrition, we used the sample size of level of undernutrition; $n=423$. Assumption for sample size calculation; the prevalence of undernutrition (p) was considered 0.5 (as there was no any study shows prevalence of undernutrition for daily laborer) expected estimates BMI < 18.5; $Z_{\alpha/2} = 1.96$ (Z -score corresponds to 95% confidence level); margin of error (d) = 0.05. With the above assumption, calculation of the sample size using Epi Info 3.5.3 statcalc was found to be 384 + 10% (non-response rate) = 423.

Cobblestone project sites namely Qatsila, Gewasa, and Tafo were selected by lottery method. Proportional allocation of sample size was used for each cobblestone project site (Qatsila = 288, Gewasa

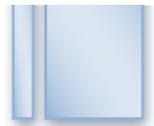
= 107 and Tafo = 29). Systematic random sampling was carried out to select study units for interview using formula $N/n = 6,615/423 = 15.6$. Therefore, the sample individual was taken every 15th and 16th after selecting the first individual by lottery methods. A list of daily laborers was obtained from the cobblestone project office.

Data Collection Process and Tool

A structured questionnaire was used to collect information on socio-demographic variables including sex, age, marital status, educational status and monthly family income. Monthly family income was estimated by combining incomes reported for all family members living together. Study participants were interviewed before they started work by data collectors (who completed grade 12 and above). Anthropometric measurements of Body weight (kg) was measured using portable mechanical analog weight scale and standing height was measured using a wall stadiometer, respectively. The scale was carefully handled and periodically calibrated by placing standard calibrate weights of 2 kg iron bars on the scale to ascertain accuracy. Subjects were instructed to take off their shoes and with minimum clothing before performing these measurements. Body Mass Index (BMI) was calculated as body weight (kg)/height (m²). The classification of BMI applied in this study was BMI value of < 18.5 kg/ m² to represented under-nutrition.

Interview using Household Dietary Diversity Score (HDDS) Questionnaire

Data were collected by face-to-face interview using a structured household's dietary diversity score modified from anthropometric indicators measurement guide FANTA that was used previously in Ethiopia, to estimate food intake.¹⁵ The HDDS included twelve food categories (Cereals, roots and tubers, vegetables, fruits, Meat and poultry, Egg, Fish, Fat rich food, milk/milk products, Sweet food and miscellaneous) was designed to obtain qualitative information about the usual food consumption patterns with an aim to estimate 24 hours food items or groups were consumed. The respondents were asked to recall the exact food intake of the previous day. One single 24-hours recall was collected for every participant. All



frequency variables were coded as yes, no and I don't know. The questionnaire was translated from English to the local language Amharic, and subsequently translated back to English.

Data Quality Control, Management and Analysis To maintain the quality of the data; a structured, pretested and standardized questionnaire was adapted from the food and nutrition technical resource, Anthropometric Indicators Measurement Guide (FATA, 2006),¹⁵ and some adjustment was made to fit the local context and study objectives. The data were collected, checked for completeness, and edited for consistency. The data were then entered to statistical software EPI Info 3.5.3 and cleaned by going back to hard copy.

The cleaned data was transferred to SPSS version 20 for data analysis. Anthropometric measurements were converted to Body Mass Index (BMI) and mean dietary intake score were computed using appropriate measures. Descriptive statistics (frequencies, percentages, etc) of different variables was computed. Anthropometric measurements were converted to Body Mass Index (BMI) and mean dietary intake score were computed using appropriate measures.

Logistic regression (Crude odd ratio (OR) with CI) was computed to see the presence of association between the selected independent variables at different categories and multivariate analysis (adjusted odd ratio (AOR)) was made to observe the relative effect of independent variable on under-nutrition by controlling the effects of other variables. Variables those with $p < 0.2$ in COR were entered in the multivariate analysis. The results were presented using tables and graphs.

Operational definitions

Daily laborer: daily laborer working in cobblestone project, grinding and digging at least for 6 months

Table 1 Socio-Demographic Characteristics of Daily Laborers Working in Cobblestone Project, Yeka Sub City, February 2015, Addis Ababa, Ethiopia

Variables	Frequency (n=423)	Percent (%)
Sex		
Male	300	70.9
Female	123	29.1

Undernutrition: daily laborers with BMI < 18.5kg/m²

Dietary diversity: the number of reported different foods and food groups consumed by daily laborers within 24 hours

Low diversity: eating less than the mean dietary diversity score

High diversity: eating greater than or equal to the mean diversity score

Ethical considerations

Ethical clearance was ensured from the Institutional Review Board of Addis Ababa University, College of Health Science. Additionally, Addis Ababa Cobblestone Project Office ethics committee approved this study and a formal letter was distributed to each cobblestone project sites. Verbal consent was obtained from individual participants.

