

# Occupational hazards and quality of life among fertilizer factory workers in Assiut City

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## Background

Occupational hazards are the major source of morbidity and mortality among the factory workers owing to exposure to many hazardous situations in their daily practices.

## Aim

This study aimed to identify the relation between the occupational hazards and quality of life (QOL) among fertilizer factory workers in Assiut City.

## Participants and methods

A descriptive study design was used. The study was conducted in a fertilizer factory. This factory was located in the west of Assiut (Manqbad Center). The sample size was 362 workers selected by convenient sampling. The study includes two tools: tool I had interview questionnaires and included three parts – part 1 included personal data, part 2 had past and present medical history, and part 3 had questions to assess occupational hazards – whereas tool II comprised QOL questionnaire.

## Results

The study revealed that more than half of workers did not know the problems of noise, whereas more than half of them knew accident exposure is one of the problems of inadequate lighting, and most workers mentioned that bad ventilation caused respiratory problems. Most workers noticed that the accidents or injuries and respiratory problems are considered the problems occurring owing mechanical and chemical hazards exposure, respectively. Moreover, more than half of the workers had moderate level of QOL.

## Conclusion

The study concluded that there was statistically significant difference between QOL and workers' complaints (skin problems and allergy symptoms, poisoning, headache, nausea and vomiting, fainting, osteoporosis, and anemia). Moreover, there was statistically significant difference between QOL of workers and physical (noisy and ventilation), mechanical, and chemical hazards. The study recommends that regular medical checkups for workers and more research studies regarding occupational hazards must be done.

## Keywords:

fertilizer factory workers, occupational hazard, quality of life

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## Introduction

Fertilizers are substances that provide nutrients to plants to increase or sustain optimal crop yield (Chien *et al.*, 2009). They are broadly divided into organic and inorganic. Organic fertilizers that may be suitable for commercial use are byproducts of livestock, fish, food, and other processing industries (Gaskell and Smith, 2007). Inorganic fertilizers are manufactured in the factory and mainly contain nitrogen, phosphorous, and potassium. Nitrogen is primarily provided by nitrogenous fertilizers such as urea or ammonia fertilizers. Further shares of nitrogen are contained in complex fertilizers that combine all three plant nutrients (nitrogen, phosphorous, and potassium) (Kamel *et al.*, 2017; Savci, 2012).

Every occupation has its own hazards and risks. According to the WHO, the term 'hazard' refers to

an inherent property of an agent, or a situation having the potential to cause adverse effects when an organism, system, or population is exposed to that agent (Howard, 2013a, 2013b).

Occupational hazard is a risk to a person in his/her working environment besides the consequences like fatal accidents, minor to severe injuries, and allergic and systemic effects which occur immediately, whereas there are those that appear at a later period, or an occupational hazard is something unpleasant that one

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may suffer or experience as a result of doing their job or hobby (World Health Organization, 2010).

As defined by the WHO 'occupational health' deals with all aspects of health and safety in the workplace and has a strong focus on primary prevention of hazards. Occupational health is a multidisciplinary field of healthcare concerned with enabling an individual to undertake their occupation, in the way that causes least harm to their health.

'Occupational health' should be aimed at promotion and maintenance of the highest degree of physical, mental and social well-being of workers in all occupations; the prevention among workers of departures from health hazards caused by their working conditions; the protection of workers in their employment from risks resulting from factors adverse to health; the placing and maintenance of the worker in an occupational environment adapted to his physiological and psychological capabilities; and, to summarize, the adaptation of work to man (WHO Committee on Occupational Health, 2011).

A wide array of workplace hazards present risks to the health and safety of people at work. These include but are not limited to 'chemicals, biological agents, physical factors, adverse ergonomic conditions, allergens, a complex network of safety risks', and a broad range of psychosocial risk factors (Abrams, 2012).

'Quality of Life (QOL)' is the perceived satisfaction of individuals about living their life in a society. This perception has a relation with a goal and expectation within the contexts of culture, values, norms, and other related issues. In addition, there is a relation with the type of their lifestyle that is consistent with their basic needs such as having a good well-being, a good health, an employment, and an ability to be a good citizen (Kittipichai *et al.*, 2012).

In other words, if the individuals can do anything that they are satisfied with, and live in a good environment, then they would have a good QOL. This thought is in line with the concept of 'Happy Workplace' that emphasizes the 'work-life balance' among the workers, that is, the balance between their personal life, family, and society (Jingjitra, 2011 and Damrongsak and Harnirattisai, 2012).

