Assessment of Nutritional Status and Morbidity Profile of Dal Mill Workers in Kalaburagi District

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ABSTRACT

Kalaburagi district is a major pulse producing and processing district of Karnataka and it is well known as Pulse bowl of Karnataka, having 308 registered dal mill units operating at various capacities. Dal mill workers in mills are exposed to dal dust linked with developing multiple morbidities. Therefore, the present study focuses to assess socioeconomic, nutritional status and occupational related morbidities among the dal mill workers. The results showed that majority of the workers belonged to age group of 25 to 35 years (46.3 %), most of them belonged to hindu religion (93.6 %) and 78.7 per cent of the respondents were married and belonged to joint family (56.3 %). Half of the mill workers (54.3 %) were living in pucca house and belonged to upper lower and lower middle class (79.3 % and 20.7 %).The mean height and weight of the mill workers were 170.6 cm and 65.9 kg, respectively. Majority (82.6 %) of the subjects had normal body mass index (BMI) of 22.6 kg / m². Half of the mill workers (58 %) were not using the protective measures during milling activities. They were suffering from musculoskeletal problems like pain in the hand and legs (72.3 %), back ache (68.3 %), body ache (69.6 %) and pain in the shoulder (57.3 %). Most of the respondents expressed that they always suffered from cold, cough and eye strain due to dust that is 53.3 per cent, 50.6 per cent and 72.3 per cent, respectively. Among dal mill workers 44.5 per cent of the workers also expressed that they had respiratory problems. Therefore, it is necessary to protect workers from dal dust exposure by implementing reduction and control methods and also through health awareness programmes.

Keywords : Dal mill, Health, Mill workers, Morbidities, Respiratory problems

OCCUPATIONAL hazards are the great burden on our health system. Over 20 million people in India working in different industries are exposed to occupational health hazard in one or other way. The diseases of the respiratory system induced by occupational dusts are influenced by the type of dust, dose and duration of exposure. Occupational health is concerned with health of the workers in its relation to work and working environment Mohankumar *et al.* (2018).

Occupational morbidities are mainly caused by a pathologic response of the workers to their working environment. With rapid industrialization of the developing world, food dust induced lung diseases are poised to become a global health problem (Anonymous, 2018). The interaction between man and his working environment may lead to ill health, if work stress is beyond human tolerance. Occupational

morbidities and injuries result from specific exposures at work. In addition, work exposures may aggravate certain illnesses or be a factor of varying importance in causing diseases of multiple etiologies.

Occupational health, as defined by the World Health Organization, is concerned with all elements of health and safety at work, with a strong focus on preventing dangers. Worker's health is influenced by a number of elements, including occupational risk factors that contribute to accidents, respiratory diseases, hearing loss, musculoskeletal diseases and stress-related disorders. The most common morbidities in occupational health reported by WHO are back pains, hearing loss, chronic obstructive lungs disease, asthma, injuries, lung cancer and leukaemia.

Nutritional deficiency disorders negatively affect health of an individual by causing decreased work

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performance, impaired defense mechanism, lowered physical stamina and attentiveness which is mainly because of poor food habits. (Pallavi *et al.,* 2020). So, health and nutritional status plays an important role because it is directly linked with the work performance. Moreover having good nutritional status plays crucial role in achieving better work outcome.

Redgram is largely grown in northern parts of Karnataka. In Karnataka, especially in Kalaburagi district and is called as 'Pulse bowl of Karnataka' (Ashokkumar and Venkataranga, 2019). It has received Geographical Indication (GI) Tag as 'Kalaburagi Tur Dal' from government of India during the year 2019. The district has an area of about 3.28 lakh hectares with production of 3.77 lakh tonnes and a productivity of 1209 kg/ha (Anonymous, 2017). More than 15,000 dal mills are located in different part of country out of which 308 registered mills are located in Kalaburagi district of Karnataka state operating across different scales. Many of the local people are currently employed in those dal mills and getting longer exposure to many environmental factors such as occupational dust, contaminated air and noise, these environmental hazards even at mild concentrations are favorable for development of occupational related morbidities among mill workers.

