

Effect of Health Education Program for Biogas Units' Owners and Biogas Stations' Employees regarding Negative Effect of Biogas Units

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Abstract

Background: Biogas is produced by methanogen bacteria during acting upon the degradable materials in an anaerobic condition. **Aim of study:** Was to evaluate effect of Health education program of the household owners of biogas units and the employees at the biogas station, for knowledge and practices regarding Negative effect of Biogas Units. **Research Design:** A quasi - experimental design was utilized in this study. **Setting:** The study was conducted at biogas units and special units of society situated in recycling center at Moshtohor village, Kualubiya Governorate. **Sample:** A convenient sample, it consisted of 118 workers (number of owner (23) and number of employees (95)). **Tools of data collection:** Two tools were used in this study. **I:** Interviewing sheet included two parts: **A);** Demographic characteristic of the workers, owner biogas unites, **B);** Current history of occupational injury or problem and workers' knowledge owners of biogas units about biogas health hazards. **II: Observational checklist:** Was consisted of two parts: **A);** Observing and assessing of working place or condition. **B);** Observing and assessing household owners of biogas units and working employees in the biogas station practices during preparing biogas production. **Results:** Less than two thirds (60.9 %) of the studied owner their age ranged from 40 to less than 50 years old. More than half (54.7 %) of the studied workers their age ranged from 40 to less than 50 years old. revealed that there was improvement in workers, owner biogas unites total knowledge about score and total practice. **Conclusion:** Studied biogas owner and workers' knowledge and practice were improved significantly post program. **Recommendation:** Educational intervention and awareness programs for workers and biogas owner regarding safety measure and negative effect of biogas. Should be provided in wide score.

Keywords: First aid, Fertilizer and chemical, Occupational health hazards, Safety measures,

Introduction:

Energy is the engine that propels economic growth. However, a sizable percentage of the global population depends on non-renewable fossil fuels and lives in energy poverty. The use of non-renewable fossil fuels for energy puts tremendous strain on the environment. Therefore, it is vital to have renewable, effective and reliable energy resources while minimizing environmental impact. Renewable energy technologies such

as biogas can help ensure long-term resource use (**Rahman et al., 2021**).

The role of biogas in resolving the energy crisis in rural areas may be essential. Anaerobic digestion of animal waste, biodegradable domestic waste, and plant material results in the production of biogas. Biogas is mainly composed of methane (60%–70%) and carbon dioxide (30%–40%). Biogas with 60 per cent methane contains 6 kWh/N m³ energy. Household use of biogas

has many environmental and economic advantages. Substituting biogas for firewood helps reduce deforestation (**Rahman et al., 2021**).

In Egypt, the total amount of biomass is of the order of 60 million ton/y, equivalent to about 20 million ton/y. Waste biomass in Egypt is generated from (MSW); agricultural residues (crop residues); agro-industrial by-products (e.g. rice husk, bagasse); animal and poultry by-products (dung); sewage sludge; forest residues; and exotic plants (water hyacinth, reeds, etc.). Furthermore, energy crops are currently emerging as a new promising renewable energy source for producing biodiesel. If Farmers' knowledge and practices of the safe and appropriate use of household biogas units (HBUs) are still limited and they could negatively impact human, animal, and environmental health (**Toa et al., 2018**).

The community health nursing has an important role by giving Farmers more information regarding their health condition and by enhancing their knowledge of the best way to deal with possible hazards of biogas unit's exposures. The community health nursing has a role in family health promotion and prevention of health hazards as it can protect the farmers and their families from occupational health hazards and upgrade work safety which can be used during biogas use (**Jolly et al., 2016**).

Significance of the study:

Moshtohor village at Kalubia governorate was selected, because it is the first village which contains 30 numbers of biogas units that recycle waste products in Egypt since 1980. Approximately 57% of biogas owners at Moshtohor village had satisfactory knowledge however only 43.5% of them had adequate practices. With lack of regular maintenance of these biogas units that may

exacerbate the health risks for many infectious diseases while dealing with wastes and unit residues (**Ibrahim et al., 2017**). There is limited information in the field of management of home and agricultural wastes in Egypt and the gap between formal and practical data. So need to improve the healthy knowledge and practices about biogas (**Elfeki et al., 2017**).

Aim of the study:

The study aimed to evaluate effect of Health education program of the household owners of biogas units and the employees at the biogas station, for knowledge and practices regarding Negative effect of Biogas Units

Research Hypothesis

Knowledge and practices of biogas station employees and biogas owners would be improved after Implementation of health educational program regarding Negative effects of Biogas Units.