RESULTS

Socio-Demographic Characteristics

Four hundred twenty three daily laborers were included in this study with a response rate of 100%. The majority of respondents were male, 300 (70.9%), and the median age of respondents was 24 years with 18 and 58 years minimum and maximum ages, respectively. More than half 247 (58.4%) were between the age of 18-24. Among study participants, 280 (66.2%) were non-married and three-quarters, 319 (75.4%), had a family size between one and two. Most of the study participants had completed primary school, 175 (41.7%) or \geq secondary school, 91 (38%). Mean and median income of the respondents was 2079 ETB and 2000 ETB respectively. The majority of the respondents, 311 (73.5%), had worked between 6-17 months in the cobblestone project (Table 1).

Age		
18-24	247	58.4
25-34	157	37.1
≥35	19	4.5
Marital Status		
Married	143	33.8
Non Married	280	66.2
Educational Status		
No Education	87	20.6
Primary	175	41.7
≥Secondary	161	38
Family Size		
≥3	104	24.6
1-2	319	75.4
Monthly Income (ETB)		
≤ 1500	154	36.4
1500-2499	124	29.3
≥2500	145	34.2
Work Experiences (in Months)		
6-17	311	73.5
18-29	74	17.5
≥30	38	9.0

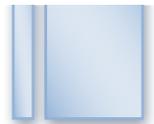
Nutritional Status

Among the study participants, 141 (33.3%) were underweight (BMI<18.50), 282 (66.7%) were BMI ≥18.5. Around one third, 133 (31.4%), of daily laborers ate breakfast less than or equal to two days per week. The majority of study participants, 410 (96.9%) and 401 (94.8%) of daily laborers, ate lunch and dinner

respectively. From study participants, 266 (62.9%) and 370 (87.4%), daily laborers ate snacks and fast food ≤ 2 times per week, respectively. Regarding the BMI of study units, 141 (33.3%) were underweight (BMI < 18.50) and 282 (66.7%) were BMI ≥ 18.5; among those 7 (1.7%) were BMI > 25 (Table 2).

Table 2 Individual Dietary habits for the last six months and Body Mass Index of Daily Laborers Working in Cobblestone Project, Yeka Sub City, February 2015, Addis Ababa, Ethiopia

Variables	Frequency (n=423)	Percent (%)
Average Meal Per Day		
1 Meal	3	0.7
2 Meals	58	13.7
3 Meals	357	84.4
>3 Meals	5	1.2
Breakfast per Week		
≤ 2 times	133	31.4
3-4 times	68	16.1
Daily	222	52.5
Lunch per Week		
≤ 2 times	3	0.7
3-4 times	10	2.4



Daily	410	96.9
Snacks per Week		
≤ 2 times	266	62.9
3-4 times	112	26.5
Daily	45	10.6
Dinner per Week		
≤ 2 times	8	1.9
3-4 times	14	3.3
Daily	401	94.8
Fast Foods per Week		
≤ 2 times	370	87.4
3-4 times	32	7.6
Daily	21	5.0
BMI (Kg/m²)		
<18.50	141	33.3
≥18.50	282	66.7

Dietary Intake and Food Consumption

From the total number of reported different foods and food groups consumed by daily laborers within 24 hours; cereals, fruits, oils and fats and miscellaneous were eaten on regular bases. A large proportion of the

subjects consumed fish and seafood, meat and poultry, eggs and vegetables less frequently. The mean dietary diversity score is 5.86, and 206 (48.7%) of daily laborers were below mean dietary diversity score. (Fig. 1).