The findings of previous studies showed that there were both positive and negative factors that affect the QOL among workers in the industrial sector. The examples of positive factors included the status of a full-time employment, satisfaction with working

situation, job satisfaction and the pride about the job, relationship with coworkers and supervisor, and work environment (Nuntaboot, 2012 and Phewkleang and Rewmongkhol, 2013).

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## Significance

As 'humans' serve as a key success factor of an organization; therefore, it is necessary that the QOL must be ensured for all of the workers in the organization. Consequently, the quality of the workers would reflect the quality of the organization. In developing countries, occupational injury and illness rates are believed to be much higher than that in developed countries. However, the numbers of occupational diseases and injuries reported in these countries are much lower than the actual numbers.

Many studies have been conducted on fertilizer factory workers and state that the workers are exposed to many injuries and problems such as respiratory, hearing, and others problems. Therefore, this study was conducted to investigate the QOL among the workers.

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## Aim

This study aimed to identify the relation between the occupational hazards and QOL among fertilizer factory workers in Assiut City.

## Research questions

- (1) What are occupational hazards among fertilizer factory workers?
- (2) Is there a relation between hazards and quality of life among fertilizer factory workers?

## Participants and methods

### Research design

A descriptive study design was used.

### Setting

The study was conducted in fertilizer factory at Assiut City. This factory was located in the west of Assiut (Manqbad Center) and provides services for Assiut Governorate. It includes two departments: administrative and technical. The technical department includes different units such as electricity, super, driers, packaging, wires station, occupational safety, and production.

### Sample

A convenient sample was used in this study. The total number of fertilizer factory workers was 394; they were

working in different departments. The sample size was 362 workers who agreed to participate in the study.

### Tools of the study

The present study included two tools:

- (1) Tool I: This was an interview questionnaire that was designed by the researchers and included three parts:
  - (a) Part 1: personal data questionnaire, which includes age, residence, educational level, marital status, type of work, years of experience, health services provided for workers, attendance of any training related to job, periodic check-up, and uses of personal protective devices.
  - (b) Part 2: past and present medical history and exposure to any health problems.
  - (c) Part 3: questions to assess occupational hazards among fertilizer workers such as physical, chemical, mechanical, and psychological hazards.
- (2) Tool II: QOL was measured by the Iranian version of the Short Form Health Survey, which was developed by Ware *et al.* (2002). There are 36 questions that measure eight dimensions of QOL: physical functioning, social functioning, role limitation (physical), role limitation (emotional), bodily pain, mental health, vitality, and general health. Each dimension has a score of 0–100, with higher scores indicating a better health status.

### Methodology

#### Administrative phase

An official approval letter was obtained from the Dean of Faculty of Nursing, Assiut University, to Director of fertilizer factory. This letter includes permission for researchers to carry out the study. The researchers explain the purpose and nature of the study to the workers.

#### Pilot study

A pilot study was conducted before starting data collection on 37 (10%) workers who were included in the sample for no modification in the sheet. The aim of the pilot study was test the clarity of the tool and to estimate the time required to fill the sheet.

Reliability was estimated by  $\alpha$  Cronbach's test for tool II, and its result was  $R$  equal to 0.68.

Validity of the tools was checked by five experts of Community Health Nursing, Assiut University, who reviewed the tools for clarity, relevantness, comprehensiveness, understanding, and applicability.

### Ethical considerations

- (1) Research proposal was approved by the ethical committee in the faculty of nursing.
- (2) There is no risk for study subjects during application of the research.
- (3) The study followed common ethical principles in clinical research.
- (4) Oral consent was obtained from participants who were willing to participate in the study after explaining the nature and purpose of the study.
- (5) Confidentiality and anonymity was assured.
- (6) Study subjects have the right to refuse to participate or withdraw from the study without any rationale at any time.
- (7) For study subjects, privacy was considered during collection of the data.

### Data collection

The researchers interviewed each participant individually at their workplace. The nature and purpose of the study were briefly explained through direct personal communication at the beginning of each interview to get their agreement before starting data collection. The sheet took about 30 min. The data were collected in the period from the April 2016 until July 2016. The researchers collect data 2 days per week, and 10–12 sheets were done each day according to the time allowance of the workers.