Subjects and method:

Research design:

Quasi experimental design was used in carrying out this study.

Setting:

This study was conducted in some of living accommodations which include biogas units and special units of society situated in recycling center at Moshtohor village, Kualubiya Governorate.

Sampling:

A convenient sample was used in the current work. The total number of owner (23) is twenty three persons and the total number of employees (95) is ninety five workers which include: -

The total number of sample was (118) employee according to the following

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inclusion criteria; age group 18 years or above, both sexes, and accepted to participate in the study.

Tools for Data Collection: Two tools were used for data collection.

Tool 1: An Interviewing questionnaire sheet included two parts:

First part:

(A) Assessment demographic characteristics of owners of biogas units.

(B) Assessment demographic characteristics of working employees in the biogas station.

(C) Basic information about work in biogas units.

Second part:

(A)-Current medical history of household owners of biogas units.

(B)- (1): Knowledge of household owners of biogas units about the biogas

(B)- (2): Information concerning methods of waste disposal

B-(3): Information concerning occupational health and safety standards and protecting biogas owners and workers from work hazards

(C) Knowledge of: working employees in the biogas station knowledge about biogas such as:

(C)- (1) Information concerning biogas waste

(C)- (2): Information concerning methods of waste disposal

(C)-(3): Information concerning occupational health and safety standards and protecting biogas owners and workers from work hazards.

Scoring system:

The scoring system for students' knowledge was calculated as follows (2) score for complete correct answer, while (1) score for incomplete correct answer and (0) for don't know answer and classified as the following: Good when the total score was 75% to 100% Average when the total score was 50 to less than 75%. Poor when the total score was less than 50%

II-Observational checklist to assess workers practice and working environment

Personal protective equipment.

Personal hygiene and first Aid:

Hazard Substances and biogas wastes

Scoring system:

The scoring system observational checklist questionnaire was calculated as follows (1) score for done, while (0) score for not done. Classified as the following: Satisfactory when the total score was > 60%.Unsatisfactory when the total score was less than < 60%

Reliability and content validity of the tools:

Tools validity test was done through five expertise's of Faculty Members of the Community Health Nursing Department-Faculty of Nursing Benha University Specialties who reviewed the tools for clarity, relevance, comprehensiveness, and applicability and give their opinion. Reliability of the tool was measured for testing the internal consistency by using test-retest reliability for a group of 10 participants who were asked to fill the questions and were asked again to refill the same questions under similar condition on one or more occasion.

The answers in the two testing were analyzed and computed for reliability. The reliability was done by Cronbachs Alpha coefficient test which revealed that each of the two tools consisted of relatively homogenous items as indicated by the moderate to high reliability of each tool. The internal consistency of the knowledge was 0.88, while practices were 0.91

Ethical consideration:

A full explanation about the aim of the study was explored. Owners and Workers oral consent was obtained before starting collecting data. This was reassured that all information gathered was confidential and used only for the purpose of the study. No names were required on the forms to ensure anonymity and confidentiality and any participant can move back at any time.

Pilot study:

After development of the tools, a pilot study was carried out on 10% of the sample to ascertain the clarity, applicability, feasibility of the tools, to estimate the exact time needed to fill in the questionnaire, and to detect any problems that might face the researcher and interfere with data collection. After conducting the pilot study, minor necessary changes were be done, the tools were be final. The pilot samples were included in the main study sample.

Field work:

Data collection procedure:

The actual field work was carried out for data collection over a period of six months at the beginning of October 2019 to the end of March 2020.the researcher was available three days/week (Saturday, Tuesday, and Thursday from 9 Am- 12 Pm. The total studied workers with inclusion criteria having a simple and full explanation of the aim and process of the study to obtain their verbal

informed consent. The time of interviewing each worker ranged between 15-30 mints.

Post-test was done after the educational intervention to evaluate effect of Health education program of the household owners of biogas units and the employees at the biogas station, for knowledge and practices regarding Negative effect of Biogas Units. Household owners of biogas units were in group (23) and workers who were included in the intervention were divided into 4 groups, each group consisted of 23-24 workers. The data collection procedure continued for 6 months. Each group attended 6 sessions and the duration of each session was 60-90 minutes.

Program construction;

The current study was carried out through four phases; Preparatory phase, developmental phase, implementation phase, and evaluation phase.

Preparatory phase:

Preparation of the study design and data collection tools was based on extensive review of the current and past available national and international references related literature about prevent negative effects of biogas units by using a journal, textbooks and internet search to contrast the tools and the home health care model. This was necessary for the researcher to be acquainted with and oriented about aspects of the research problem as well as to assist in the development of data collection tools. Also prepared handout for studied worker that included all items about prevent negative effects of biogas units, this took about two months for preparing the tools.