As a result, mill workers have a high level of morbidities. It is critical to reduce the burden of diseases among mill workers in order to improve their quality of life. Primary healthcare services could be tailored to the local conditions based on the pattern and magnitude of morbidity. Thus, a study was performed to assess the socio-economic, nutritional status and morbidity profile of dal mill workers in Kalaburagi district, as well as to offer remedial measures based on the study's findings.

METHODOLOGY

The research study was conducted in Kalaburagi district of Karnataka state during the year 2019-20. Kalaburagi district was purposively selected because of major pulse producing area, as it is well known aspulse bowl of the state and having majority of dal mills in the district.

Study Area and Sample Size: The study was conducted in the Kapnoor Industrial Area, Kalaburagi which is six km away from the main city. About 300 dal mill workers who were engaged in milling activities were randomly selected for the study.

Inclusion and Exclusion Criteria: All the male workers with age group between 25 to 50 years, who were currently working in the identified dal mills from past one year and workers who expressed their willing to participate in the study were included. Workers below 25 and above 50 years of age, who are ill at the time of data collection and those not willing were excluded from the study.

Data Collection Tools: A pretested structured questionnaire was used to collect the data. The questionnaire consisted of the socio-demographic profile, health and nutritional status, dietary habits, clinical status, occupational details, morbidity profile and occupational hazards of the workers. The complete detailed information on age, gender, religion and family type was obtained (Sudha *et al.,* 2013). Education, occupation, income and socio-economic status were assessed by modified Kuppuswamy's Socio-economic Status Scale (Saleem, 2020).

Anthropometric Measurements: Recording of somatic measurements like height (m), weight (kg), waist and hip circumference of the dal mill workers were taken by standard procedures and tools (Jelliffe, 1966).

Body Mass Index (BMI): The BMI of the subjects was assessed by using height (m) and weight (kg), as per the WHO guidelines and was considered to categorize the subjects with following categories (WHO, 2017).

$$\text{Body Mass Index (BMI)} = \frac{\text{Weight (kg)}}{\text{Height (m}^2)}$$

BMI Category	BMI (kg/m^2)
Underweight	<18.5
Normal	18.5–24.9
Overweight	25–29.9
Obese	≥30

Waist to Hip Ratio (WHR): Waist to hip ratio is an indicator of distribution of adipose tissue in the body. Waist circumference and hip circumference were used to calculate the waist to hip ratio and standardized according to Lean *et al.* (1995).

$$\text{Waist-Hip Ratio} = \frac{\text{Waist (cm)}}{\text{Hip (cm)}}$$

Male	At risk	No risk
	> 0.90	< 0.90

Lean Body Mass Index (LBMI): Lean body mass index was calculated for all the dal mill workers using the formula (Rao and Balakrishna, 1995).

$$\text{Lean Body Mass Index (LBMI)} = \frac{\text{Height 2 (cm)}}{\text{Weight (kg)}}$$

The morbidity status of the subjects was assessed using questionnaire for the past three months.

Data Analysis: The study data obtained was subjected to statistical analysis with appropriate tools. Descriptive statistics like mean and standard deviation were calculated.

RESULTS AND DISCUSSION

Socio Economic Profile of Dal Mill Workers

Socio economic status of the dal mill workers is represented in Table 1. Forty-six per cent of the respondents belonged to age group of 25 to 35 years. 42.0 per cent of the respondents were between the age group of 36 to 45 years of age. Only 11.6 per cent belonged to the age group between 46 to 50 years. Majority of the respondents belonged to Hindu religion (93.6 %) and only 6.3 per cent were Muslims.The results are in accordance with the study carried out by Alemseged *et al.* (2020) where most 48.9 per cent of the flour mill workers were found between the age group of 26 - 45 years. In the current study most of the workers belonged to younger age group, this indicates as age increases it is difficult to engage in moderate to heavy work.