### Statistical analysis

The data was computerized and verified using the SPSS (SPSS Inc., Chicago, IL, USA), version 19 to perform tabulation and statistical analysis. Data were presented using descriptive statistics in the form of frequencies and percentages for qualitative variables, and mean and SDs for quantitative variables. Studied variables were compared using  $\chi^2$ -test. Statistical significance was considered at  $P$  value less than 0.05.

### Results

Table 1 reveals the distribution of the studied sample regarding personal characteristics among fertilizer factory workers; it was observed that the mean age of workers was (mean $\pm$ SD) 46.3 $\pm$ 9.2 years, and 87.3% of them were from rural areas. Regarding educational level, Table 1 shows that 78.4% of workers had technical education. Moreover, 37.5% of them worked as a technician in the factory. More than two-thirds (71.3%) of workers attended training course after employment. Moreover, 58.6% of workers had more than 15 years of experience and only 4.4% of them had less than 5 years.

**Table 1 Distribution of the fertilizer factory workers regarding personal characteristics at Assiut City (n=362)**

| Personal characteristics                      | n (%)      |
|---|------------|
| Age (years)                                   |            |
| Range   | 25–59      |
| Mean±SD                                       | 46.3±9.2   |
| Residence                                     |            |
| Rural   | 316 (87.3) |
| Urban   | 46 (12.7)  |
| Educational level                             |            |
| Illiterate                                    | 2 (0.6)    |
| Basic education                               | 30 (8.3)   |
| Technical education                           | 284 (78.4) |
| University                                    | 46 (12.7)  |
| Department                                    |            |
| Electricity                                   | 140 (38.7) |
| Super   | 106 (29.3) |
| Driers  | 28 (7.7)   |
| Packaging                                     | 10 (2.8)   |
| Vires station                                 | 44 (12.2)  |
| Occupational safety                           | 14 (3.8)   |
| Production                                    | 20 (5.5)   |
| Type of work                                  |            |
| Technician                                    | 266 (73.5) |
| Worker  | 96 (26.5)  |
| Attending of training course after employment |            |
| Yes   | 258 (71.3) |
| Names of training course <sup>a</sup>         |            |
| Protection from occupational hazards          | 240 (66.3) |
| Uses of machines                              | 190 (52.5) |
| First aid                                     | 132 (36.5) |
| Working hours                                 |            |
| Range   | 8–12       |
| Mean±SD                                       | 8±0.3      |
| Years of experiences                          |            |
| <5  | 16 (4.4)   |
| 5–10  | 66 (18.2)  |
| 10–15   | 68 (18.8)  |
| >15   | 212 (58.6) |
| Range   | 2–39       |
| Mean±SD                                       | 20.4±10    |

<sup>a</sup>More than one answer.

Table 2 shows the distribution of the studied sample regarding the services provided in fertilizer factory. It was found that 91.7% of services provided for the workers were health insurance service, whereas 39.2% of workers mentioned that the factory provides periodic check-up for them. The vast majority (96.7%) of workers stated that the physician is present always in the factory. Moreover, the majority (86.7%) of workers noticed that nursing services were presence in the factory.

Table 3 illustrates the protective clothes used by workers in order of their work in fertilizer factory. It was noticed that 84.5% of workers use protective clothing. More than half (60.2%) of them wear

**Table 2 Distribution of the studied sample regarding services provided in fertilizer factory at Assiut City (n=362)**

| Services provided <sup>a</sup>                      | n (%)      |
|---|------------|
| Meal  | 282 (77.9) |
| Health insurance                                    | 332 (91.7) |
| Recreational  | 28 (7.7)   |
| Periodic check-up                                   |            |
| Yes   | 142 (39.2) |
| No  | 220 (60.8) |
| Duration  |            |
| Every 6 months                                      | 108 (77.1) |
| Every year  | 32 (22.9)  |
| Presence of physician                               |            |
| Yes   | 350 (96.7) |
| No  | 12 (3.3)   |
| Time of present                                     |            |
| Always  | 346 (98.9) |
| Two times per week                                  | 4 (1.1)    |
| Nursing services                                    |            |
| Yes   | 314 (86.7) |
| First aids  | 306 (84.5) |
| Simple procedures (as dressing, sutures, injection) | 44 (12.2)  |

<sup>a</sup>More than one answer.