Program development phase:

Program was developed after the results. General objective of the program was

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improving participants and practices to prevent negative effects of biogas units. Contents of the program: the contents were designed to meet the biogas owners and employees needs in the biogas station to improve their knowledge and practices, to fit into their interest and level of understanding. The contents include

Occupational health hazards (physical, fire, mechanical, electrical, psychological hazard Meaning, causes, types, avoidance of occupational health hazards.

Practices of workers related safety measures and first aid program regarding occupational health hazards. Occupational health and safety standards (inside biogas units): Aims of occupational health and safety environment inside the field of work. Preventing work environment hazards and unit harm. Precaution from harms due to using unit tools. Precaution from psychological risks relates to work environment: Safety biogas station (precautions during handling of solid waste, liquid waste, biogas unit.

Program implementation phase: The program was implemented in a period of six months .Data were collected over 4 months from the start of October 2019 to the end of March 2020, the study was conducted by the researcher for the studied sample. This study was conducted in some of living accommodations which include biogas units and special units of society situated in recycling center at Moshtohor village, Kualubiya Governorate.

The program was carried out through 6 sessions, one & half hour/ day from (11am – 12,30pm) the duration of each session was 60-90 minutes. The researcher collected data

from the workers through filling the sheet. The average number of interviewing the workers was between 23-24 workers per group depending on their presence in the setting.

The nursing intervention construction was implemented for the workers at the suitable time for them. They received the same number of sessions to ensure that they were exposed to the same learning experience.

First session: Covered included an orientation to the nursing intervention program, terms of biogas unit introduction about biogas unit, history of origin and development of biogas. Importance of applying biogas technology at Egypt. Taking into consideration the use of simple language. Motivation, open discussion and reinforcement were used during the lecture to enhance learning. Each session started with a summary about what had been given through the previous session and objectives of new topics. At the end of each session, workers and biogas owner participated in a discussion to correct any misunderstanding. Also, they were informed about the time of next session. Time required for first session 90 minutes.

Second session: Covered include types of biogas units, cycle of biogas production of feed stock to anaerobic dig estate. Stages through the digestion process to biofuels production. Time required for second session 60 minutes.

Third session: Covered the compounds of biogas various within the anaerobic reactor, various uses of biogas in various field of life and Advantages and impacts of biogas technologies to community level. Time required for third session 60 minutes.

Fourth session: Covered negative effects on environmental and health from biogas production, methods of prevention from biogas risks and safety of biogas units. Time required for fourth session 90 minutes.

Fifth session: Personal Equipment PE and its importance, types of PPE and its relation with occupational health hazards at biogas sectors, perform of personal hygiene procedures in handling of biogas waste. Time required for fifth session 90 minutes.

Six session: covered hand washing, hand washing tools & timing and management of biogas wastes and substances. Time required for six session 90 minutes.

Teaching methods:-

All sample received the same intervention instructions content using the same teaching methods, which were lecture & discussion, demonstration and re-demonstration and presentation.

Teaching aids: Suitable teaching aids were specially selected for nursing intervention construction as follow: Booklets & pictures, laptop and handouts.

Program evaluation phase: After the implementation of the program immediately the post test was to workers to assess the knowledge and practices by the same format of the pre-test to evaluate the effectiveness of the implemented program. This was done immediately after the intervention of program implementation.

Statistical analysis:

Data was coded and transformed into specially designed form to be suitable for computer entry process. Data was entered and analyzed by using SPSS (Statistical Package for Social Science) statistical package version

22. Graphics were done using Excel program. Quantitative data were presented by mean (X) and standard deviation (SD). It was analyzed using student t- test for comparison between two mean, however, if the data was not normally distributed, non-parametric tests were used. Qualitative data were presented in the form of frequency distribution tables, number and percentage. It was analyzed by chi-square (χ^2) test. However, if an expected value of any cell in the table was less than 5, Fisher Exact test was used. Level of significance was set as P value <0.05 for all significant tests.

Significance level was considered as follow:

Highly statistically significant $P \leq 0.001^{**}$
Statistically significant $P < 0.05^*$
Not significant $P > 0.05$

Result:

Table (1): Shows that; less than two thirds (60.9 %) of the studied owner their age ranged from 40 to less than 50 years old with the mean age 45.72 ± 6.41 and the majority (91.3 %) of them were male. Regarding to educational level less than three quarters (73.9 %) of the studied owner were Middle- school education, most of them (87%) of them were married and less than half (47.8%) of them their family members were ranged from 3-5. The entire studied owner has enough monthly income.