In the present study 19.7 per cent of the respondents were illiterate, 39.3 per cent of mill workers had their

TABLE 1

Socio demographic characteristics of dal mill workers (n=300)

Characters	No.	%
Age (Years)		
25-35	139	46.3
36-45	126	42.0
46-50	35	11.6
Religion		
Hindu	281	93.6
Muslim	19	6.30
Education		
Illiterate	59	19.7
Primary school	21	7.00
Middle school	30	10.0
High school	67	22.3
Intermediate	112	37.3
Graduate	11	3.70
Marital status		
Married	236	78.7
Unmarried	64	21.3
Familytype		
Joint	169	56.3
Nuclear	131	43.7
Occupation		
Industry labour	255	85.0
Industry labour & Agriculture	45	15.0
Family Income		
49962 - 74755	0	0.00
29973 - 49961	39	13.0
10,002 - 29972	245	81.7
≤ 10,001	16	5.3
Housing condition		
Katcha house	137	45.7
Pucca house	163	54.3
Type of food		
Vegetarian	241	80.3
Non-Vegetarian	59	19.6

education upto school level. Most of the respondents had their education upto intermediate or diploma level (37.3 %). Few of the mill workers were graduated about 3.7 per cent. The results are comparable with study conducted by Sudha *et al.* (2013) on occupational hazards faced by dal mill workers where most of the workers 33.3 per cent studied upto secondary level. Similarly, the result is in conformity with the study conducted by Deshpande *et al.* (2019) where 42.06 per cent respondents had education upto school level and few (3.4 %) were graduated. In the present study majority of the respondents were married (78.7 %).

Fifty per cent of the respondents belonged to joint family that is (56.3 %) and majority of the mill workers (85.0 %) were dependent on milling work as their main occupation and few of the mill workers had agriculture as their subsidiary occupation (15.0 %). The study results are in line with the study conducted by Sudha and Rupali (2013) on occupational health hazards faced by the flour mill workers, where 60 per cent of the respondents were working in flour mills. In the present study more than fifty per cent of the workers were living in pucca house that is (54.3 %), remaining were in katcha house. Majority of dal mill workers were vegetarian (80.3 %).

Distribution of dal mills workers based on the socio-economic class shown in Fig. 1 where most of the mill workers belonged to the upper lower class (79.3 %), some of the respondents were in the class of lower middle class that is (20.7 %) may be due to agriculture assubsidiary family occupation. These findings are in accordance with the study conducted

Fig. 1: Distribution of subjects based on their socio-economic class

by Rana *et al.* (2018) where majority of rice mill workers belonged to upper lower socio-economic class.

Anthropometric measurement of the subjects is presented in Table 2. The mean height and weight of the subjects were found to be 170.6 ± 4.14 cm and 65.9 ± 7.63 kg, respectively. The anthropometric indices like mean body mass index of the dal mill workers was 22.6 ± 2.71 kg / m² and lean body mass index of the workers was 442.3 ± 50.0. The mid upper arm circumference and triceps thickness of mill workers was 27.8 ± 3.0 cm and 11.5 ± 2.51 mm, respectively. The mean waist to hip ratio was found to be 0.89 ± 0.02. The present study is in compliance with research conducted by Roopa *et al.* (2020) where rice mill workers had height of 167.5 ± 9.01, weight 67.9 ± 10.04 and had 24.11 ± 2.10 kg/m² BMI.

TABLE 2
Mean anthropometric profile of dal mill workers
(n=300)

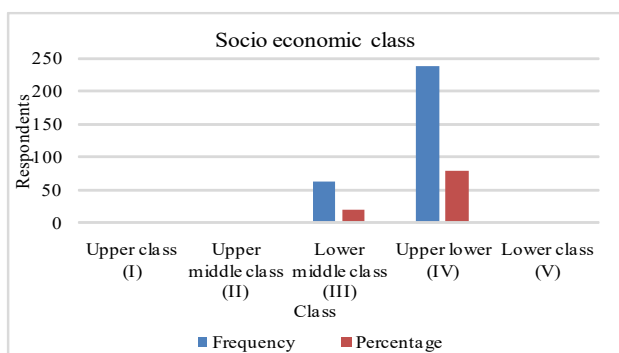| Anthropometric measurements and Indices	Mean ± SD
Height (cm)	170.6 ± 4.14
Weight (kg)	65.9 ± 7.63
Body Mass Index (kg/m²)	22.6 ± 2.71
Lean Body Mass Index (LBMI)	442.3 ± 50.0
Mid upper arm circumference (MUAC)	27.8 ± 3.0
Triceps (mm)	11.5 ± 2.51
Waist circumference (cm)	89.8 ± 3.70
Hip circumference (cm)	99.8 ± 4.0
Waist to hip ratio (WHR)	0.89 ± 0.02