**Table 3 Protective clothes used by workers in order of work in fertilizer factory at Assiut City (n=362)**

| Use of protective clothes during work | n (%)      |
|---------------------------------------|------------|
| Yes                                   | 306 (84.5) |
| No                                    | 56 (15.5)  |
| Protective clothes <sup>a</sup>       |            |
| Mask                                  | 150 (41.4) |
| Eye goggles                           | 126 (34.8) |
| Apron                                 | 62 (17.1)  |
| Rubber boot                           | 70 (19.3)  |
| Protective ear gears                  | 106 (29.3) |
| Gloves                                | 6 (1.7)    |
| Overhead protective gears             | 218 (60.2) |

<sup>a</sup>More than one answer.

overhead protective gears followed by masks and the glasses, whereas only 1.7% wears gloves.

Table 4 shows the previous history of health problems among fertilizer factory workers. It reveals that 19.3% of workers had previous history of health problems. More than half (62.9%) of them had respiratory problems, and 20.1% had auditory problems, whereas only 2.9% of workers had disk prolapse.

Table 5 reveals the present complaints of fertilizer factory workers. It is observed that 80.1 and 77.3% of workers complained of headache and respiratory problems, respectively, followed by osteoporosis. In contrast, only 14.4% of workers complained of drowsy and loss of concentration followed by hypotension. Moreover, only 13.3% of workers were exposed to injuries during work, whereas 33.3% had

**Table 4 Previous history of health problems among fertilizer factory workers at Assiut City (n=362)**

| Previous history of health problems <sup>a</sup> | n (%)     |
|--|-----------|
| Yes  | 70 (19.3) |
| Joints problems                                  | 4 (5.8)   |
| Auditory problems                                | 14 (20.1) |
| Chronic headache                                 | 8 (11.6)  |
| Respiratory problems                             | 44 (62.9) |
| Chronic diseases                                 | 6 (8.7)   |
| Disk prolapsed                                   | 2 (2.9)   |
| Skin allergy and inflammation                    | 4 (5.8)   |

<sup>a</sup>More than one complaint.**Table 5 Present complaints of fertilizer factory workers at Assiut City (n=362)**

| Present complaints <sup>a</sup>   | n (%)      |
|-----------------------------------|------------|
| Skin problem and allergy symptoms | 80 (22.1)  |
| Poisoning                         | 74 (20.4)  |
| Headache                          | 290 (80.1) |
| Nausea and vomiting               | 114 (31.5) |
| Fainting                          | 86 (23.8)  |
| Drowsy and loss of concentration  | 52 (14.4)  |
| Hypotension                       | 42 (11.6)  |
| Eye problems                      | 180 (49.7) |
| Respiratory problems              | 280 (77.3) |
| Osteoporosis                      | 196 (54.1) |
| Gastrointestinal problems         | 114 (31.5) |
| Anemia                            | 134 (37.0) |
| Teeth problems                    | 126 (34.8) |
| Injury during work                |            |
| Yes                               | 48 (13.3)  |
| No                                | 314 (86.7) |
| Place of injury                   |            |
| Vertebral column                  | 12 (25.0)  |
| Face                              | 4 (8.3)    |
| Forearm                           | 16 (33.3)  |
| Neck                              | 2 (4.2)    |
| Leg                               | 12 (25.0)  |
| Chest                             | 2 (4.2)    |
| Cause of injury                   |            |
| Chemical                          | 30 (62.5)  |
| Mechanical                        | 18 (37.5)  |

<sup>a</sup>More than one complaint.

forearm injuries and 62.5% of these injuries were caused by chemical agents.

Table 6 shows the workers' knowledge toward occupational hazards in fertilizer factory. It shows that 59.1% of workers do not know the problems of noise, whereas 59.6% of them know that accident exposure is one of problems of inadequate lighting, and 82.8% of workers mention that bad ventilation in the factory causes respiratory problems. The majority (82.8 and 80.7%) of workers noticed that the accidents or injuries and respiratory problems are the problems of mechanical and chemical hazards exposure, respectively.

