International Journal of Research and Review
Volume 11; Issue: 6; June 2024
Website: www.ijrrjournal.com
Research Paper *E-ISSN: 2349-9788; P-ISSN: 2454-2237*

Ocular Surface in Bangle Makers of Firozabad

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DOI: https://doi.org/10.52403/ijrr.20240635

ABSTRACT

Purpose: The bangle-making industry in Firozabad, India, is a significant source of employment for thousands of workers. However, the occupational hazards associated with this industry, particularly the exposure to glass dust and chemical fumes, calcide powder, etc. have raised concerns regarding the ocular health of bangle makers. This study is aimed to evaluate and describe the status of ocular surface among the bangle makers in Firozabad.

Method: This was an OSDI questionnaire based cross sectional descriptive study, consisting a series of 12 questions about symptoms as itching, redness, blurred vision, grittiness, watering etc. Torch light examination of each subject was performed to look for any ocular abnormalities. An unstructured survey regarding the work hours in the factory, working experience in the bangle making industry, ocular complaints, history of hospital visits and prior eye-check-ups was also done. The responses were represented with the help of tables and chart.

Results: 74 participants were enrolled in this study, OSDI score ranging from 23-33 that comes in moderate value. Maximum workers reported with normal eye health but there were ocular morbidities and surface abnormalities prevailing in this population, i.e. pterygium (8%), cataract (5.3%), pinguecula (2.7%), itching (6.7%), redness (4%).

Conclusion: There is a need to improve occupational safety measures amongst the industry workers, including the provision of proper eye protection and mandatory eye check-ups to minimize the adverse effects on the ocular health of bangle makers, also need to increase awareness to motivate the workers for regular eye check-ups.

Keywords: Ocular Surface, Infrared radiation, Occupational hazards, Ocular morbidities, Bangle makers.

INTRODUCTION

Eyes and related structures have been widely reported to be affected by occupational hazards in literature. Injuries from chemicals or foreign objects and corneal abrasions are some of the most common workplace hazards, some common causes of these hazards at work are projectiles, chemicals, blood borne pathogens and the most prevailing cause is radiation (especially infrared rays (IR) or heat, ultraviolet rays (UV), visible lights). This could be because radiations are easily absorbed by ocular structures and may cause harmful manifestations [1]. Generally, the cornea can absorb almost all wavelengths greater than 3000 nm, crystalline lens absorbs radiations between 900 nm to 1400 nm and retina absorbs remaining infrared less than 1400 nm wavelength [2].

Industries more prone to IR radiations are chain makers, welders, black smiths, tin plating, and glass and metals workers. Some activities such as glass blowing may produce significant low-level, long-term

exposure to the workers. Since the end of 19th century, the harmful effects of prolonged exposure of the eye to cumulative radiation of glassblowing have been recognized [3]. These effects include ultraviolet keratitis [4], arc eye or welder's flash [5], ocular surface squamous neoplasia (high exposure of ultraviolet B radiation leads to severe pain and visual loss, arises at limbal region) [6] pterygium, pinguecula, chronic dry eye problems, cataract. Some glass and steel workers developed cataract that is most known ocular occupational disease in recent time also named as glass blowers' cataract [7].

One of the many industries dealings with IR radiations is bangle making industry, which deals with working in IR radiations for prolonged duration [8]. Bangle making involves significant levels of exposure to optical radiations in daily routine [9,10]. Along with other described occupational hazards, dry eye in bangle makers is also of common occurrence [11]. The amount of heat involved in glass industry is generated by furnaces and high temperature of surrounding area [12]. The majority of population is exposed to an artificially controlled indoor environment with less humidity and high temperature can have an adverse effect on the tear film physiology of the eyes of most workers [12,13]. This can result from a lack of tear fluid or from evaporation [14,15].

According to recent article from DED definition by dry eye work shop [DEWS-II], this is a multifactorial disease of ocular surface due to loss of homeostasis of tear film, and accompanied by ocular symptoms, in which tear film stability and hyperosmolarity, ocular surface inflammation and neuro-sensory abnormalities plays etiological roles [16]. People with dry eyes may experience foreign body sensation, grittiness, and scratchy, burning eyes etc [17].

There is data suggesting that dry eye disease is one of the commonplace morbidities to prevail in various occupational sectors. Its prevalence amongst bangle makers shall not be uncommon. However, there are just a few counted evidences available on the prevalence of dry eye in the bangle industry workers [17].

Keeping all this in mind, this study aims to determine ocular surface disease index [OSDI] score to determine the prevalence of dry eye in bangle makers and to describe the morbidities present in the ocular surface of the subjects. Along with this, we also aim to obtain the history of ocular check-ups by these bangle industry workers.