Distribution of the subjects acceding to BMI are presented in Table 3. Majority of the subjects were in the category of normal body mass index (82.6 %) followed by (12.3 %) of the mill workers were in the category of overweight and a few of the mill workers were in the category of underweight and obese category about 3.0 per cent and 2.0 per cent, respectively. The study similar to the study conducted by Mohankumar *et al.* (2018) where most of construction workers (87.4 %) were within the normal BMI category, a few of the subjects were in the

TABLE 3

Distribution of dal mill workers according to body mass index   (n=300)

	No.	%
BMI Categories		
Underweight	6	2.00
Normal	248	82.6
Overweight	37	12.3
Obese	9	3.00
WHR Category		
Normal < 0.90	221	73.67
At risk > 0.90	79	26.33

category of underweight, over weight and obese like 5.3 per cent, 7 per cent and 0.3 per cent, respectively. The distribution of workers based on the waist to hip ratio is also depicted in Table 3. Overall majority of the workers were in the normal waist to hip ratio (73.67 %) and few were obese (26.33 %).

Table 4, depicts the association between age and body mass index of dal mill workers. It was observed that mill workers were in the age range of 25 - 35 years (46.3 %), (81.2 %) had the normal range of BMI that is 18.5 to 24.9 followed by mill workers (12.9 %) in overweight category that is 25.0 to 29.9 and a few were obese 2.15 per cent. Workers aged between 36 - 45 years (42.0 %), majority (80.1 %) were found to be within normal range, some (14.2 %) mill workers were overweight and a few of the mill workers (4.76) were obese. workers who are aged between 45 - 50 years (11.6 %), where majority of the mill workers

were within the normal range that is (97.1 %) only one respondent was in overweight category. On overall, among dal mill workers, majority (82.6 %) were within the normal BMI range, followed by (12.3 %) overweight and a few of the mill workers were obese (3 %). Positive association was recorded at 0.05 per cent level of significance for age and BMI of dal mill workers. The results are in accordance with the study by Sandeep *et al.* (2015) among construction workers 58.7 per cent were in the normal range, 9.8 per cent were overweight and 0.6 per cent were obese in the active age group. The normal BMI of the workers could be attributed to their diet predominantly consisted of cereals, pulses, nuts and oil seeds.

Average Dietary Intake of Dal Mill Workers

The average consumption of food items from dal mill workers are depicted in Table 5. It showed that the consumption of milk and milk products, vegetables and fruits consumption were very low when compared to recommend dietary allowance *i.e.,* 150, 241.7 and 36.7, respectively. Whereas, consumption of cereals and pulseswere higher than the RDA and consumption of nuts and oil seeds and fats were almost near to RDA. The statistical analysis showed a significant difference at one per cent level for the intake of milk and milk products, vegetables, fruits, nuts and oil seeds and fats. But cereals and pulse consumption showed a positive significant difference at one per cent level. The requirement of pulses was almost met as per the RDA. Accept pulses and fats significant difference observed in consumption of different food groups.

TABLE 4

Association between age and BMI of dal mill workers

Age (Years)	Body mass index				Total	Chi-Square Value
	Underweight	Normal	Overweight	Obese		
	< 18.50	18.50 - 24.9	25.0 - 29.9	>30.0		
25 - 35	5 (3.59)	113 (81.2)	18 (12.9)	3 (2.15)	139 (46.3)	
36 - 45	1 (0.79)	101 (80.1)	18 (14.2)	6 (4.76)	126 (42.0)	12.945*
45 - 50	0 (0.00)	34 (97.1)	1 (2.85)	0 (0.00)	35 (11.6)	
Total	6 (2.0)	248 (82.6)	37 (12.3)	9 (3.0)	300 (100)	