Table (2): Shows that; more than half (54.7 %) of the studied workers their age ranged from 40 to less than 50 years old with the mean age 41.35 ± 7.57 , the majority (91.6 %) of them was male and almost three quarters (74.7%) of them from rural area. Regarding to educational level more than half (51.6%) of the studied workers were middle-school education, most of them (91.6%) of them were married and more than half (58.9%) of them their family members were

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ranged from 3-5. Most of the studied workers (95.8%) has enough monthly income.

Figure (1): Illustrates that, less than one quarter (21.7%) of the studied owner had good scores of total knowledge at preprogram which increased to 56.5 % post program implementation. While 52.2% of them had poor total scores of total knowledge at preprogram and then this percentage decreased to 21.7% post program implementation.

Figure (2): Illustrates that, only (8.4 %) of the studied workers had good scores of total knowledge at preprogram which increased to 57.9 % post program implementation. While 62.1% of them had poor scores of total knowledges at pre program and then this percentage decreased to 16.8 % post program implementation.

Figure (3): Illustrates that, 30.4% of the studied owner had satisfactory regarding total practices preprogram, and then this percentage increased to 73.9% post program implementation.

Figure (4): Illustrates that, 31.6 % of the studied workers had satisfactory level regarding total practices preprogram, and then this percentage increased to 66.3 % post program implementation.

Table (3): Shows that, there were a statistically significant relation between studied owner's age and level of education and their total knowledge score at preprogram implementation, $p < 0.05^*$. While, there was a

statistically significant relation between studied owner's level of education and their total knowledge score at post program implementation, $p < 0.05^*$.

Table (4): Shows that, there was a highly statistically significant relation between studied workers' level of education and their total knowledge score at preprogram implementation, $p < 0.001^{**}$. While, there was a statistically significant relation between studied workers' gender and monthly income and their total knowledge score at post program implementation, $p < 0.05^*$.

Table (1): Frequency distribution of studied owner regarding demographic characteristics (n=23).

Characteristics	No	%
Age		
18< 30 years	6	26.1
40< 50 years	14	60.9
30< 40 yeas	3	13.0
Min- Max	31-64	
Mean ±SD	45.72±6.41	
Gender		
Male	21	91.3
Female	2	8.7
Level of education		
Primary education	5	21.7
Middle- school education	17	73.9
Graduate education	1	4.3
Social status		
Married	20	87.0
Divorced	3	13.0
Number of family members		
3	5	21.7
3-5	11	47.8
6 or more	7	30.4
Monthly income		
Enough	23	100.0

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Table (2): Frequency distribution of studied workers regarding demographic characteristics (n=95).

Characteristics	no	%
Age		
18< 30 years	7	7.4
40< 50 years	52	54.7
30< 40 yeas	25	26.3
more than 50 years	11	11.6
Min- Max		25-58
Mean ±SD		41.35±7.57
Gender		
Male	87	91.6
Female	8	8.4
Housing		
Rural	71	74.7
Urban	24	25.3
Education		
Primary education	32	33.7
Middle- school education	49	51.6
graduate education	14	14.7
Social status		
Single	4	4.2
Married	87	91.6
Widower	4	4.2
Number of family members		
3	15	15.8
3:5	56	58.9
6 or more	24	25.3
Monthly income		
Enough	91	95.8
Not enough	4	4.2