MATERIALS & METHODS

This survey based descriptive cross-sectional study aimed to evaluate and describe the ocular surface among the bangle makers in Firozabad. A total of 74 subjects above the age of 18 years, working in Firozabad bangle industries, who were willing to participate in our study were included and workers with acute or chronic systemic infections, subjects who underwent any previous [six months] surgery, i.e. cataract, etc. subjects using any systemic medication [diuretics, beta-blockers etc.] were excluded.

A detailed history was obtained from each subject to ensure that the inclusion criteria are fulfilled. A gross torchlight examination was performed in each subject to assess the ocular surface as per the pre-set case recording format to look for signs of inflammation or abnormalities in the conjunctiva and cornea, and evaluate the eyelids and lashes.

To estimate the prevalence of dry eye disease, OSDI questionnaire administered to each enrolled subject in their native language and the scores calculated. Dry eye grading was done as per the OSDI score classification.

An unstructured survey regarding the work hours in the factory, working experience in the bangle making industry, ocular complaints (if any), history of hospital visits and prior eye-check-ups was also undertaken.

STATISTICAL ANALYSIS

The analysis of the obtained data was done on SPSS and inferences from the population like male and female ratio, work hours, work experience in the industry, morbidities in the ocular surface, OSDI scores, ocular symptoms faced and history of hospital visits and ocular check-ups were represented in form of tables and charts.

RESULT

75 workers from bangle making industry were enrolled in this study with mean age 38.84 ± 10.02SD. The minimum age of the subject was 22 years and the maximum age was 65 years. Out of 75 subjects 54 were males (73%) and 20 were females (27%). **Figure 1** and **table 1** shows the distribution of males and females that participated in study.

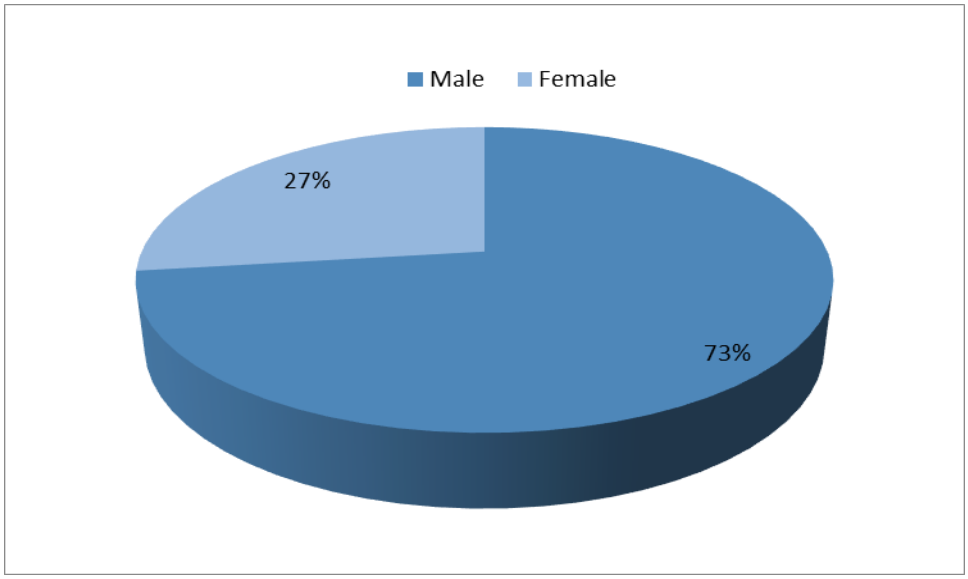

Figure 1: Pie chart depicting male and female ratio

Table 1: Distribution of males and females in the study

Gender	Frequency	Percent
Male	54	73
Female	20	27

Out of 75 workers majority of population, 64 subjects (85.7%) work for more than 8 hours per day and 10 individuals (14.3%) works for 6 to 8 hours per day. **Figure 2** and **table 2** shows the working hours of individuals.

