

Effectiveness of an Informational Booklet on Knowledge regarding Ill-Effects of Ammonia among Workers of Selected Cold Storage Plants of District Shimla, Himachal Pradesh

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Abstract: Background: Ammonia is a chemical substance used in several chemical industry segments such as the fertilizer, pharmaceutical, textile, and industrial refrigeration industries. On the one hand, as a refrigerant, it has several characteristics that make it extremely attractive. On the other hand, it is toxic and combustible. People who work in such facilities are at an increased risk for inhalational, dermal exposure and sometimes even fatal conditions. To increase the knowledge of cold store workers regarding ill effects of ammonia, information booklet has been proved effectively. Methods and Material: Non-randomized control group pre- test post- test design was used with sample size 60 selected by convenience sampling technique. Data was collected by self -structured knowledge questionnaires. An Informational booklet was administered. Results: In pre-test knowledge, 3 (10%) had good knowledge, 16 (53.3%) had an average knowledge and 11 (36.7%) had average knowledge. In post-test knowledge score, 23 (76.7%) had good knowledge and 7 (23.3%) had an average knowledge. Conclusion: The study findings concluded that information booklet was effective in improving the level of knowledge among cold store workers regarding ill-effects of ammonia.

Keywords: knowledge, effectiveness, information booklet, ammonia, cold store

1. Introduction

Ammonia is a chemical substance used in several chemical industry segments, such as the fertilizer, pharmaceutical, textile, and industrial refrigeration industries. On the one hand, as a refrigerant, it has several characteristics that make it extremely attractive. For example, it has better heat transfer properties, the volumetric refrigerating effect is higher than other fluids with similar vapor pressure, and has no ozone depletion potential (ODP) and extremely lower GWP. On the other hand, it is toxic and combustible^[1]

Ammonia refrigeration is one of the older types of refrigeration that is still used today. While the average person doesn't realize it, just about all food and drinks that are purchased have been kept cold using ammonia refrigeration at some point along the way. This is because it is a reliable and efficient refrigerant with years of safe, proven utility.

For industrial and agricultural purposes, ammonia is often shipped as a liquefied, compressed gas. This is commonly called anhydrous ammonia as it has no water. Most people are exposed to ammonia from breathing the gas. They will notice the pungent odor and experience burning of the eyes, nose, and throat after breathing even small amounts. With higher doses, coughing or choking may occur. Exposure to high levels of ammonia can cause death from a swollen throat or from chemical burns to the lungs. Skin contact with ammonia-containing liquids may cause burns. Eye exposure to concentrated gas or liquid can cause serious corneal burns or blindness. Drinking a concentrated ammonia solution can cause burns to the mouth, throat, and stomach. Generally, the severity of symptoms depends on the degree of exposure.^[2]

However, the danger always exists that exposure will occur due to a leak or catastrophic release of Anhydrous Ammonia from a refrigeration system. A release of Anhydrous Ammonia could happen in a number of ways: physical impact to the refrigeration system, seal leaks, piping corrosion, and hydraulic shock.^[3] The study was conducted in India whose result showed that most of the workers 25 (41.6%) were aged below 30 years, 41 (68.3%) were male, 23 (38.4%) had primary education, 24 (40%) had 5 – 6 years of experience, 34 (56.7%) were residing in rural area, 43 (71.7%) had no previous exposure. The knowledge shows that 33 (55%) had inadequate knowledge, 24 (40%) had moderately adequate knowledge and 3 (5%) had adequate knowledge on ill-effects of ammonia. The mean score of knowledge was 10.38 with standard deviation 2.57 with minimum score of 6 and maximum score of 17.0^[4]

Similarly, a cross-sectional study was conducted in year 2018 in an Ammonia factory. The sample size was about 62 workers, the data was collected by using questionnaire method, and this information was analyzed by using SPSS software. The findings of the study indicated that about 38.7% of the sample have nose irritations, 37.1% have throat irritation, and 27.4% and 12.9% for eye and mouth irritations. In addition, there are relationship between years of experience and eye, nose irritation, while study showed that no relation between years of experience with mouth and throat irritation. Furthermore, there are no correlation between qualification level, smoking and working hour with irritation effects of ammonia. The study concluded that exposure to ammonia gas causes irritation to the upper respiratory tract system and eyes, therefore, suitable personal protective equipment for ammonia exposure must be worn^[5].

