

Ergonomic study of visual discomforts due to lighting conditions in rural and urban homes of Ludhiana district

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■ **ABSTRACT :** The present study entitled ergonomic study of visual discomforts due to lighting conditions in rural and urban homes of Ludhiana district was undertaken to study the visual discomforts faced by the respondents in rural and urban homes of Ludhiana district, to assess the impact of inadequate lighting conditions on human health. Study was conducted as household survey in rural and urban homes in Ludhiana district. Results of the study revealed that from both urban and rural area various visual discomforts like declined vision, eye strain, glare in eyes, were observed due to inadequate light. Some subjective scales used also highlighted that respondents felt visual discomforts due to poor lighting. Ocular Surface Disease Index (OSDI) scale was used to analyze symptoms related to visual problems and it was found that in rural area maximum number (88.33%) of the respondents and in urban area around half (53.33%) of the respondents were having mild level of dry eyes disease followed by moderate one fourth (25.00%) in urban area and 11.67 per cent in rural area. Only 16.67 per cent of the respondents in urban area were having high level of dry eye diseases. Whereas, Aramuc Scientific Scale showed that in urban area one third (33.33%) of the respondents and in rural area 20.00 per cent of the respondents were having true dry eyes. Therefore, lighting of the house should be ergonomically designed which can help to reduce the visual problems. These corrective measures can be achieved by proper lighting, right positioning of light fixtures, proper type of light source should be used.

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Light is crucial to human functioning and allow us to figure out things and carry out the activities although it is also essential because it affects human beings psychologically and physiologically. Evaluation of lighting conditions in the different parts of work place at home should also focus on the impact of

inadequate lighting conditions on human health *i.e.* psycho-emotional problems due to improper light and perceived discomforts due to glare while performing different tasks. People perceive their luminous environment through their eyes, but they process this information with their brain. Light scenes are therefore

judged in connection with references and expectations. The luminous environment can be appreciated in many ways. For example, more or less agreeable, more or less attractive, more or less appropriate to the functioning of the space, more or less highlighting image. Variations of luminances and colours can strengthen attractiveness, trigger emotions, and affect our mood, the impact of lighting depending much on the individuals and their state of their mind.

On the other hand, glare is any light source either direct or reflected that reduces short term or long term visual performance. It is the equivalent of noise in an audio system. Glare results from an extremely complex set of interactions between the lighting, both electric and natural, the surroundings and the visual system of the body (McLean, 2004).

■ RESEARCH METHODS

For conducting the field survey, for the selection of rural sample, from the list one block in Ludhiana district was randomly selected and further from the selected block two villages was randomly selected. From each selected village 30 homemakers will be randomly selected making total rural sample of 60 homemakers. For the selection of the urban respondents, out of four zones of Ludhiana city, one zone was randomly selected and from the selected zone two localities have been randomly selected, and from each selected locality 30 respondents will be randomly selected thus making total urban sample 60. Thus making the total sample 120 *i.e.* 60 each from rural and urban areas. A pre-structured interview schedule was used to ergonomically evaluate the work places of the respondents and to assess the lighting conditions of rural and urban houses. Visual discomfort will be assessed through various indicators *viz.*, eye strain, blur vision, dryness, double vision, declined vision, itchiness and headache. The assessment will be done by using objective assessment scales *viz.*, Ocular Surface Disease Index (OSDI) and Aramuc Scientific Scale were used explained in subjective assessment technique.

■ RESEARCH FINDINGS AND DISCUSSION

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

Visual discomforts due to inadequate lighting :

Survey on household workers depicts that vision discomfort is most frequent among the respondents which may be due to working in an inadequate lighting conditions. Visual comfort is also highly dependent on the application, for example lighting that is considered comfortable in an entertainment setting may be disliked and regarded as uncomfortable in a working space (Boyce, 1983). Other involved factors leading to visual fatigue and discomfort, poor lighting and reflection due to glare. Therefore, visual problems faced by respondents were assessed by:

Taking subjective responses for visual discomforts:

- Using Ocular Surface Disease Index (OSDI)
- Using Aramuc Scientific Scale

Subjective responses for visual discomforts :

Subjective response is a statement that has been colored by the character of the speaker or writer. It often has a basis in reality, but reflects the perspective through with the speaker views reality. It cannot be verified using concrete facts and figures.