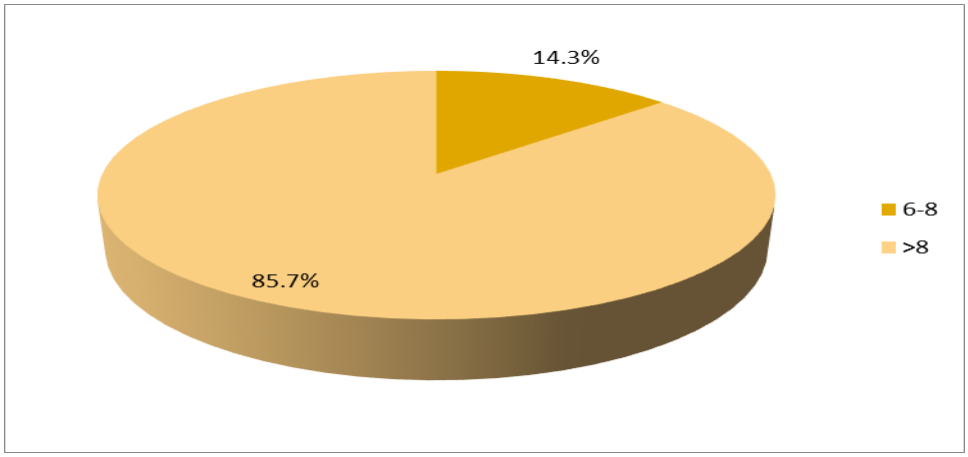

Figure 2: Pie chart demonstrating working hours per day of subjects

Table 2: Individual's data of working hours per day

working hours per day	Frequency	Percent
6-8	10	13.3
>8	64	85.3

In total enrolled 75 subjects OSDI score varied from minimum of 3.12 to a maximum of 30.55, with an average impact of 10.18 ± 4.55 SD and a notable degree of variability. **Table 3** presents the OSDI data of enrolled population in this study.

Table 3: OSDI scores in the enrolled subjects.

	Subjects	Minimum	Maximum	Mean	Std. Deviation
OSDI Score	74	3.12	30.55	10.18	4.55

In overall 75 participants, 60 subjects (80%) found with normal limit had healthy eyes without significant ocular morbidities. However, a population of participants experienced various ocular conditions, as 6 subjects of pterygium (8%), 4 subjects of cataract (5.3%), 2 subjects with pinguecula (2.7%), 1 with corneal opacity (1.3%) and 1 with ptosis (1.3%). **Figure 3** and **table 4** shows the overall data about ocular morbidities in population.

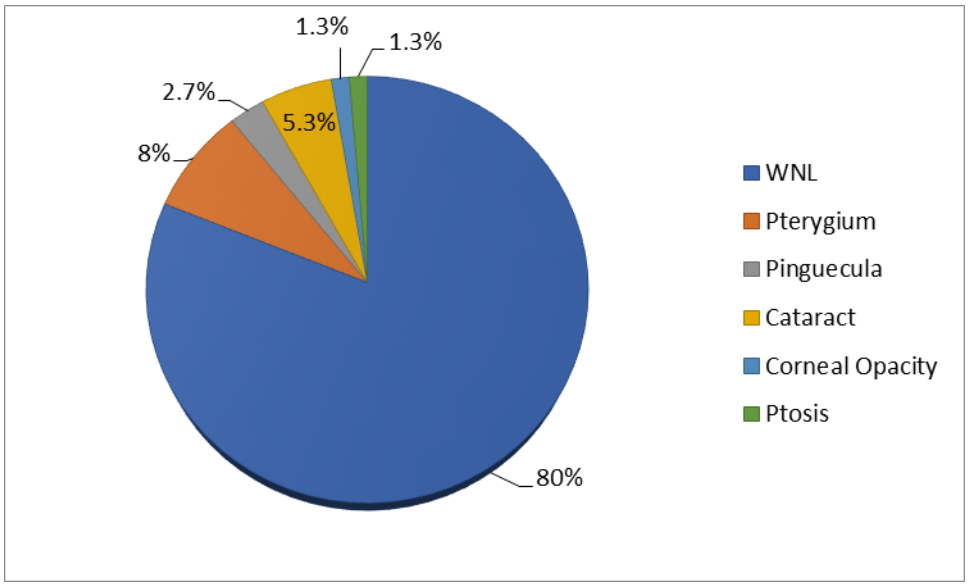

Figure 3: Pie chart demonstrating the ocular morbidity in population

Table 4: Ocular morbidities among the population

Ocular morbidities	Frequency	Percent
WNL	60	80.0
Pterygium	6	8.0
Pinguecula	2	2.7
Cataract	4	5.3
Corneal Opacity	1	1.3
Ptosis	1	1.3

Out of total 74 subjects, 59 subjects (78.7%) found with normal limit had healthy eyes without ocular surface complaints. However, a population of participants complaining various abnormality symptoms, as 5 subjects reported about itching and watering (6.7%), 3 reported for redness (4%) and 2 with burning sensation (2.7%). Figure 4 and table 5 Showing the overall data about ocular morbidities in population.