Ammonia releases have occurred that caused injuries and/or fatalities. However, a release that results in serious injuries or fatalities is the exception, not the rule. Most facilities have trained operators onsite who operate and maintain the system. Some facilities hire specialized refrigeration contractors to operate and maintain the refrigeration system. Only trained individual should operate an ammonia refrigeration system. Implementing effective control measures and work practices can significantly reduce occupational exposure to ammonia

2. Methodology

Research Design

The research design for the study was quasi experimental non randomized control group pre- test post- test design to accomplish the main objective i.e. to assess the effectiveness of an informational booklet on knowledge regarding ill-effects of ammonia among workers of selected cold storage plants of District Shimla, Himachal Pradesh.

Research Setting

The final study was conducted at Adani's cold storage plant and Bija Agri-fresh Bithal, Rampur Bushahar, Shimla Himachal Pradesh

Sample size

The sample size comprised of 60 cold store workers. In this, 30 cold store workers were selected from Adani's cold storage plant Shimla which was experimental group and 30 from Bija Agri-fresh Bithal, Shimla which was control group.

Research sampling technique

The choice of sampling technique depends upon the nature of problem, the kind of variables included in the study, the type of research and the number of sampling unit. In the present study, non- Probability Convenient sampling technique was used to select the subset of population.

Selection and development of tool

Tool was selected on the basis of objectives of the study. Self - Structured Knowledge Questionnaire was used to assess the effectiveness of an informational booklet on knowledge regarding ill-effects of ammonia among workers.

The tool was developed from various sources like textbook, journals and discussion with experts in field of community medicine and general medicine.

Ethical Considerations

Research approval was approved by research committees prior to the pilot and main study. Permission was sought from ethical committee of S.N.G.N.C., I.G.M.C., Shimla; General Manager, Devbhumi cold store plant; General Manager, Bija Agri fresh, Shimla; General Manager, Adani cold store plant, Bithal, Rampur Bushahar, Shimla.

Data Collection Procedure and Analysis

Collection of data was in 2 phases i.e. pre-test and post-test. Pre-test was done on 03/06/2024 in experimental group and in control group by using self-structured knowledge questionnaires. Informational booklet was administered on 10/06/2024 to experimental group. Post-test was conducted by using same tool on 20/06/2024 in experimental group and

control group. After the collection of whole data, researcher was thankful to the study subject or concerned authority for their full cooperation. According to the objectives, hypothesis of the study and opinion of the expert it was planned to organize, tabulate, analyze and interpret with data by using both descriptive and inferential statistics.

3. Results

1) Socio-Demographic characteristics

This section describes the sample characteristics of workers under the study. The sample characteristics are described in terms of age, education status, area of residence, type of family and income per month, no. of siblings, marital status, no. of children and personal habits, other sources of income, prior information and source of information regarding ill effects of ammonia in both experimental and control group. . Frequency and percentage distribution were computed for describing the sample characteristics. The findings are presented in table 4.1

Table 1: Frequency and Percentage Distribution of Demographic Variables Among Workers of Cold Store, n=60

Socio-Demographic Variables	Experimental group (n1=30)		Control group (n2=30)	
	Frequency (f)	Percentage (%)	Frequency (f)	Percentage (%)
Age in years				
18-23 years	0	0.00	6	20.00
24-27 years	3	10.00	3	10.00
28-32 years	4	13.30	9	30.00
≥33 years	23	76.70	12	40.00
Education status				
Illiterate	0	0.00	1	3.30
Middle	2	6.70	4	13.30
High school	5	16.70	6	20.00
Senior Secondary	10	33.30	7	23.30
Graduate	10	33.30	8	26.70
Post graduate	2	6.70	4	13.30
> post graduate	1	3.30	0	0.00
Area of Residence				
Urban	1	3.30	2	6.70
Rural	29	96.70	28	93.30
Type of Family				
Nuclear	9	30.00	7	23.30
Joint	19	63.30	22	73.30
Extended	2	6.70	1	3.30
Monthly family income				
10,000 -15,000/	4	13.30	18	60.00
15,001-20,000/	6	20.00	7	23.30
20,001- 25,000/	5	16.70	1	3.30
>25,000/	15	50.00	4	13.30
No. of Siblings				
No sibling	2	6.70	1	3.30
One	8	26.70	11	36.70
Two	14	46.70	7	23.30
> two	6	20.00	11	36.70
Marital status				
Married	26	86.70	21	70.00
Unmarried	2	6.70	9	30.00
Widow/widower	2	6.70	0	0.00
No. of Children				
No children	4	13.30	11	36.70
One	9	30.00	13	43.30

