

Assessment of Pulmonary Fitness of Stone Art Workers in Rajasthan



Home Science

KEYWORDS : Stone art, marble dust, Fitness

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ABSTRACT

Rajasthan produces over 95% of the marble produced in India. The workers mainly involved in marble cutting, stone art and transportation of marble plates are exposed to marble dust which occurs across a range of marble factories. The marble dust particles have high concentration of silica. The workers usually inhale a large amount of dust during working as well as non-working time period also. The present study was done with the objective to assess the pulmonary fitness of the workers engaged in stone art work. The study comprised of a sample of 30 male workers engaged in stone art industries from at least last five years. To measure the pulmonary fitness capacity of workers PEFR (Peak Expiratory Flow Rate) meter was used for the workers in different sections of the stone art units viz; Designing, Tracing, Jewelry making, Calibration, Engraving, Fixing and Polishing. The results elicited that the majority of workers were having lung capacity less than 50% of the standard PEFR values. The results of pulmonary ventilation capacity of workers clearly designate the fact that as age of workers advanced the pulmonary fitness level reduced. The possible reason for this may be with advancing age the number of years of exposure to environmental pollutions i.e. stone dust increases, which affects the pulmonary fitness of workers negatively.

INTRODUCTION

Rajasthan produces over 95% of the marble produced in India. Production of marble in Rajasthan during the year 2007-08 was 13684 tonnes, out of 32 districts, marble deposits are being exploited in 20 districts. The stone cutting units are an unorganized sector of the country. The workers mainly involved in marble cutting, stone art and transportation of marble plates are exposed to marble dust which occurs across a range of marble factories. The marble dust particles have high concentration of silica. The workers usually inhale a large amount of dust during working as well as non-working time period also. Occupational health plays an important role in maintaining and maximizing competitiveness and productivity in industries. Marble industry is one of the occupations which adversely affect the health of workers. Health and safety issue of work is concerned with occupational health.

Marble art work involves cutting, finishing, polishing and other tasks. Marble sawing equipment includes large circular saws, where various types of diamond and other equipment are used for smoothing, polishing, and edging the raw marble. During the cutting process about 25 percent of the original marble mass is lost in the form of dust. Processing of marble results in the formation of marble dust, which is suspended in the air and is inhaled by the workers. Epidemiological studies indicates that workers exposed to marble dust stand an increased risk of suffering from asthma symptoms, chronic bronchitis, nasal inflammation and impairment of lung function. (Camici et al., 1978 Angotzi et al., 2005; Leikin et al., 2009)

MATERIALS AND METHOD

The present study was conducted in workers of stone art work at Udaipur city (Rajasthan). Udaipur region is known for marble mining and the stone art work is a popular industry in the State. A sample of 30 male workers engaged in stone art industries from at least last five years in the age group of 25-45 years. An interview schedule was designed to elicit work profile, health status and working environment of workers in different sections of the stone art units viz; Designing, Tracing, Jewellery making, Calibration, Engraving, Fixing and

Polishing. Workers of stone art units are exposed to stone and marble dust which may affect their breathing fitness. To measure the pulmonary ventilation capacity PEFR (peak expiratory flow rate) meter was used. It was measured by using peak expiratory and inspiration flow rate equipment.

RESULTS AND DISCUSSION

1. Background information of the respondents.

A total of 30 workers of stone art units were selected for the study, from each section of the units viz. Engraving, Calibration, Filling and Fixing, Jewellery making, Designing Tracing and Packaging. The distribution of subject as per background attributes is given in table: 1. Age has an important role for every occupation. Workers from different age groups were working in this occupation. The age and experience in number of years determines production efficiency and quality of work.

Table – 1 Percentage distribution of respondent showing background attributes
N = 30

S.No.	Categories	Percentage
1	Age (in years)	
	25-30	46
	31-35	20
	36-40	17
	41-45	17
2	Education	
	Primary	20
	Secondary	57
	Senior Secondary	3
	Graduate	20
3	Number of years in the occupation	
	5	3
	6 - 10	37
	11 - 15	13
	More than 15	47

Table 1 show that majority i.e. 46 percent of workers were in the age group of 25 - 30 years. It is good symbol for industry that most of the workers were of young age, which will help to perform task with accuracy. It was seen that 20 percent

of the workers fell in the age group of 31 - 35 , while equal percentage i.e. 17 percent fell in age group of 36 – 40 years and 41 -45 years respectively. Regarding education, majority of respondent (57%) were educated up to secondary level, while 20% were graduate and 20% had education only up to primary standard.

The occupation risk factors manifest only after the worker is exposed to working condition for considerable number of years. It was seen that majority, 47 percent of worker were engaged in this occupation from more than 15 years; while 50 percent were in this trade from 6 to 15 years and only one respondent (3%) had experience of 5 years in this occupation.

2. Assessment of health status of stone art workers

2.1 Body Mass Index (BMI):

In all occupation, it is important to ensure acceptable adjustment between man's physical fitness and work in order to promote health and safety and improve quality of work and performance. Thus, knowledge of individual's capabilities and limitations from physical point of view will help to determine job demand fitness compatibility. The height and weight of a person is also indicative of one's fitness. According to Garrow (1984), the body mass index (BMI) can be obtained from the height and weight and the individual can be put in to various categories to establish whether he is energy deficient, normal or obese.