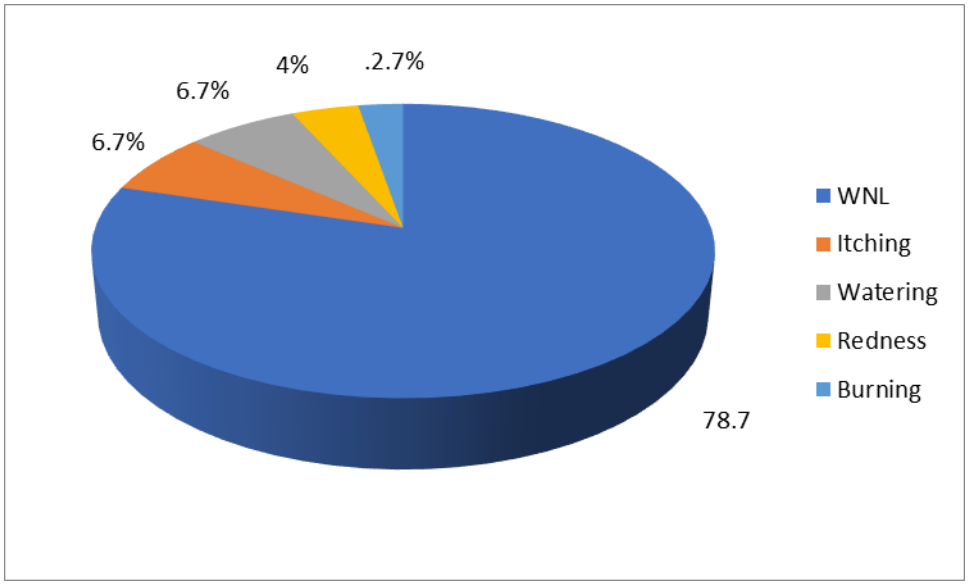

Figure 4: Pie chart demonstrating ocular surface abnormalities

Table 5: Complains of the enrolled subjects about ocular surface.

Ocular surface complains	Frequency	Percent
WNL	59	78.7
Itching	5	6.7
Watering	5	6.7
Redness	3	4.0
Burning	2	2.7

Out of 74 subjects only 12 subjects (16.21%) of the surveyed individuals had an eye check-up in the last year, while the majority of 62 subjects (83.78%), did not have any eye check-up. **Figure 5** and **table 6** showing the data of eye checkup.

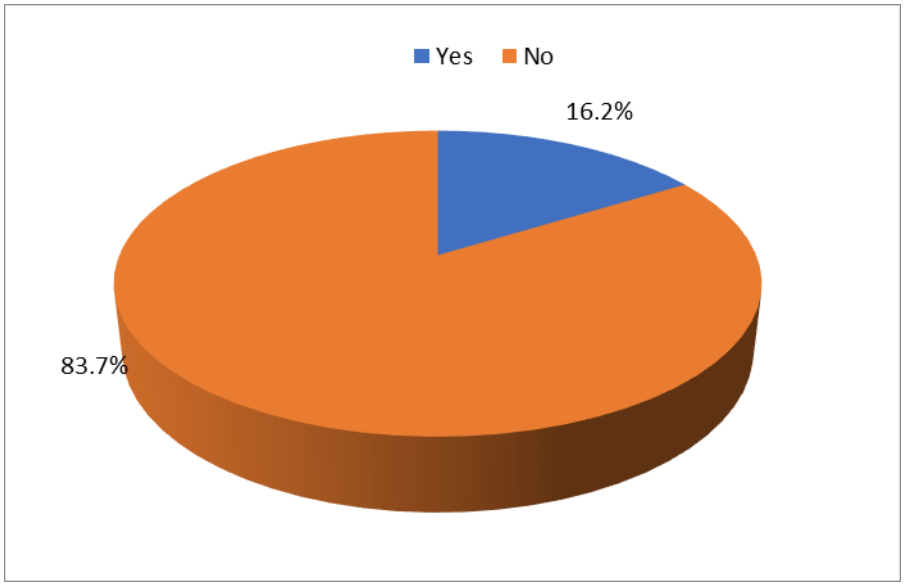

Figure 5: Pie chart depicting the ratio of subjects who went for an ocular check-up in the previous year

Table 6: Depicting the ratio of subjects who visited the hospital last year

Eye checkup (last year)	Frequency	Percentage
Yes	12	16.21
No	62	83.78

DISCUSSION

The present study aimed to assess the ocular surface health among bangle makers in Firozabad by evaluating their demographic characteristics, working conditions, and ocular morbidities. The findings provide valuable insights into the ocular health challenges faced by these individuals and underscore the need for interventions to protect their ocular surface. The study utilized a descriptive cross-sectional design.