Visual discomforts faced due to inadequate lighting:

The crux of the Table 1 portraits that in rural areas Declined Vision, Eye Strain, Glare in Eyes and in urban areas Headache, Eye Strain, Glare in Eyes were the main visual discomforts faced by respondents and got 1, 2 and 3 ranks, respectively. Where, in rural areas other symptoms that got 4,5,6,7 ranks were tired Eyes, Itchiness, Heaviness, Dryness in the Eyes and in urban areas Tired Eyes, Heaviness, Declined Vision, Dryness in the Eyes got the same ranks. The least score *i.e.* 8,9,10 were assigned to Headache, Double Vision and Blur Vision in rural areas and Itchiness, Double Vision and blurred vision in urban areas, respectively. These results are supported by Sandhu (2001) and Snehlatha (2007) who reported that respondents working in unsuitable lighting conditions faced various visual problems like blurred vision, watery eyes, burning and redness of eyes. The findings of the study were in conformity with those of Edwards and Torcellini (2002); Wilkins *et al.* (2010) and Tetlow (2007).

Perceived discomforts due to glare faced by respondents while performing different tasks :

Table 2 highlighted the perceived discomforts due to glare faced by respondents while performing different

tasks. Further table indicated that in rural area around half (54.76%) of the respondents while doing pre-preparation found glare satisfactory and 42.86 per cent found just noticeable, whereas in urban area 61.11 per cent found glare satisfactory and 20.37 per cent just noticeable. Therefore, in urban area 75.47 per cent of the respondents while doing cooking found glare satisfactory and 16.98 per cent responded just acceptable.

In urban area around half (52.38%) and in rural area 39.02 per cent of the respondents found glare to be just noticeable while cleaning their utensils, whereas in rural area 56.10 per cent and in urban area 40.48 per cent of the respondents felt the glare to be satisfactory while doing the same. Hence, 63.34 per cent of the urban

and 58.97 per cent of the rural respondents felt the glare satisfactory while washing their clothes.

While cleaning of house, in urban area majority (81.82%) of the respondents found the glare to be satisfactory, whereas in rural area 34.09 per cent found the glare to be satisfactory and 11.36 per cent of the respondents found the same to be just acceptable. Regarding dining 76.67 per cent of rural and 71.67 per cent of urban area found the glare to be just noticeable. Thus, 41.67 per cent of rural and 40.00 per cent of urban respondents found glare when they groom their self.

In rural area 42.86 per cent of the respondents while doing sewing and knitting found the glare to be satisfactory. Whereas, in urban area while doing knitting 72.97 per cent and sewing around half (51.43%) of the

Sr. No.	Visual discomfort	Mean score		Ranks	
		Rural	Urban	Rural	Urban
1.	Headache	1.35	2.55	8	1
2.	Eye strain	1.80	2.27	2	2
3.	Glare in eyes	1.65	2.10	3	3
4.	Tired in eyes	1.65	2.07	4	4
5.	Heaviness	1.58	1.88	6	5
6.	Declined vision	1.98	1.77	1	6
7.	Dryness in the eyes	1.35	1.55	7	7
8.	Itchiness	1.62	1.42	5	8
9.	Double vision	1.10	1.27	9	9
10.	Blur vision	1.05	1.17	10	10