*Significant @ 5 per cent level ; Numbers in parenthesis indicates percentage

TABLE 5
Average dietary intake of dal mill workers

Food groups (g)/day	RDA#	Actual intake Mean ± SD test		% Adequacy	'Z' test	
Cereals	270	322.7 ±	24.2	119.50	10.859	**
Pulses	90	89.7 ±	11.60	99.67	1.549	NS
Milk and Milk products	300	150 ±	17.50	52.33	45.272	**
Vegetables	350	241.7 ±	39.30	69.06	13.715	**
Fruits	150	36.7 ±	12.10	24.40	46.580	**
Nuts & Oil seeds	20	16.4 ±	2.86	82.00	6.348	**
Fats	27	25.3 ±	3.60	94.00	2.271	NS

RDA#, NIN, Dietary Guidelines for Indians (2017). **Significant at the 1 per cent level,

It can be observed from Table 5 dal mill workers were consuming more cereals and pulses and fats when compared to all other food groups and it was more than the RDA for cereals and almost equal for pulses and fats. Since pulse is the major crop grown in the Kalaburagi district, consumption of pulses found to be higher due to easy availability of the pulses and moreover use of different kinds of pulse in their daily diet. Oil seeds and nuts were found to be on par with the RDA.The consumption of milk, vegetables and fruits were low when compared to RDA. This trend may be due to the socio-economic condition of the dal mill workers but, cereals and pulses are available at low rates compared to other commodities so, it leads to higher consumption of the same. Moreover, the dal mill workers may not have the knowledge and awareness regarding nutritional importance of the protective foods like fruits and vegetables groups. Similar results were found by Bellurkar (2015) that, cent per cent farm workers were consuming cereals, pulses and green leafy vegetable.

Clinical Status of Dal Mill Workers

The clinical status of the selected mill workers is depicted in Table 6. Most of the mill workers had dyspigmentation (51.33 %), easy plucabaility (10.33 %) and sparseness (14.67 %).

Whereas, pertaining to the skin appearance majority of the workers had dry and rough skin (78.00 %). These symptoms might be due to the extensive

TABLE 6
Clinical symptoms observed among dal mill workers (n=300)

Clinical symptoms*	No.	%
Hair		
Dis pigmentation	154	51.33
Easy plucabaility	31	10.33
Sparseness	44	14.67
Skin		
Dry and Rough	234	78.00
Mouth (Gums)		
Bleeding gums	24	8.00
Teeth		
Normal	272	90.67
Moulted	16	5.33
Dental caries	12	4.00
Nail		
Kolinychia	07	2.33
Brittle ridge nails	13	4.33

*Multiple response

exposure to the dal dust in the working environment and lack of use of protective measures in the working area.

Eight per cent had bleeding gums, 5.33 per cent had molted teeth and 4.00 per cent were observed with dental carries, these clinical signs might be attributed to that majority of the workers were consuming tobacco and other forms of guthka like betel leaves

and areca nut. Majority of the workers had normal teeth (90.67 %).

Pertaining to the nail very few of the workers were observed with koilonychias and brittle ridge nails *i.e* ., 2.33 and 4.33 per cent, respectively. Similar results were observed by Mohankumar *et al.* (2018) among construction workers.

Fig. 2 depicts the uses of personal protective equipments among dal mill workers, the results showed that majority 58 per cent of the dal mill workers were not using the protective measures during milling activities. Whereas, a few of the mill workers were using locally available hand kerchiefs and towels as protective measures always (18.3 %) and 23.7 per cent were using sometimes in the milling area. The reason was mill owners not provided any protective equipments and workers were not able to afford to buy. The present study results are on par with the
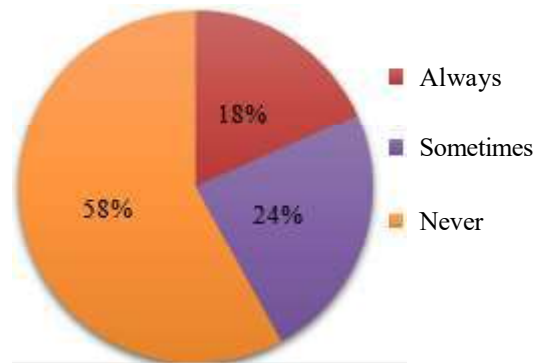
Use of Protective Measure

Fig. 2: Use of Personal protective equipment's among dal mill workers

research conducted by Rana *et al.* (2018) where 57.1 per cent of the rice mill workers were not using personal protective equipments.