**Table 6 Workers' knowledge toward occupational hazards in fertilizer factory at Assiut City (n=362)**

| Occupational hazards               | n (%)      |
|------------------------------------|------------|
| Problems of noise                  |            |
| Headache                           | 38 (10.5)  |
| Irritability                       | 34 (9.4)   |
| Hearing problems                   | 20 (5.5)   |
| Loss of concentration              | 44 (12.1)  |
| Lack of production                 | 12 (3.3)   |
| Do not know                        | 214 (59.1) |
| Problems of inadequate lighting    |            |
| Accident exposure                  | 216 (59.6) |
| Lack of production                 | 40 (11.0)  |
| Eye problems                       | 8 (2.2)    |
| Headache and irritability          | 10 (2.7)   |
| Do not know                        | 88 (24.3)  |
| Problems of bad ventilation        |            |
| Respiratory problems               | 300 (82.8) |
| Spread of infectious disease       | 44 (12.1)  |
| Headache and loss of concentration | 4 (1.2)    |
| Lack of production                 | 16 (4.4)   |
| Problems of mechanical hazards     |            |
| Accident or injury                 | 300 (82.8) |
| Do not know                        | 62 (17.2)  |
| Problems of chemical hazards       |            |
| Respiratory problems               | 292 (80.7) |
| Gastrointestinal problems          | 44 (12.2)  |
| Skin problems                      | 181 (50.0) |

Table 7 illustrates the QOL among fertilizer factory workers. It was observed that 53.1% of workers had moderate level of QOL and only 5.5% of them had good level.

Table 8 shows the relation between QOL and present complaints among fertilizer factory workers. There was a statistically significant difference between QOL of workers and the following complaints :skin allergy and inflammation, poisoning, headache, nausea and vomiting, fainting, osteoporosis, and anemia ( $P < 0.001$ ,  $< 0.001$ ,  $< 0.001$ ,  $0.044$ ,  $0.001$ ,  $0.005$ , and  $0.024$ , respectively).

Table 9 reveals the relation between QOL and occupational hazards. It was found that there was a statistically significant difference between QOL of workers and the following occupational hazards (noisy and ventilation as a physical hazards, mechanical hazards, and chemical hazards ( $P = 0.009$ ,  $< 0.001$ ,  $< 0.001$ ,  $< 0.001$ , respectively).

## Discussion

Workers represent half of the world's population. Maintaining a safe working environment is reflected on workers' health. Some reasons for not implementing the safety policy by most developing countries are lack

of effective enforcement system, lack of information and accurate records of occupational diseases and accidents, and lack of basic professional training in occupational health and safety (Mostafa and Momen, 2014).

Occupational health means provision of comprehensive healthcare (personal and impersonal) to workers through a mix of promotive, preventive, curative, and rehabilitative interventions, so as to raise their QOL (Park, 2005 and Shah, 2006).

**Table 7 Quality of life among fertilizer factory workers at Assiut City (n=362)**

|          | Quality of life [n (%)] |
|----------|-------------------------|
| Poor     | 150 (41.4)              |
| Moderate | 192 (53.1)              |
| Good     | 20 (5.5)                |

This study aimed to identify the relation between the occupational hazards and QOL among fertilizer factory workers in Assiut City. The present study clears that the mean age of participant workers was 46.3±9.2 years. This was similar to a study conducted by Hovland *et al.* (2014), as they reported that the mean age was 47.3±9.9 years.

**Table 8 Relation between quality of life and present complaints among fertilizer factory workers at Assiut City (n=362)**