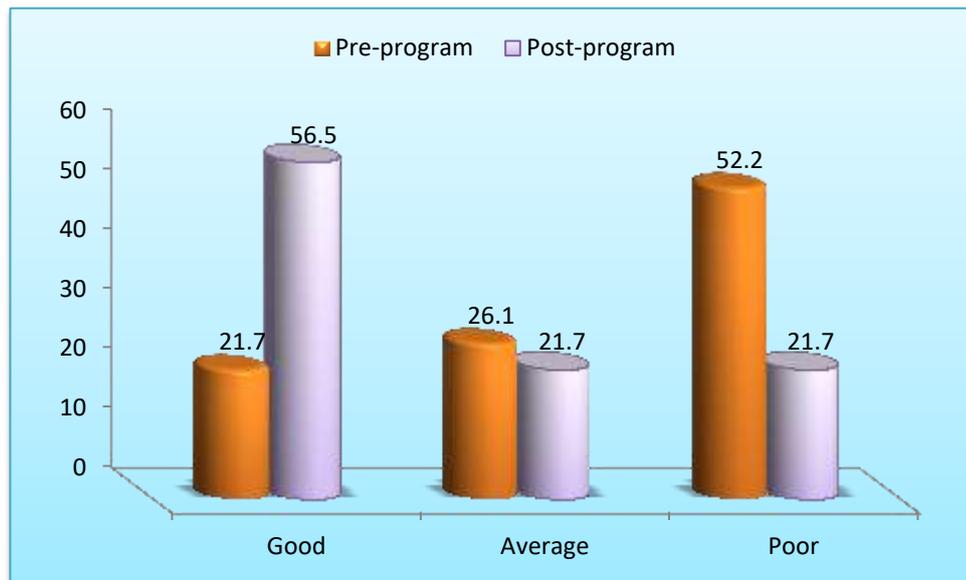


Figure (1): Percentage distribution of studied owner regarding their total knowledge level pre and post program (n=23).

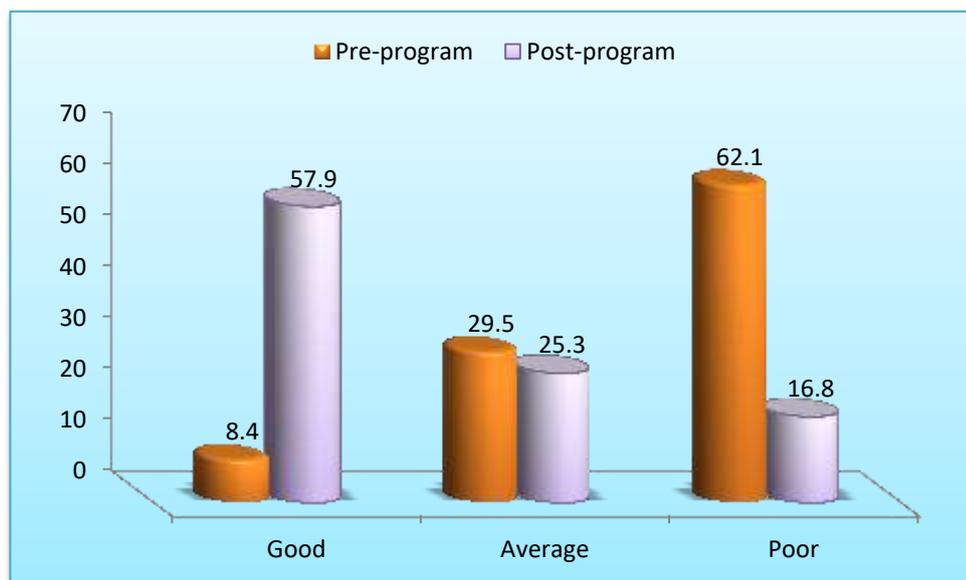


Figure (2): Percentage distribution of studied workers regarding their total knowledge level pre and post program (n=95).

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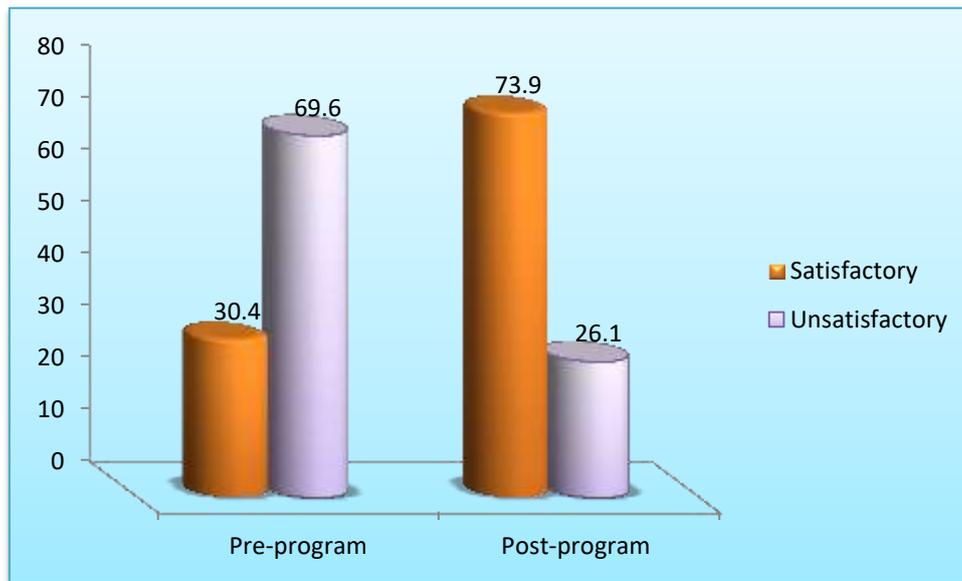


Figure (3): Percentage distribution of studied owner regarding their total practices level pre and post program (n=23).