Morbidity profile of the subjects depicted in Table 7, where most of the subjects involved in milling activities

TABLE 7
Morbidity profile of dal mill workers

Morbidities*	Never		Sometimes		Occasional		Always	
	No	%	No	%	No	%	No	%
Pain in hands and legs	0	0.00	8	2.60	75	25.0	217	72.3
Giddiness	0	0.00	171	57.0	80	26.6	49	16.3
Back ache	0	0.00	63	21.0	32	10.6	205	68.3
Head ache	6	2.0	124	41.3	96	32.0	74	24.6
Fatigue	0	0.0	186	62.0	63	21.0	51	17.0
Body ache	0	0.0	39	13.0	52	17.3	209	69.6
Chest pain	278	93.0	6	2.0	14	5.0	0	0.00
Irritability	170	56.6	92	30.6	27	9.0	11	3.60
Fever	241	80.3	30	10.0	21	7.0	8	2.60
Breathlessness	98	32.6	35	11.6	60	20.0	107	35.6
Eye strain	10	3.33	68	22.6	40	13.3	217	72.3
Cold	56	18.6	43	14.3	41	13.6	160	53.3
Cough	60	20.0	46	15.3	42	14	152	50.6
Acidity	277	92.3	6	2.0	10	3.3	7	2.30
Tooth pain	240	80.0	21	7.0	13	4.3	6	2.00
Pain in shoulder	26	8.6	63	21.0	39	13.0	172	57.3
Respiratory problem	84	28.0	36	12.0	46	15.3	134	44.6

*Multiple response.

were always suffering from musculoskeletal problems like pain in the hand and legs (72.3 %), back ache (68.3 %), body ache (69.6 %) and pain in the shoulder (57.3 %), these are common aliments among mill workers manly because of carrying heavy loads on back and shoulders. The results are on par with the study conducted by Roy *et al.* (2020) where 65 per cent of rice mill workers had musculoskeletal discomforts.

Ten per cent of the respondents expressed that they suffered from fever sometimes and around 50 per cent of the mill workers expressed that they always suffered from cold and cough problems that is mainly due to dust in the mill that is about (53.3 %) and (50.6 %), respectively. Eye strain was also main problem associated with the mill workers (72.3 %) mainly due to dust particles in the milling area. Similar findings were reported by Sudha and Rupali (2013) on occupational health hazards faced by the flour mill workers where 60 per cent of the respondents suffered from eye problems mainly due to the flour dust.

Respiratory problems were one of the major issues among the dal mill workers, where half of the workers (44.6 %) felt because of exposure to dal dust and expressed that they had respiratory problems like difficulty in breathing and asthma. A few of them (12 %) had respiratory problems sometimes and 15.3 per cent of the workers suffered occasionally, this might be because some workers were using locally available hand kerchiefs and towels as protective measures during milling activities but most of the workers exhibited that, these respiratory problems are mainly due to exposure to the dust and it is also correlated with less use of personal protective equipments or protective measures in the working area. The present findings are on par with the research conducted by Seema *et al.* (2010) where 42.6 per cent of the rice mill workers had respiratory morbidities.

Inustrial workers are at high risk of developing occupational hazards and morbidities in one or the other ways due to exposure to contaminated environment and other work place hazards. The present study shows that majority of the dal mill workers are having one or the other occupational morbidities due to exposure to dal dust in milling area and also less use of personal protective equipment's in working area. So, it is important to reduce the occupational morbidities and hazards among workers in the working area. The dietary intakes of certain foods of dal mill workers were below the RDA which could be enhanced with long term interventions. Necessary awareness programmes should be created among the mill workers and owners for the reduction and control of occupational morbidities and hazards by using personal protective equipments to protect the worker's health in milling industries.

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