Two	14	46.70	6	20.00
More than two	3	10.00	0	0.00
Personal habits				
Children	2	6.70	3	10.00
Chewing tobacco	0	0.00	8	26.70
Alcoholism	13	43.30	4	13.30
Nothing	15	50.00	15	50.00
No. of Dependents in Family				
Zero	0	0.00	0	0.00
1-2	9	30.00	11	36.70
3-5	19	63.30	18	60.00
>5	2	6.70	1	3.30
Other Source of Income				
Agriculture	13	43.30	28	93.30
Business	0	0.00	0	0.00
Govt. jobs	0	0.00	0	0.00
Private jobs	17	56.70	2	6.70
Others	0	0.00	0	0.00
Prior knowledge				
Yes	29	96.70	23	76.70
No	1	3.3	7	23.3
Source of Information				
Mass media	20	66.70	6	20.00
Office authorities	9	30.00	19	63.30
Friends/ neighbours	0	0.00	1	3.30
Others	1	3.30	4	13.30

2) Assessment of pre and post-test knowledge

Table 3: Comparison within the Group with Paired & Unpaired 't' Test of Knowledge Scores, N=60

		Knowledge Score				Paired 't' Test			
		Pretest		Posttest					
Group	N	Mean	SD	Mean	SD	df	t	T value at 0.05	Result
Exp Group	30	12.63	4.930	22.03	2.341	29	11.874	2.756	P value =<0.001***
Cont Group	30	12.600	2.908	13.67	3.367	29	2.023	2.756	P value =0.052 ^{NS}
		Control group		Experimental group					
Unpaired 't' Test	df	58		df	58				
	t	11.175		t	11.175				
	T	2.663		T	2.663				
	Result	P value =0.052NS		Result	P value=<0.001***				

Maximum=30

Minimum=0

Table 3 depicts that by using paired 't' test, it was found that there was significant improvement in knowledge scores within the experimental group with t value 11.874 at degree of freedom 29. This finding suggests that the intervention or treatment applied to the Experimental Group was effective in enhancing their knowledge significantly. Hence Conversely, the control group showed slight increase in knowledge scores from pre-test to post-test where t value is 2.02 at degree of freedom 29. This indicates that without the specific intervention received by the Experimental Group, there was only a little improvement in knowledge scores over time in the Control Group.

Furthermore, the unpaired t-test comparing the post-test scores between the Experimental and Control Groups showed a significant difference, t value of 11.175 with degree of freedom 58 indicating that the post-intervention knowledge scores were significantly higher in the Experimental Group compared to the Control Group. Research hypothesis H_1 was accepted and null hypothesis H_{01} was rejected.

Table 2: Comparison of pre and post interventional level of knowledge score in both experimental and control group, N=60

Criteria Measure of Level of Knowledge									
Level of Knowledge	Score	Experimental				Control			
		Pre-Test		Post-Test		Pre-Test		Post-Test	
		(f)	(%)	(f)	(%)	(f)	(%)	(f)	(%)
Good	21-30	3	10	23	76.7	0	0	1	3.3
Average	11-20	16	53.3	7	23.3	22	73.3	24	80
Poor	0-10	11	36.7	0	0	8	26.7	5	16.7

Maximum=30

Minimum=0

Table 2 depicts that that in pre-test knowledge of experimental group, 3 (10%) participants fell in good range (21-30), 16 participants (53.3%) fell within the average range (11-20) and 11 participants (36.7%) scored in the average range (0-10). In post-test knowledge of experimental group, 23 participants (76.7%) achieved scores in the good range (21-30), the number of participants with average knowledge scores were 7 (26.7%) and none of the participants were in poor knowledge scores.

In pre-test knowledge of control group, 0 participants had good knowledge scores, 22 (73.3%) participants had average knowledge scores and 8 (26.7%) participants had poor knowledge scores. In post-test knowledge of control group, 1 (3.3%) participants fell in the good range (21-30), 24 participants (80%) achieved scores in the average range (11-20) and 5 (16.7%) participants fell within the poor range (0-10).