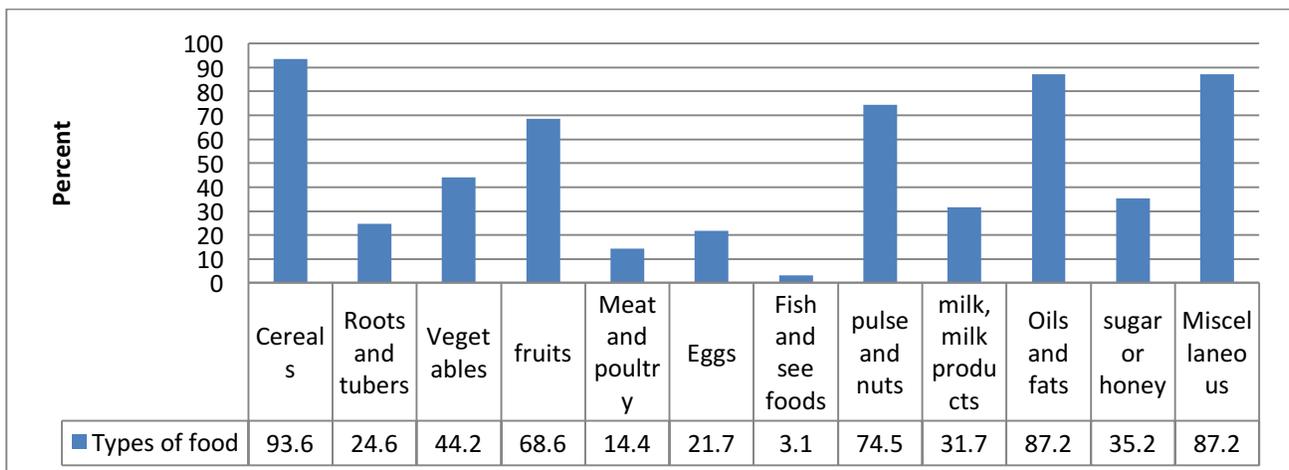


Fig 1 Dietary Intake of Daily Laborers during the previous 24-hour period (Yesterday day and night) working in Cobblestone Project, Yeka Sub City, February 2015, Addis Ababa, Ethiopia

Of study participants, 20.1%, 56.7% and 21.3% of the respondents were smokers, alcohol consumers and

khat chewers respectively. Among study participants, 43.7% obtained their food outside the home. (Table 3)



Table 3 Behavioral Related Factors and Food Sources of Daily Laborers Working in Cobblestone Project, Yeka Sub City, February 2015, Addis Ababa, Ethiopia

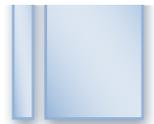
Variables	Frequency (n=423)	Percent (%)
Smoking Cigarette		
Yes	84	19.9
No	339	80.1
Smoking per Day		
1-5	38	45.2
6-10	38	45.2
More than 10	8	9.5
Alcohol Drinking		
Yes	240	56.7
No	183	43.3
Alcohol Drinking per Day		
Sometimes	153	63.8
Once a Day	79	32.9
More than Once a Day	8	3.3
Khat Chewing		
Yes	90	21.3
No	333	78.7
Khat Chewing per Day		
Sometimes	57	63.3
Once a Day	27	30.0
More than Once a Day	6	6.7
Source of Food (Consumed at Work)		
At Home	238	56.3
Outside Home	185	43.7
Available		
Yes	29	15.7
No	156	84.3
Accessible		
Yes	53	28.6
No	132	71.4

Associated Factors

The multivariate analysis was done by considering the conceptual framework to assess the relative effect of explanatory factors on the outcome variable (undernutrition). Daily laborers who had no education were eight times [OR= 7.83; 95% CI ;(3.78, 16.22)] and primary school were two times [OR=2.26; 95% CI; (

1.25, 4.08)] more likely to be undernourished compared to secondary and above education level.

Daily laborers who had a bigger family size (≥ 3) were three times [AOR=2.88; 95% CI; 1.54-5.40] more likely to be undernourished compared to low family size (≤ 2). Daily laborers who had a monthly income <1500 ETB were ten times [OR= 9.77; 95%CI; (4.92, 19.39)] and 1500-2499 ETB were two times [OR= 2.16; 95% CI;



(1.08, 4.34)] more likely to be undernourished compared to those with a monthly income \geq 2500 ETB. (Table 4).

Table 4 Bivariate and Multivariate Analysis of Undernutrition and its Determinant Factors Among Daily Laborers Working in Cobblestone Project, Yeka Sub City, February 2015, Addis Ababa, Ethiopia