The ratio of weight (kg) / height² (m.) is referred to as Body Mass Index. It provides a reasonable indication of the nutritional status of a person. The BMI has good correlation with fitness. It may also be used as an indicator of health risk.

Table - 2 Body Mass Index of the respondents in stone art work N = 30

BMI Categories	Percentage of respondents
*CED Grade III (severe)	Nil
CED Grade II (moderate)	21
CED Grade I (mild)	16
Low weight normal.	16
Normal	47
Obese grade I	Nil
Obese grade II	Nil

*CED = chronic energy deficiency

It was indicated that more than half of the respondents (53%) fell in some abnormality of health, while it was good to note that 47 percent were in normal category of BMI. A detailed look at table – 2 explains that 21% respondents fell in moderate category (CED Grade II) which was alarming, while equal percentage (16%) were in CED Grade I (mild) and Low weight normal category. No respondent was found in obese and severe CED category.

The difference between BMI status of respondents can be attributed mainly to low income, mal- nutrition, socio- economic factor, poor working condition, poor eating habits, lack of proper knowledge about nutrition and also due to some physical disorders like T.B., respiratory diseases, hypertension etc.

2.2 Prevalence of disease and treatment:

Table 3: Percentage distribution of respondents by prevalence of disease and treatment N = 30

Disease	Respondents (%)
T.B.	Nil
Asthma	14
Heart Disease	10
Respiratory Disease	24
Hypertension	30
Any other	10
Treatment	
Medicine	27
Rest only	23
Any other	13

While conducting study the investigator enquired about various ailments or diseases from which the workers suffered. It was seen that 14 percent of workers were suffering from Asthma, 10 percent had heart problems, 24 percent were having some sort of respiratory diseases, 30 percent suffered from hypertension and 10 percent were having miscellaneous diseases. On enquiring what treatment they resort to while suffering from such wide variety of diseases. It was elicited that 27 percent of them took medicines for getting relief; they either consulted doctor or sometimes took medicines on their own. While 23 percent said that they take rest for relief. It was shocking to note that 13 percent took the ailment lightly and would not bother. Many of them did not realize that the cause of diseases could be their exposure to the unsafe work environment. Hence, need was felt to educate them about role of their occupation on their health status and related safety measures for precaution.

1. Measurement of pulmonary ventilation capacity.

Assessment of Peak Expiratory Flow Rate of workers in different sections of Stone Art units:

Workers of stone art units have to work with stone and marble, the dust of which may affect their breathing fitness. To measure the pulmonary capacity of workers PEFR (Peak Expiratory Flow Rate) meter was used. It was seen that in selected stone art units the workers were engaged in different sections like Engraving, Calibration, Filling and Fixing, Designing, Tracing and Packaging and Jewellery Making. From among the 30 male workers selected for the study, pulmonary ventilation capacity of six workers in each section was assessed, using a PEFR meter. Various standard specifications for normal average value of PEFR in l/s are tabulated according to the age and height of workers in table – 4 and subject value is depicted as per age and height.

Table: 4 Assessment of Peak Expiratory Flow Rate of workers in 'Designing and Tracing' section of Stone art units

Age (years)	Height <150cms		Height 151 – 160cms		Height 161 – 170cms		Height 171 – 180cms	
	Normal Value	Average Sample Value	Normal value	Average Sample value	Normal Value	Average Sample value	Normal Value	Average Sample Value
25 – 30	8.2	–	9.0	–	9.6	6.65 (33.34%)	9.9	–
31 – 35	7.6	–	8.7	–	9.4	–	9.7	–
36 – 40	7.5	–	8.2	–	9.2	–	9.4	8.95 (16.67%)
41 – 45	7.4	–	8.1	–	8.8	–	9.2	5.51 (50%)

workers was lower than the normal values. Out of 6 workers in the section, one respondent in the age group of 36-40 years falling in height range of 171-180cms exhibited good PEFR value i.e., 8.95 l/s which was very close to normal value for this group i.e. 9.4 l/s, this may be due to his good individual fitness. Three respondents in the age group of 41-45 years

falling in height range of 171-180cms exhibited low PEFR value i.e., 5.51 l/s which was very low to standard normal value for this group i.e., 9.2 l/s. Two respondents in the age group of 25-30 years falling in height range of 161-170cms exhibited low PEFR values i.e., 6.65 l/s which were low to normal value for this group i.e., 9.6 l/s.