Study included 75 bangle makers, with a mean age of 38.84 years. The majority of participants were male (73%), reflecting the gender distribution in this occupation. The age range and gender distribution of the subjects provide a representative sample for assessing the ocular surface health in this specific population. Most of the participants (85.3%) reported working for more than 8 hours per day, indicating prolonged occupational exposure. This extended duration of work may contribute to increased ocular surface stress and susceptibility to ocular disorders. It is essential to address the potential impact of long working hours on ocular health through interventions such as regular breaks, proper lighting, and ergonomic considerations. The OSDI questionnaire used to assess ocular symptoms and their impact in vision related function ranged from 3.12 to 30.55, questionnaire revealed that 78.7% of the participants had a normal range, indicating a significant ocular surface complaint. However, a notable percentage of individuals reported symptoms such as itching (6.7%), watering (6.7%), redness (4%), and burning sensation (2.7%). These symptoms are suggestive of ocular surface abnormalities and may indicate the presence of underlying conditions such as dry eye syndrome. Furthermore, the study identified various ocular morbidities among the participants. Pterygium (8%) was the most prevalent condition, followed by cataract (5.3%), pinguecula (2.7%), corneal opacity (1.3%), and ptosis (1.3%). The prevalence of these ocular morbidities suggests a higher risk among bangle makers compared to the general population. Pterygium, in particular, is known to be associated with chronic exposure to dust, high exposure to radiation, and other occupational hazards. The findings of this study provide insights into the prevalence of dry eye and other ocular morbidities among bangle makers in Firozabad.

Literature review provides some relevant studies conducted in similar occupational settings. For example, a study conducted in glass industry workers in Firozabad found a high prevalence of dry eye disease. Another study investigated eye exposure to optical radiation in the glassblowing industry in Ontario, highlighting the importance of protective measures and eye examinations. There are also studies on metal exposure and dry eye metrics in shipyard welders and the prevalence of radiation-related eye diseases among welders in Ghana.

Also, the limited access to eye doctors among bangle makers in Firozabad has contributed to an increased risk of eye problems in the community. Due to various factors such as financial constraints, lack of awareness, low paid jobs and demanding work schedules, many bangle makers find it challenging to prioritize regular eye examinations or seek timely medical attention for ocular issues. The absence of routine eye check-ups leads to undiagnosed and untreated conditions that may worsen over time. Eye problems such as dry eye syndrome, pterygium, cataracts, and other ocular morbidities can progress silently, causing discomfort, visual impairment, and even permanent damage if left unaddressed. Efforts should be made to increase awareness among bangle makers about the importance of regular eye check-ups and the availability of affordable or free eye care services.

Major limitations of the study include lack of objective test, only subjectively evaluated by using OSDI questionnaire was done. Any further study which could utilize objective means to evaluate the quality and quantity of the tear film can yield better conclusions. Another significant limitation of this study

is the lack of subject data, which hinders a comprehensive analysis of the eye problems faced by bangle makers in Firozabad. This limitation arises from the unwillingness of individuals to take time off from their jobs to eye check-ups. This also highlights the necessity of organizing awareness programs in these areas and motivate the factory owners to establish a proper health check-up protocol for the workers.

The bangle making industry is known for its demanding nature, with workers often under pressure from supervisors to maximize productivity and meet strict deadlines. The lack of subject data poses significant limitations to understanding and addressing the eye problems in this community.

CONCLUSION

Efforts should be made to increase awareness among bangle makers about the importance of regular eye check-ups and the availability of affordable or free eye care services. Establish eye health camps or mobile eye clinics to reach out to the bangle makers in their workplaces. Additionally, policy interventions may be necessary to ensure that protective eyewear is provided to workers and that they are granted adequate time off for medical appointments without facing adverse consequences.

By overcoming the barriers that prevent bangle makers in Firozabad from visiting eye doctors, it is possible to improve their eye health outcomes, enhance their quality of life, and promote a safer and more productive work environment.

Declaration by Authors

Ethical Approval: Not Required

Acknowledgement: None

Source of Funding: None

Conflict of Interest: The authors declare no conflict of interest.

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How to cite this article: Khushi Bhardwaj, Harshita Pandey. Ocular surface in bangle makers of Firozabad. *International Journal of Research and Review*. 2024; 11(6): 311-318. DOI: *https://doi.org/10.52403/ijrr.20240635*

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