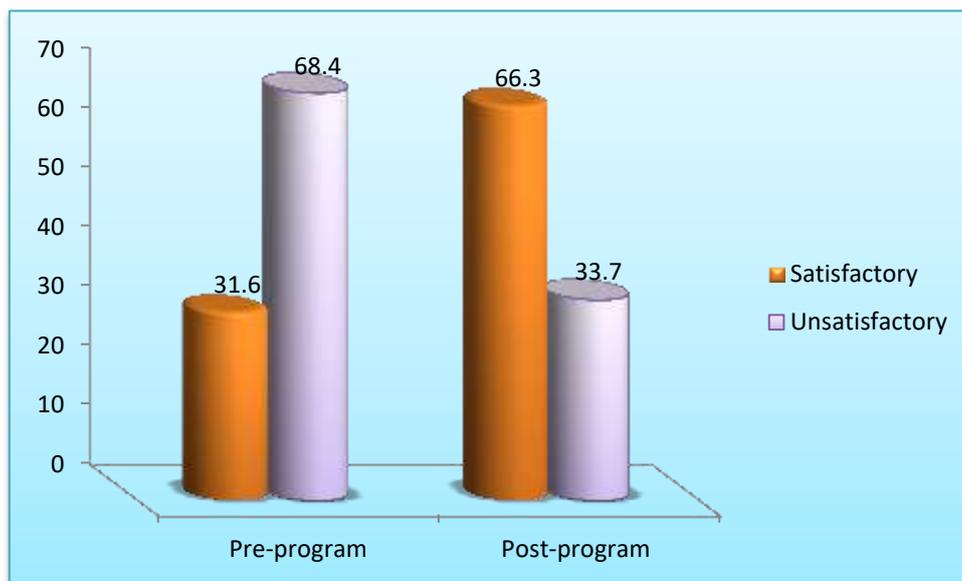


Figure (4): Percentage distribution of studied workers regarding their total practices level pre and post program (n=95).

Table (3): Statistically relation between owner total knowledge and their demographic characteristics pre and post program (n=23).

Items	Pre						X ²	p-value	Post						X ²	p-value
	Poor (n=12)		Average (n=6)		Good (n=5)				Poor (n=5)		Average (n=5)		Good (n=13)			
	n	%	n	%	n	%			n	%	n	%	n	%		
Age																
18< 30 years	6	50.0	0	0.0	0	0.0	9.71	.046*	1	20.0	1	20.0	4	30.8	1.55	0.818
40< 50 years	6	50.0	4	66.7	4	80.0			3	60.0	4	80.0	7	53.8		
30< 40 years	0	0.0	2	33.3	1	20.0			1	20.0	0	0.0	2	15.4		
Gender																
Male	12	100.0	5	83.3	4	80.0	2.428	0.297	4	80.0	4	80.0	13	100.0	2.848	0.241
Female	0	0.0	1	16.7	1	20.0			1	20.0	1	20.0	0	0.0		
Level of education																
Primary education	5	41.7	2	33.3	0	0.0	13.83	.008*	4	80.0	1	20.0	0	0.0	13.99	.007*
Middle-school education	7	58.3	4	66.7	4	80.0			1	20.0	4	80.0	12	92.3		
Graduate education	0	0.0	0	0.0	1	20.0			0	0.0	0	0.0	1	7.7		
Social status																
Married	10	83.3	5	83.3	5	100.0	0.958	0.619	5	100.0	4	80.0	11	84.6	1.026	0.599
Divorced	2	16.7	1	16.7	0	0.0			0	0.0	1	20.0	2	15.4		

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Table (4): Statistically relation between worker total knowledge and their demographic characteristics pre and post program(n=95).