| Present complaints                      | Quality of life [n (%)] |                  |             | $\chi^2$ | P value |
|---|-------------------------|------------------|-------------|----------|---------|
|   | Poor (n=150)            | Moderate (n=192) | Good (n=20) |          |         |
| <b>Skin allergy and inflammation</b>    |                         |                  |             |          |         |
| Yes                                     | 57 (38.0)               | 21 (10.9)        | 2 (10.0)    | 37.60    | <0.001* |
| No                                      | 93 (62.0)               | 171 (89.1)       | 18 (90.0)   |          |         |
| <b>Poisoning</b>                        |                         |                  |             |          |         |
| Yes                                     | 48 (32.0)               | 24 (12.5)        | 2 (10.0)    | 21.10    | <0.001* |
| No                                      | 102 (68.0)              | 168 (87.5)       | 18 (90.0)   |          |         |
| <b>Headache</b>                         |                         |                  |             |          |         |
| Yes                                     | 140 (93.3)              | 142 (74.0)       | 8 (40.0)    | 20.13    | <0.001* |
| No                                      | 10 (6.7)                | 50 (26.0)        | 12 (60.0)   |          |         |
| <b>Nausea and vomiting</b>              |                         |                  |             |          |         |
| Yes                                     | 58 (38.7)               | 50 (26.0)        | 6 (30.0)    | 6.24     | 0.044*  |
| No                                      | 92 (61.3)               | 142 (74.0)       | 14 (70.0)   |          |         |
| <b>Fainting</b>                         |                         |                  |             |          |         |
| Yes                                     | 50 (33.3)               | 34 (17.7)        | 2 (10.0)    | 13.56    | 0.001*  |
| No                                      | 100 (66.7)              | 158 (82.3)       | 18 (90.0)   |          |         |
| <b>Drowsy and loss of concentration</b> |                         |                  |             |          |         |
| Yes                                     | 24 (16.0)               | 28 (14.6)        | 0 (0.0)     | 3.69     | 0.158   |
| No                                      | 126 (84.0)              | 164 (85.4)       | 20 (100.0)  |          |         |
| <b>Hypotension</b>                      |                         |                  |             |          |         |
| Yes                                     | 20 (13.3)               | 18 (9.4)         | 4 (20.0)    | 2.74     | 0.254   |
| No                                      | 130 (86.7)              | 174 (90.6)       | 16 (80.0)   |          |         |
| <b>Eye problems</b>                     |                         |                  |             |          |         |
| Yes                                     | 76 (50.7)               | 90 (46.9)        | 14 (70.0)   | 3.9      | 0.137   |
| No                                      | 74 (49.3)               | 102 (53.1)       | 6 (30.0)    |          |         |
| <b>Respiratory problems</b>             |                         |                  |             |          |         |
| Yes                                     | 122 (81.3)              | 140 (72.9)       | 18 (90.0)   | 5.3      | 0.069   |
| No                                      | 28 (18.7)               | 52 (27.1)        | 2 (10.0)    |          |         |
| <b>Osteoporosis</b>                     |                         |                  |             |          |         |
| Yes                                     | 80 (53.3)               | 112 (58.3)       | 4 (20.0)    | 10.79    | 0.005*  |
| No                                      | 70 (46.7)               | 80 (41.7)        | 16 (80.0)   |          |         |
| <b>Gastrointestinal problems</b>        |                         |                  |             |          |         |
| Yes                                     | 46 (30.7)               | 64 (33.3)        | 4 (20.0)    | 1.57     | 0.455   |
| No                                      | 104 (69.3)              | 128 (66.7)       | 16 (80.0)   |          |         |
| <b>Anemia</b>                           |                         |                  |             |          |         |
| Yes                                     | 62 (41.3)               | 70 (36.5)        | 2 (10.0)    | 7.49     | 0.024*  |
| No                                      | 88 (58.7)               | 122 (63.5)       | 18 (90.0)   |          |         |
| <b>Teeth problems</b>                   |                         |                  |             |          |         |
| Yes                                     | 46 (30.7)               | 76 (39.6)        | 4 (20.0)    | 5.00     | 0.082   |
| No                                      | 104 (69.3)              | 116 (60.4)       | 16 (80.0)   |          |         |

\*P<0.05, statistically significant difference.

**Table 9 Relation between quality of life and occupational hazards among fertilizer factory workers at Assiut City (n=362)**

| Occupational hazards      | Quality of life [n (%)] |                  |             | $\chi^2$ | P value |
|---------------------------|-------------------------|------------------|-------------|----------|---------|
|                           | Poor (n=150)            | Moderate (n=192) | Good (n=20) |          |         |
| <b>Physical hazards</b>   |                         |                  |             |          |         |
| <b>Noisy</b>              |                         |                  |             |          |         |
| Yes                       | 59 (39.3)               | 52 (27.1)        | 3 (15.0)    | 9.50     | 0.009*  |
| No                        | 91 (60.7)               | 140 (72.9)       | 17 (85.0)   |          |         |
| <b>Lighting</b>           |                         |                  |             |          |         |
| Efficient                 | 98 (65.3)               | 130 (67.7)       | 12 (60.0)   | 0.59     | 0.745   |
| Inefficient               | 52 (34.7)               | 62 (32.3)        | 8 (40.0)    |          |         |
| <b>Ventilation</b>        |                         |                  |             |          |         |
| Efficient                 | 124 (82.7)              | 186 (96.9)       | 20 (100.0)  | 23.15    | <0.001* |
| Inefficient               | 26 (17.3)               | 6 (3.1)          | 0 (0.0)     |          |         |
| <b>Mechanical hazards</b> |                         |                  |             |          |         |
| Yes (300)                 | 132 (88.0)              | 165 (85.9)       | 3 (15.0)    | 68.9     | <0.001* |
| No (62)                   | 18 (12.0)               | 27 (14.1)        | 17 (85.0)   |          |         |
| <b>Chemical hazards</b>   |                         |                  |             |          |         |
| Yes (292)                 | 97 (64.7)               | 180 (93.8)       | 15 (75.0)   | 46.1     | <0.001* |
| No (70)                   | 53 (35.3)               | 12 (6.3)         | 5 (25.0)    |          |         |
| <b>Psychological</b>      |                         |                  |             |          |         |
| Good (356)                | 145 (96.7)              | 191 (99.5)       | 20 (100.0)  | 4.4      | 0.108   |
| Bad (6)                   | 5 (3.3)                 | 1 (0.5)          | 0 (0.0)     |          |         |