Table -5 Assessment of Peak Expiratory Flow Rate of workers in 'Calibration' section of stone art units

Age (years)	Height <150cms		Height 151 – 160cms		Height 161 – 170cms		Height 171 – 180cms	
	Normal Value	Average Sample value	Normal value	Average Sample value	Normal Value	Average Sample value	Normal Value	Average Sample Value
25 – 30	8.2	–	9.0	6.35 (16.67%)	9.6	5.3 (33.34%)	9.9	–
31 – 35	7.6	–	8.7	5.6 (16.67%)	9.4	6.9 (16.67%)	9.7	–
36 – 40	7.5	–	8.2	–	9.2	–	9.4	–
41 – 45	7.4	–	8.1	–	8.8	6.05 (16.67%)	9.2	–

It was observed that in Engraving Section only male workers were engaged. The data in table 5 clearly depict that PEFR sample value of male workers was considerably low as compared to standard average normal value as per age and height groups. Out of 6 workers working in the section, one was in the age group of 25 – 30 years within height range of 151 – 160cms, whose PEFR was considerably low, that is 6.35 l/s as compared to normal PEFR value 9.0 l/s. Only one was in the age group of 31-35 years falling in same height

range but with further low PEFR value of 5.6 l/s. Two workers were in the age group of 25-30 years within height range of 161-170cms. their PEFR was considerably low, i.e., 5.3 l/s as compared to normal PEFR value of 9.6 l/s. While two workers were in the age group of 31-35 years and 41-45 years, falling in the same height range but with further low PEFR value 6.9 l/s and 6.05 l/s respectively. One interesting fact was observed while reading data is that as age advances the PEFR fitness reduces.

Table- 6 Assessment of Peak Expiratory Flow Rate (l/s) of workers in 'Engraving' section of stone art units

Age (years)	Height <150cms		Height 151 – 160cms		Height 161 – 170cms		Height 171 – 180cms	
	Normal Value	Average Sample value	Normal value	Average Sample value	Normal Value	Average Sample value	Normal Value	Average Sample Value
25 – 30	8.2	–	9.0	–	9.6	7.24 (83.34%)	9.9	–
31 – 35	7.6	–	8.7	–	9.4	–	9.7	–
36 – 40	7.5	–	8.2	–	9.2	6.2 (16.67%)	9.4	–
41 – 45	7.4	–	8.1	–	8.8	–	9.2	–

The data in table 6 clearly depict that PEFR sample value of workers was considerably low as compared to standard average normal value as per age and height groups. Out of 6 workers working in the section, five were in the age group of 25 – 30 years, in the height range of 161 – 170cms; their PEFR was considerably low, i.e. 7.24 l/s as compared to normal PEFR value of 9.6 l/s. Only one worker was in the age group of 36 – 40 years falling in same height range but with further low PEFR i.e., 6.2 l/s as against normal value of 9.2 l/s. The PEFR values clearly depicts that PEFR values reduced with age of workers which might be due to increased span of exposure to stone dust which increased with age.

Table: 7 Assessment of Peak Expiratory Flow Rate of workers in 'Jewellery Making' section of stone art units

Age (years)	Height <150cms		Height 151 – 160cms		Height 161 – 170cms		Height 171 – 180cms	
	Normal Value	Average Sample value	Normal Value	Average Sample value	Normal Value	Average Sample value	Normal Value	Average Sample Value
25 – 30	8.2	–	9.0	–	9.6	5.85 (16.67%)	9.9	–
31 – 35	7.6	–	8.7	–	9.4	4.15 (16.67%)	9.7	7.35 (33.34%)
36 – 40	7.5	–	8.2	–	9.2	–	9.4	6.8 (16.67%)
41 – 45	7.4	–	8.1	–	8.8	4.25 (16.67%)	9.2	–

Table: 7 presents the similar results i.e., irrespective of age and height categories, all workers exhibited lower PEFR values as compared to standard normal PEFR values. There was an exception of two respondents in the age group of 31-35 years with height 171-180 cm whose PEFR was comparatively better than the others.

Table-8 Assessment of Peak Expiratory Flow Rate of workers in 'Filling and Fixing' section of stone art unit.

Age (years)	Height<150cms		Height 151 – 160cms		Height 161 – 170cms		Height 171 – 180cms	
	Normal Value	Average Sample value	Normal value	Average Sample value	Normal Value	Average Sample Value	Normal Value	Average Sample Value
25 – 30	8.2	–	9.0	4.15 (16.67%)	9.6	5.3 (33.34%)	9.9	–
31 – 35	7.6	–	8.7	–	9.4	6.4 (16.67%)	9.7	–
36 – 40	7.5	–	8.2	–	9.2	4.7 (16.67%)	9.4	5.2 (16.67%)
41 – 45	7.4	–	8.1	–	8.8	–	9.2	–

Table 8 follows the similar trends as in the other sections of stone art work units. The average sample values of PEFR were considerably lower than the standard normal values. Four workers in the height range of 161-170cms belonging to different age categories had low PEFR than the normal values, similar was the case for other subjects falling in different age and height category. This clearly shows that the pulmonary ventilation capacity of all the workers was affected due to stone dust in the environment.

Thus the results of pulmonary ventilation capacity of workers clearly designate the fact that as age of workers advanced the pulmonary fitness level reduced. The possible reason for this may be with advancing age the number of years of exposure to environmental pollutions i.e. stone dust increases, which affects the pulmonary fitness of workers negatively. The results are supported by Kukker,R. 2006, who studied pulmonary fitness of textile mill workers and reported that the PEFR values were lower than the standard average normal value for workers engaged in all the sections of the industry, viz; Blow Room, Spinning, Weaving and Carding.

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