Items	Pre						X ²	p-value	Post						X ²	p-value
	Poor (n=59)		Average (n=28)		Good (n=8)				Poor (n=16)		Average (n=24)		Good (n=55)			
	no	%	no	%	no	%			no	%	no	%	no	%		
Age																
18< 30 years	6	10.2	0	0.0	1	12.5	7.354	0.289	1	6.3	2	8.3	4	7.3	3.974	0.68
b- 40< 50 years	28	47.5	18	64.3	6	75.0			8	50.0	15	62.5	29	52.7		
30< 40 yeas	16	27.1	8	28.6	1	12.5			6	37.5	6	25.0	13	23.6		
more than 50 years	9	15.3	2	7.1	0	0.0			1	6.3	1	4.2	9	16.4		
Gender																
Male	55	93.2	25	89.3	7	87.5	0.57	0.752	12	75.0	20	83.3	55	100.0	12.876	.002*
Female	4	6.8	3	10.7	1	12.5			4	25.0	4	16.7	0	0.0		
Housing																
Rural	47	79.7	16	57.1	8	100.0	8.052	.018*	13	81.3	17	70.8	41	74.5	0.554	0.758
Urban	12	20.3	12	42.9	0	0.0			3	18.8	7	29.2	14	25.5		
Level of education																
Primary education	26	44.1	4	14.3	2	25.0	41.13	.000**	4	25.0	8	33.3	20	36.4	0.947	0.918
Middle-school education	33	55.9	10	35.7	6	75.0			9	56.3	12	50.0	28	50.9		
Graduate education	0	0.0	14	50.0	0	0.0			3	18.8	4	16.7	7	12.7		
Social status																
Single	4	6.8	0	0.0	0	0.0	5.33	0.255	0	0.0	1	4.2	3	5.5	1.913	0.752
Married	51	86.4	28	100.0	8	100.0			16	100.0	22	91.7	49	89.1		
Widower	4	6.8	0	0.0	0	0.0			0	0.0	1	4.2	3	5.5		
Monthly income																
Enough	57	96.6	26	92.9	8	100.0	1.047	0.592	13	81.3	23	95.8	55	100.0	10.804	0.005
Not enough	2	3.4	2	7.1	0	0.0			3	18.8	1	4.2	0	0.0		

Discussion:

Regarding the socio-demographic characteristics of the studied owner, the current study showed that slightly more than three fifths of the studied owner their age ranged from 40 to less than 50 years old with the mean age 45.72 ± 6.41 and the majority of them were male. This finding agreed with **Agarwala et al., (2017)**, who studied "Impact of biogas interventions on forest biomass and regeneration in southern, India", and found that more than three fifths (62.5 %) of the studied owner their age ranged from 40 to less than 50 years old with the mean age 44.8 ± 6.41 and the majority (98%) of them were male.

Regarding to educational level, marital status and income, the current study showed that more than half of the studied workers were middle- school education, most of them of them were married while most of the studied workers (95.8%) has enough monthly income. These finding in contrast with **Škrkal et al., (2019)**, who studied "Exposure of the biogas station operators working with contaminated biomass. Radiation protection dosimeter, Prague", and found that more than half (55.6%) of the studied workers were middle- school education, majority of them (93.6%) of them were married while most of the studied workers (95.8%) has enough monthly income. This might be due to work early and this job didn't require high level of education.

As for studied owner's total knowledge level pre and post program, the current study showed that less than one quarter (21.7%) of the studied owner had good scores of total knowledge at pre program which increased to less than three fifths (56.5 %) post program implementation. While more than half (52.2%) of them had poor total knowledge scores at pre program and then this percentage decreased to more than one fifth (21.7%)post program

implementation. These finding in contrast with **Chala et al., (2018)**, who studied "Biogas potential of coffee processing waste in Ethiopia" and found that more than two thirds (68.7%) of the studied owner had good scores of total knowledge at pre program which increased to majority (89.5 %) post program implementation. While more than one fifths (22.2%) of them had poor total knowledge scores at pre program and then this percentage decreased to less than one fifth (13.7%)post program implementation.

Concerning on studied workers' total knowledge about occupational health and safety standards pre and post program, the current study showed that few of the studied workers had good scores of total knowledge at pre program which increased to less than three fifths post program implementation. While more than three fifths of them had poor total knowledge scores at pre program and then this percentage decreased to less than one fifth post program implementation. These findings in the same line with **Ali et al., (2020)**, who studied "Mapping of biogas production potential from livestock manures and slaughterhouse waste: A case study for African countries, Mauritania", and found that few (10.4 %) of the studied workers had good scores of total knowledge at pre program which increased to less than three fifths (59%) post program implementation. While more than three fifths (62.1%)of them had poor total knowledge scores at pre program and then this percentage decreased to less than one fifth(16.8 %) post program implementation.

Regarding to studied owner's total practices level pre and post program, the current study showed that less than one third of the studied owner had satisfactory total practices preprogram, and this percentage increased to less than three quarters post

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program implementation. This finding agreed with **Pilloni et al., (2020)**, who studied "Assessing the success and failure of biogas units in Neigria", and found that less than one third (32.4%) of the studied owner had satisfactory total practices preprogram, and this percentage increased to more than three quarters (75.9%) post program implementation.