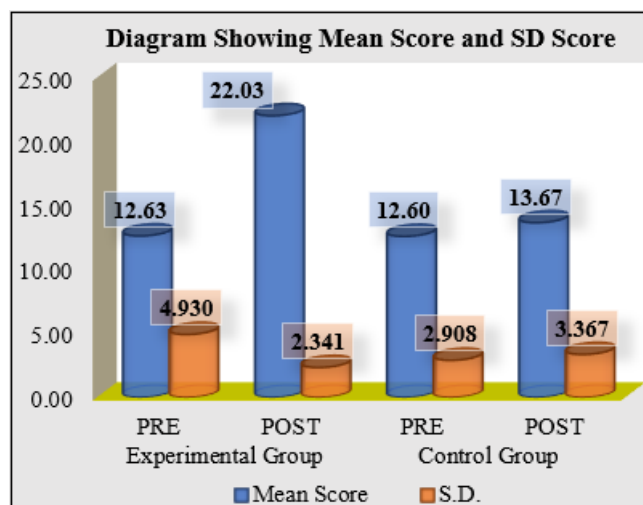


Figure 1: Clustered Cylindrical Diagram showing comparison of knowledge scores between experimental and control group

3) Association of socio-demographic variables

Table 4: Association of post-test knowledge scores and demographic variables in experimental group, N=60

Demographic Criteria				Association of Knowledge Score with Demographic Variables (Post Knowledge) Experimental Group			
Variables	Good	Average	Poor	df	χ^2	Table value	P value
Age in years							
18-23 years	0	0	0	0.207	2	5.991	0.902
24-27 years	2	1	0				
28-32 years	3	1	0				
> 33 years	18	5	0				
Education status							
Illiterate	0	0	0	9.317	5	11.070	0.097
Middle	0	2	0				
High school	3	2	0				
Senior Secondary	8	2	0				
Graduate	9	1	0				
Post graduate	2	0	0				
> post graduate	1	0	0				
Area of Residence							
Urban	1	0	0	0.315	1	3.841	0.575
Rural	22	7	0				
Type of family							
Nuclear	8	1	0	0.280	3	7.815	0.964
Joint	15	4	0				
Extended	0	2	0				
Monthly family income							
10,000 -15,000/	3	1	0	0.280	3	7.815	0.964
15,001-20,000/	5	1	0				
20,001- 25,000/	4	1	0				
> 25,000/	11	4	0				
No. of siblings							
No sibling	2	0	0	1.684	3	7.815	0.641
One	7	1	0				
Two	10	4	0				
> two	4	2	0				
Marital Status							
Married	19	7	0	1.405	2	5.991	0.495
Unmarried	2	0	0				
Widow/widower	2	0	0				
No. of Children							
No children	4	0	0	2.848	2	5.991	0.241
One	6	3	0				
Two	10	4	0				
More than two	4	0	0				
Personal Habits							
Children	2	0	0	4.716	2	5.991	0.095
Chewing tobacco	0	0	0				
Alcoholism	12	1	0				
Nothing	9	6	0				
No. of Dependents in Family							
Zero	0	0	0	7.574	2	5.991	0.023*
1-2	4	5	0				
3-5	17	2	0				
>5	2	0	0				
Other Source of Income							
Agriculture	7	6	0	6.679	1	3.841	0.010*
Business	0	0	0				
Govt. jobs	0	0	0				
Private jobs	16	1	0				
Others	0	0	0				
Prior knowledge							

Yes	22	7	0	0.315	1	3.841	0.575
No	1	0	0				
Source of information							
Mass media	16	4	0	3.416	2	5.991	0.181
Office authorities	7	2	0				
Friends/ neighbours	0	0	0				
Others	0	1	0				

Table 4 depicts the association between the level of score and socio demographic variable. Based on the objective used to Chi-square test used to associate the level of knowledge and selected demographic variables in post-experimental group. The Chi-square value shows that there is significance association between the score level and demographic variables that is number of dependents, a ($\chi^2=7.574$, P value is 0.023, and 2 degrees of freedom, table value is 5.991), other sources of income family monthly income ($\chi^2=6.679$, P value is 0.010, and 1 degree of freedom, table value is 3.841)

There is no significance association between the level of scores and other demographic variables (age, education status, type of family, family income, no. of siblings, marital status, no. of children, personal habits, no. of dependents, prior information and source of information). The calculated chi-square values were less than the table value at the 0.05 level of significance.

Discussion

The discussion relates the result of the finding of the present study with the findings of the study concluded in the past. Present study findings have been discussed in accordance with the objectives of the study.