*Multiple responses

Sr. No.	Glare	Disturbing		Just acceptable		Satisfactory		Just noticeable	
		R	U	R	U	R	U	R	U
1.	Food preparation								
	Pre-preparation	-	-	-	3 (5.56)	23 (54.76)	33 (61.11)	18 (42.86)	11 (20.37)
	Cooking	-	2 (3.77)	1 (2.33)	9 (16.98)	18 (41.86)	40 (75.47)	-	-
	Cleaning of utensils	-	-	-	-	23 (56.10)	17 (40.48)	16 (39.02)	22 (52.38)
2.	Washing of cloths	-	-	-	1 (2.27)	23 (58.97)	28 (63.64)	-	7 (15.91)
3.	Cleaning of house	-	-	5 (11.36)	1 (4.55)	15 (34.09)	18 (81.82)	-	1 (4.55)
4.	Dining	-	-	-	-	12 (20.00)	10 (16.67)	46 (76.67)	43 (71.67)
5.	Grooming	-	-	-	-	25 (41.67)	24 (40.00)	-	30 (50.00)
6.	Sewing	-	-	-	13 (37.14)	15 (42.86)	18 (51.43)	-	-
7.	Knitting	-	-	-	5 (13.51)	3 (42.86)	27 (72.97)	-	3 (8.11)
8.	Reading	-	-	1 (3.13)	17 (33.33)	13 (40.63)	29 (56.86)	-	1 (1.96)
9.	Writing	-	-	-	2 (5.26)	7(25.93)	24 (63.16)	1 (3.70)	8 (21.05)
10.	Working on computers	-	-	-	-	2 (8.70)	22 (66.67)	5 (21.74)	8 (24.24)
11.	Watching TV	-	-	-	2 (3.33)	20 (57.14)	25 (41.67)	-	32 (53.33)

*Figures in parentheses indicate percentages

**Multiple Responses

respondents felt glare to be satisfactory. Regarding reading in urban area 56.86 per cent and in rural area 40.63 per cent of the respondents found the glare to be satisfactory, followed by 33.33 per cent in urban area and only 3.13 per cent in rural area found the glare just acceptable. In urban area 63.16 per cent and in rural area one fourth (25.93%) of the respondents experienced glare while doing writing.

Regarding working on computer in urban area 24.24 per cent and in rural area 21.74 per cent of the respondents felt glare just noticeable. Therefore, in urban area 66.67 per cent and in rural area only 8.70 per cent of the respondents experienced glare to be satisfactory. While watching TV 57.14 per cent of the rural respondents and 41.67 per cent of the urban respondents felt glare to be satisfactory. Glare can impair vision and can cause visual discomfort. The presence of high illuminance in the field of view produce disturbance in retina's power to adjust and this leads to fatigue of eye muscles and loss of power to sustain precision needed for clear sight (Bhavani and Khan, 2011). The findings are also in line with the results reported by Dutt (1980), Thangaraj and Balaji (2014) and Berthaume (2007).

Using ocular surface disease index (OSDI) :

This index demonstrates sensitivity and specificity in distinguishing between normal subjects and patients with dry eye disease. The respondents got through OSDI Scale were assessed on a scale of 0 to 100, with higher scores representing greater disability. Mean scores and mean ranks were calculated in Table 3 and 4 on the basis of the statements given in scale.

Table 3 depicts that in rural areas poor vision, gritty eyes and sensitivity of eyes and in urban areas sensitivity of eyes, poor vision and gritty eyes were the main visual problems faced by respondents on the five point scale and got 1, 2 and 3 ranks, respectively. Whereas, in both rural and urban areas other problems like painful or sore eyes and blurred vision got 4 and 5 ranks, respectively showing that these symptoms were rarely felt by respondents.

The second part of the OSDI Scale indicates that in what way the vision related problems affect the day to day activities of respondents. Table 4 depicts that in rural areas respondents felt more problems while watching TV followed by reading as they got 1 and 2 ranks, respectively. Working on computer was the other problem faced by the respondents of both rural and urban areas due to poor or blurred vision.

Further, OSDI was used to get the level of dry eye disease in Table 5 and it was found that in rural areas (88.33%) of respondents had mild level of dry eye disease followed by moderate level (11.67%). whereas, in urban areas (53.33%) of respondents had mild level of dry eye disease followed by moderate level (25.00%). It can be observed that (16.67%) urban respondents had severe level of dry eye disease followed by normal level (5.00%) when OSDI was analyzed.