\* $P < 0.05$ , statistically significant difference.

The results of the current study show that more than three-quarters of workers had technical education, and these findings agree with Jeffree *et al.* (2016), who found that the majority of individuals in both groups (case and control) were schooled until secondary level.

According to protective clothes use as reported by workers, most workers used the protective clothes. More than half of them wear overhead protective gears followed by masks and glasses, whereas only 1.7% wear gloves. These results match with the study conducted in Nigeria among paint factory workers, and it found that 85.5% of them did not use gloves, whereas 25.5% of them used boots (Awodele *et al.*, 2014). From researchers' point of view, this could be attributed to lack of awareness about importance of personal protective equipment (PPE) in prevention of occupational hazards and also worker's discomfort from PPE.

The results of the current study disagree with the study carried out by Jeffree *et al.* (2016) about hearing impairment and contributing factors among fertilizer factory workers. They reported that 77.6% of workers had years of experience of at least 15 years, whereas the present study found that more than two-fifths of the participant workers had years of experience of at least 15 years. Moreover, the study disagrees with the current study in area of attending training course, whereas 59.2% attended training course, whereas the present study mentioned that 71.3% attended training

course. This means that administrative authority have an interest in training the workers about occupational hazards and safety measures.

Regarding the complaints among fertilizer factory workers, the current study indicated that 33.7% of them have eye problems, and these findings are in line with the study by Parulekar *et al.* (2015), as they found that the prevalence of eye problems (ocular injury, conjunctival diseases, and refractive errors) was 34.6% in chemical and fertilizer industry, 37.6% in shipbuilding industry, and lowest in rubber industry at 24.3%. This may be attributed to the lack of compliance with PPE especially eye goggles.

Montano (2014) stated that 693 workers were exposed to biological hazards and 299 (43.1%) of them were exposed to skin problems; these findings contraindicated with the current study which found that less than one-quarter of workers had skin complaints.

Regarding the injury during the work and the cause of it, the study by Khan *et al.* (2006) clears that more than two-thirds (69.7%) of participants had injury related to mechanical event and more than one-quarter (27.9%) had injury related to chemical agents; these results are in disagreement with the result of the current study as it found that 37.5% of injury were because of mechanical, whereas 62.5% were because of chemical substances. This refers to incompliance with protective clothes.

The current study found that more than half of participants had moderate level of QOL, whereas only 5.5% of them had good level, and these results are in the same line with the study conducted by Kittipichai *et al.* (2015). Also the present study reported that approximately half of respondents (50.9%) had a moderate level of QOL, which is consistent with this study, whereas it found that the other half (49.1%) of them had a good level of QOL, which disagrees with the present study.

The present study investigates that there is a relation between QOL and occupational hazards among fertilizer factory workers, and this may refer to occupational environment affecting health status of workers such as exposed to injury, diseases, and others. Moreover, poor work environment affects satisfaction and happiness, as if the individual can do anything that they are satisfied with, and live in a good environment, then they would have a good QOL.

## Conclusion

From this study, it could be concluded that there was a statistically significant difference between QOL and the following workers' complaints (skin allergy and inflammation, poisoning, headache, nausea and vomiting, fainting, osteoporosis, and anemia). Moreover, there was a statistically significant difference between workers' QOL and noise and ventilation as physical hazards, mechanical hazards, and chemical hazards.

## Recommendations

The following recommendations are proposed:

- (1) Adequate supply and regular cleaning of PPE.
- (2) Regular medical checkups for workers.
- (3) Provision of leisure during a shift to reduce fatigue and boredom.
- (4) Training program for workers about occupational hazards in chemical industry.
- (5) Increase awareness of fertilizer factory workers toward importance of compliance with PPE at workplace.

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## Conflicts of interest

There are no conflicts of interest.

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