Objective 1: To assess the knowledge regarding ill-effects of the ammonia among workers of selected cold storage plants of District Shimla, Himachal Pradesh.

Pre-test level of knowledge reveals that reveals that 10% workers in experimental group had good knowledge, 53.3% are in experimental group who had average knowledge while 36.7% are in experimental who had poor knowledge. This indicates that it was necessary for the investigator to improve the knowledge of the cold store workers by providing specific information regarding ill effects of ammonia. The findings of the study were similar to a study conducted by Alfred Solomon D and Nandhini S (2020), which showed that 33(55%) had inadequate knowledge, 24(40%) had moderately adequate knowledge and 3 (5%) had adequate knowledge on ill-effects of ammonia.

Objective 2: To evaluate the effectiveness of an informational booklet on the knowledge regarding ill-effects of ammonia among workers of selected cold storage plantsof District Shimla, Himachal Pradesh.

The present study shows that the mean posttest knowledge score is 22.03 while mean score of pretest knowledge is 12.63. p value is <0.001. The findings of the study reveal that informational booklet was effective in evaluating the knowledge of cold store workers regarding ill effects of ammonia. The findings were similar to the study conducted by Alfred Solomon D and Nandhini S (2020), which

concluded that to improve the awareness of workers about health effects of ammonia gas, the training programme should be introduced regarding the safety policy at selected ice factory.

Objective 3: To find out the association of level of knowledge regarding ill-effects of ammonia among workers with their socio-demographic variables.

In analysis the Chi square value shows that there is significant association between the score level and demographic variables (area of residence, family income per month). There is no significance association between the level of scores and other demographic variables (age, education status, type of family, no. of siblings, marital status, no. of children, other sources of income, prior information and source of information). The calculated chi-square values were less than the table value at the 0.05 level of significance. The findings of the study were similar to the study conducted by Alfred Solomon D and Nandhini S (2020), which revealed that the demographic variables of age and area of living had shown statistically significant association with level of knowledge on ill effects of ammonia among workers at ice factory and cold store facilities at $p < 0.05$ level and the other demographic variable had not shown statistically significant association with level of knowledge on ill-effects of ammonia.

4. Conclusion

The study was conducted to evaluate the effectiveness of an informational booklet on knowledge regarding ill-effects of ammonia among workers of selected cold storage plants of District Shimla, Himachal Pradesh. It was concluded that the informational booklet was found effective in improving the knowledge score regarding ill-effects of the ammonia.

On the basis of total score, findings revealed that in pre-test knowledge of experimental group, 3(10%) had good knowledge, 16 (53.3%) achieved an average score. 11 (36.7%) scored poorly. While in the control group, 22 (73.3%) had an average score and 8 (26.7%) scored poorly. In post-test knowledge score of experimental groups, 23 (76.7%) had good knowledge, 7(23.3%) achieved an average score. While in the control group, 1(3.3%) had good knowledge, 7 (23.3) achieved an average score and 5(16.7%) scored poorly. In experimental group, post interventional mean of knowledge score was 22.03, with a standard deviation of 2.341. Whereas in control group, post interventional mean of knowledge score was 13.67, with a standard deviation of 3.367. Thus, it showed that knowledge of the participants significantly improved in the experimental group during post-test.

References

- [1] Yang Z, Wu X. Retrofits and options for the alternatives to HCFC-22. Energy. 2013 Sep; 59:1–21.
- [2] Ammonia | Medical Management Guidelines | Toxic Substance Portal | ATSDR [Internet]. www.cdc.gov. Available from: <https://www.cdc.gov/TSP/MMG/MMGDetails.aspx?mgid=7&toxid=2>
- [3] Usda.gov. [cited 2026 Aug 20]. Available from:

https://www.fsis.usda.gov/sites/default/files/media_file/2020-08/Ammonia.pdf

- [4] Solomon A. Assess the knowledge regarding ill-effects of ammonia among workers of selected ice factory and cold storage plant. ~ 86 ~ International Journal of Advance Research in Community Health Nursing [Internet]. 2020;2(2):86–8. Available from: <https://www.communitynursing.net/article/view/47/2-2-24>
- [5] Huda Mohamed et al., Irritation Effects of Ammonia Gas on Workers in Ammonia Factory at Elberga Petroleum Company During 2017. Sch J ApplSci Res 2018, 1(5)

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