Using aramuc scientific scale :

This scale is a numerical scale which indicates a true dry eye. If the total score is greater than 7, it indicates a true dry eye. The respondents were asked for various symptoms which indicate the dry eye on five point scale

Sr. No.	Visual problems faced during the last week	Rural		Urban	
		Mean scores	Mean rank	Mean scores	Mean rank
1.	Eyes sensitive to light	1.77	3	3.17	1
2.	Poor vision	2.02	1	1.97	2
3.	Gritty eyes or irritation in eyes	2.00	2	1.67	3
4.	Sore eyes	1.47	4	1.57	4
5.	Blurred vision	1.05	5	1.20	5

Sr. No.	Obstructions due to vision problem during the last week	Rural		Urban	
		Mean scores	Mean rank	Mean scores	Mean rank
1.	Reading	1.35	2	2.85	1
2.	Watching TV	1.55	1	2.55	2
3.	Working with computer	1.23	3	2.18	3

Sr. No.	Level indicating dry eyes disease severity	Rural	Urban
1.	Normal	-	3 (5.00)
2.	Mild	53 (88.33)	32 (53.33)
3.	Moderate	7 (11.67)	15 (25.00)
4.	Severe	-	10 (16.67)

*Figures in parentheses indicate percentages

Sr. No.	Symptoms	Rural		Urban	
		Mean score	Ranks	Mean score	Ranks
1.	Excess watering	0.82	3	1.55	1
2.	Redness and itching	0.65	4	0.98	2
3.	Excess mucous discharge	0.02	6	0.90	3
4.	Sandy and gritty sensation	1.95	1	0.87	4
5.	Burning	0.92	2	0.60	5
6.	Blurred vision	0.10	5	0.33	6

to get mean score and mean ranks. Table 6 and Fig. 1 shows that in rural areas 'sandy and gritty sensation in eyes' and 'burning of eyes' and in urban areas 'excess watering of eyes' and 'redness and itching in eyes' were the main symptoms indicating dry eye as they got 1 and 2 ranks, respectively. Where, in rural areas other symptoms who got 3 and 4 ranks were 'excess watering of eyes' and 'redness and itching in eyes' and in urban areas 'excess mucous discharge' and 'sandy and gritty sensation in eyes' got the same ranks. The least score *i.e.* 5 and 6 were assigned to 'blurred vision' and 'excess mucous discharge' in rural areas and 'burning of eyes' and 'blurred vision' in urban areas.

On the basis of overall analysis by using Aramuc Scientific Scale, it was revealed that (20.00%) of the respondents in rural areas and (33.33%) of the respondents in urban areas had the symptoms showing true dry eyes (Fig. 1). Therefore, it can be concluded

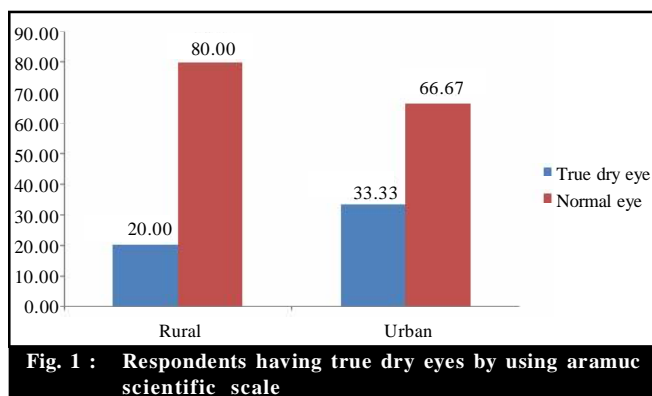


Fig. 1 : Respondents having true dry eyes by using aramuc scientific scale

that working in inadequate lighting conditions leads to dry eyes disease which can be treated as early as possible to avoid future discomfort to eyes. Also blinking of eyes in between the work makes the eyes relaxed to some extent. Rana (2013) also reported that ignorance about causes and consequences had resulted in degradation of quality of vision among majority of respondents.

Conclusion :

On the basis of above findings, it can be concluded that from both urban and rural area various visual discomforts like declined vision, eye strain, glare in eyes, etc were seen due to inadequate light. Some subjective scales also highlighted that respondents felt visual discomforts due to poor lighting. Therefore, lighting of the house should be ergonomically designed which can help to ultimately reduce the visual problems. These corrective measures can be achieved by proper lighting, right positioning of light fixtures, proper type of light source should be used, organization of work area and comfortable environmental parameters.

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