

Investigation of Job Satisfaction and Occupational Safety Perceptions of Employees in Wastewater Treatment Plants: Study of Istanbul

Uçan R¹, Şanlıer H², Özay ME³

¹Assistant Professor, ²Postgraduate, ³Assistant Professor
Uskudar University, Department of Occupational Health and Safety, Istanbul, Turkey.

ABSTRACT

Introduction: There exist many fatal occupational accidents in the works carried out in wastewater treatment plants.

Objectives: This research was carried out to determine the relationship between job satisfaction levels and occupational safety perceptions of employees working in wastewater treatment plants.

Methods: In this study, a questionnaire including Minnesota Job Satisfaction Scale and Occupational Safety Scale was applied to a total of 161 people aged 16-65 years working in two different Advanced Biological Wastewater Treatment Plants in Istanbul by simple random sampling. Statistical Package for Social Science version-22 was used. Seventeen hypotheses were analyzed to show relation between the occupational safety perceptions and socio-demographic parameters of employees.

Results: The results show that there is no significant relationship between job satisfaction and occupational safety perception of the personnel working in wastewater treatment plants ($F=0.096$ and $p=0.227 >0.05$). On the other hand, it is found that there is a statistically significant difference between the level of job satisfaction perception and age of the employees ($F=2.358$ and $p=0.002 <0.05$), as well as monthly income ranges ($F=4.126$ and $p=0.008 <0.05$).

Conclusion: Consequently, the hazards associated with the work should be explained to employees of the wastewater treatment plant in detail. Furthermore, it is suggested to maintain an increase in wages to increase job satisfaction.

Key words: Job satisfaction, Occupational health and safety, Occupational safety perception, Wastewater treatment plant

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Introduction

The International Labor Organization (ILO) states that approximately 313 million occupational accidents occur annually worldwide and more than two million people die each year as a result of these accidents. According to the 2016 statistics of

occupational accidents in Turkey, in total 286 068 insured workers have had an occupational accident, 597 insured workers got occupational diseases and 1405 people lost their lives.¹ As in many sectors, there are many fatal occupational accidents in the works carried out in wastewater treatment plants.² On November 21, 2017, an employee who worked at the wastewater treatment plant in Watertown, New York, in the USA died of an unknown cause.³ On September 11, 2013, an employee who worked in the waste water treatment plant in Canastota county of New York State died as a result of the steam boiler explosion.⁴

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Corresponding Author

Dr. Müge Ensari Özay
Assistant Professor
Department of Occupational Health and Safety, Uskudar University
Mimar Sinan, Selmani Pak Cd, 34672 Uskudar/Istanbul
E-mail: muge.ensariozay@uskudar.edu.tr
ORCID ID: 0000-0002-4785-5503



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On July 2, 2016, while two workers were performing maintenance work in a wastewater treatment plant in Amarillo, USA, they were affected by hydrogen sulfide gas and they were found unconscious by other colleagues.⁵ On January 31, 2018, an employee died in a waste water treatment plant in the Lothian district of Withburn, Scotland.⁶ On December 12, 2016, an employee who fell into a 15-meter-high wastewater treatment vessel at a waste water treatment plant in Shreveport, Louisiana, USA, died.⁷ Ten workers were injured as a result of an explosion at a waste water treatment plant in Chicago, USA on August 30, 2018.⁸

The number of wastewater treatment plants (WWTP) was 145 in 2002 in Turkey, and it increased to 653 in 2015. In addition to these facilities, the Ministry planned to construct a total of 1501 water treatment plants until 2023.⁹ As the number of treatment plants increases, the number of employees increases. Thus, the number of occupational risks and injuries may increase, and more detailed research will be required on occupational safety perceptions of employees.