Characteristics	Undernutrition Yes	Crude OR (95% CI)	Adjusted OR (AOR)
Sex			
Male	112 (37.3%)	1.93 (1.19-3.11)	1.16 (0.62-2.17)
Female	29 (23.6%)	1	1
Educational Status			
No Education	50 (57.5%)	6.41 (3.56-11.56)	7.83 (3.78-16.22)*
Primary	63 (36.0%)	2.67 (1.60-4.45)	2.26 (1.25-4.08)*
\geq Secondary	28 (17.4%)	1	1
Family Size			
\geq 3	50 (48.1%)	2.31 (1.47-3.65)	2.88 (1.54-5.40)*
1-2	91 (28.5%)	1	1
Monthly Income (ETB)			
< 1500	83 (53.9%)	5.35 (3.15-9.08)	9.77 (4.92-19.39)*
1500-2499	32 (25.8%)	1.59 (0.88-2.85)	2.16 (1.08-4.34)*
\geq 2500	26 (17.9%)	1	1
Dietary Diversity			
< Mean	89 (43.2%)	2.41 (1.59-3.65)	1.82 (1.07-3.08)*
\geq Mean Score	52 (24.0%)	1	1
Smoking			
Yes	50 (59.5%)	4.00 (2.43-6.59)	2.02 (1.06-3.87)*
No	91 (26.8%)	1	1
Alcohol Drinking			
Yes	108 (45.0%)	3.71 (2.36-5.86)	3.32 (0.80-6.11)
No	33 (18.0%)	1	1
Khat Chewing			
Yes	43 (47.8%)	2.19 (1.36-3.53)	1.69 (0.90-3.17)
No	98 (29.4%)	1	1

* *Factors that have association with undernutrition*

DISCUSSION

This study illustrated that one-third of daily laborers were undernourished (BMI<18.5). This finding is higher compared to studies in Indian factory workers (33.3% versus 20.0%).¹⁶ This may indicate daily laborers in Addis Ababa were more likely to be disadvantaged to avail and access food at work place.^{12, 17} The national nutrition program gives priority (pregnant and lactating women, infant and children, people living with HIV/AIDS food insecure households and displaced population groups) and to the rural population,¹⁸ but this study shows significant

undernutrition exists in daily laborers in urban setting with low socio-economic status.

From reported different foods and food groups consumed by daily laborers within 24 hours; cereals, pulse and nuts, fruits, oils and fats and miscellaneous were eaten on regular bases. Meat and poultry, egg, fish and seafood, milk and milk products were the lowest or not taken at all on regular bases. This is similar to studies in Gondar (Ethiopia), and India.^{19, 20} This indicates study participants were consuming low dietary protein, which is important for wear-and-tear



rate of body muscles, to repair and regenerate the muscular structure and ligaments.²¹

The majority of study participants were alcohol consumers. This is similar to studies in Japan among term-limited and tenure-track employees.^{10, 11} In this study daily laborers eat breakfast less regularly (31.4% less than two times per week and 16.1% between 3 and 4 times per week). This finding is comparable to study done in Japan.¹⁰

Study participants who had no education were significantly more likely to be undernourished compared to \geq secondary education level. Daily laborers who had low monthly income (<1500 ETB) were significantly more likely to be undernourished compared to monthly income \geq 2500 ETB; it is also true in studies of Jimma (Ethiopia) and Mexican adults.²²⁻²⁴ Daily laborers with bigger family size (\geq 3) were significantly more likely to be undernourished compared to low family size. Smokers were significantly more likely to be undernourished compared to non-smokers. This is similar to studies in Egypt detailing smoking bans at universities.²⁵

In this study, adjusted regression model shows lower educational status, bigger family size ($>$ 2), lower monthly income (<1500 ETB), low dietary diversity and smoking were found to be significant factors for under-nutrition.

CONCLUSION AND RECOMMENDATION

From this study finding, one third of cobblestone workers were undernourished. Significant determinants of undernutrition include lower educational level, bigger family size, lower monthly income, smoking and low dietary diversity.

It is important that nutrition programs consider expanding their focus to the growing population of cobblestone workers in urban dwellers (cobblestone project). This can be an interim strategy until the majority are empowered through better education and earn sufficient income to feed themselves. For those who can afford, it is important to emphasize the importance of improving their dietary diversity and eating habits in improving their nutritional status. It is recommended that further research to be undertaken

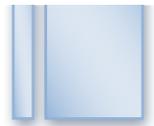
for better understanding of undernutrition level in cobblestone projects including migration status.

ACKNOWLEDGEMENT

We would like to express our thanks to the schools of Public Health, College of Health Sciences, Addis Ababa University for giving us the chance to conduct this research. Our heartfelt thanks also go to Yeka Sub City Cobblestone Project Office for their cooperation and permission to conduct this study. We would also like to thank Ms. Caitlin Quade for reviewing the writing style. We want to thank all the study participants and data collectors for their cooperation and willingness to participate in this study. Furthermore, we would like to thank all staffs of the School of Public Health library for providing me important references for this research work.

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