Concerning on studied workers' total practices level pre and post program, the current study illustrated that less than one third of the studied workers had satisfactory level regarding total practices preprogram, and then this percentage increased to less than two thirds post program implementation. These findings agreed with **Mohamed et al., (2020)**, who studied "Analysis of the energy balance of the local energy supply system based on the bioenergy complex, Jordan", and found that one third (33.3%) % of the studied workers had satisfactory level regarding total practices preprogram, and then this percentage increased to two thirds (66.3 %) post program implementation

According to relation between owner's total knowledge and their demographic characteristics pre and post program, the current study showed that there were a statistically significant relation between studied owner's age and level of education and their total knowledge score at preprogram implementation, $p < 0.05^*$. While, there was a statistically significant relation between studied owner's level of education and their total knowledge score at post program implementation, ($p < 0.05^*$). These findings agreed with **Alexander et al., (2019)**, who found there were a statistically significant relation between studied owner's age and level of education and their total knowledge score at preprogram implementation, $p < 0.05^*$. While,

there was a statistically significant relation between studied owner's level of education and their total knowledge score at post program implementation, ($p < 0.05^*$).

According to relation between workers' total knowledge and their demographic characteristics pre and post program, the current showed that, there was a highly statistically significant relation between studied workers' level of education and their total knowledge score at preprogram implementation, $p < 0.001^{**}$. While, there was a statistically significant relation between studied workers' gender and monthly income and their total knowledge score at post program implementation, ($p < 0.05^*$)(table 4). These findings agreed with **Saracevic et al., (2018)**, who found that there was a highly statistically significant relation between studied workers' level of education and their total knowledge score at preprogram implementation, $p < 0.001^{**}$. While, there was a statistically significant relation between studied workers' gender and monthly income and their total knowledge score at post program implementation.

Conclusion

The program succeeded to improve knowledge and practices of biogas station employees and biogas owners improved after Implementation of health educational program regarding Negative effects of Biogas Units.

Recommendations:

Educational intervention and awareness programs for workers and biogas owner regarding safety measure and negative effect of biogas should be provided in wide score.

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تأثير برنامج تثقيفي صحي لأصحاب وحدات البيوجاز والعاملين بها لتجنب الآثار السلبية الناجمة عنها

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يتم إنتاج الغاز الحيوي بواسطة بكتيريا الميثانوجين أثناء العمل على المواد القابلة للتحلل في حالة لاهوائية. يتكون الغاز الحيوي من ٣٠ إلى ٤٠٪ من ثاني أكسيد الكربون (CO₂) ، و ٥٠ إلى ٧٠٪ من الميثان (CH₄) ، وبعض الغازات النزرة مثل كبريتيد الهيدروجين والهيدروجين والنيروجين. نظرًا لأن الغاز الحيوي يحتوي على ٧٠٪ من الميثان ، يمكن استخدام الغاز الحيوي كمصدر للطاقة. يمكن أيضًا تحويل محتوى الطاقة في الغاز الحيوي إلى أشكال مختلفة مثل الطاقة الميكانيكية (لتشغيل الآلات) والطاقة الحرارية (للإضاءة والطهي) من خلال الاحتراق. لذلك هدفت هذه الدراسة الي تقييم أثر برنامج التثقيف الصحي لأصحاب وحدات الغاز الحيوي في المنازل والعاملين في محطة الغاز الحيوي ، لمعرفة وممارسات التأثير السلبي لوحدة الغاز الحيوي. وقد أجريت الدراسة بعض المساكن التي تشمل وحدات الغاز الحيوي والوحدات الخاصة للمجتمع الموجودة في مركز إعادة التدوير في قرية مشتهور بمحافظة القليوبية. حيث شملت العينة على تم استخدام عينة ملائمة في العمل الحالي. العدد الإجمالي للمالك (٢٣) ثلاثة وعشرون شخصًا ومجموع عدد الموظفين (٩٥) خمسة وتسعون عاملاً. حيث أظهرت النتائج وجود علاقة ارتباطية ذات دلالة إحصائية بين درجة المعرفة الكلية للمالك المدروس والممارسات الكلية عند تطبيق ما قبل البرنامج $P < 0.05$ * . بينما كانت هناك علاقة ذات دلالة إحصائية عالية بين مجموع درجات المعرفة للمالك المدروس والممارسات الكلية في تنفيذ البرنامج. كما اوصت الدراسة بضرورة تنفيذ برامج تدريبية مستمرة أثناء الخدمة ودورات تنشيطية للعاملين لتحديث معارفهم وممارساتهم حول الوقاية من مخاطر الصحة المهنية (التأثير السلبي لوحدة الغاز الحيوي).