Operation of wastewater treatment plants is quite extensive and complex. Wastewater treatment plants include one of the physical, chemical and biological processes or combinations of these to ensure the specified discharge standards and reuse wastewater.¹⁰ Because of the operation, maintenance and human factors, there are many hazards and risks in terms of occupational health and safety. Özkars evaluated the occupational risk analyzes and accident possibilities of the Sivas Wastewater Treatment Plant and showed the importance of training of employees, routine inspections and occupational safety perceptions of employees in terms of occupational safety.¹¹ Although there exist several studies about job satisfaction and occupational awareness on different sectors, there are lack of studies about job satisfaction of waste water treatment plant employees. Rafique and Mahmood stated that more than 5,000 studies had been published on this topic.¹² Lu has a review study about job satisfaction among hospital nurses.¹³ Ewen and coworkers have a review study about well-being and job satisfaction of pathologists.¹⁴

In this study, it is aimed to measure the job satisfaction levels of employees working in the wastewater treatment plant and to examine their occupational safety perceptions. In addition, the relationships between the demographic characteristics of the plant employees and their job satisfaction, occupational

safety perception and awareness of operational hazards were also investigated.

Methods

This study was aimed to investigate the relationship between job satisfaction and occupational safety perception of the personnel working in wastewater treatment plants. The research was carried out in cross-sectional type between November 17, 2018 and December 7, 2018 in two different Advanced Biological Waste Water Treatment Plants in Istanbul. A total of 250 employee are working in both treatment plants. The position of employees in the facilities are system operators, electrical engineers, electric technician, chemist, chemical engineer, chemistry technician, environmental engineer, laboratory manager, laboratory analysis supervisor, site supervisors and office workers (accounting, human resources and administrative affairs). The sample of the research consisted of a total of 163 personnel, 105 employees in one of the Advanced Biological Waste Water Treatment Plant and 58 employees in the other. The survey of 2 people was considered invalid because they could not fill the questionnaires completely. Simple random sampling method was used. The necessary permission was obtained from the Istanbul Metropolitan Municipality of İSKİ General Directorate Department of Wastewater Treatment on 09/10/2018. The purpose and content of the research was explained to the employees working in the plant and the application was carried out with the workers who wanted to participate in the research. The inclusion criteria were working full time in wastewater treatment plant, and volunteering to participate in the survey. The exclusion criterion was incomplete questionnaire.

Data Collection

In this research, data was collected using a questionnaire consisting of four parts. The first part of the questionnaire consisting of six questions was aimed to measure the demographic characteristics of the employees (gender, age, education level, marital status, monthly income, professional experience). In the second part, the Minnesota job satisfaction questionnaire (20 questions) was used to measure the job satisfaction levels of the workers. In the third part of the questionnaire, an occupational safety awareness questionnaire (8 questions) prepared by authors was used to measure employees' awareness of operational hazards in the workplace environment. In the last

section, the occupational safety scale (32 questions) was used to measure the employees' occupational safety perceptions. All of the questions except demographic features were followed by 5-point Likert scale. The analysis of the data was carried out with the Statistical Package of Social Science 25 (SPSS) version 22.

One Sample Kolmogorov-Smirnov test was used to analyze the normality of the marital status, age, education, monthly income level and professional experience of employees working in the wastewater treatment plant with the perception of occupational safety, the level of job satisfaction and operational hazards. It was seen that the distributions are normal. Thus, independent sample t-test was used to compare quantitative continuous data between two independent groups, and One-Way Analysis of Variance was used to compare quantitative continuous data between more than two independent groups. Correlation analysis was also conducted to determine the relationships between the quantitative variables of the research.

Minnesota job satisfaction questionnaire was developed to measure the levels of job satisfaction of employees by Weiss et al. and translated into Turkish by Baycan.^{15,16} It is a 5-point Likert type scale with 20 questions to identify the internal and external job satisfaction factors. The scale consists of the points of internal satisfaction, external satisfaction and general satisfaction. In the research, general satisfaction point will be evaluated. The overall satisfaction score is obtained by dividing the total score of the all items by 20. The neutral satisfaction score for the scale is 3. If the score obtained from the scale is greater than 3, job satisfaction is considered high. If the score obtained is less than 3, job satisfaction is considered low.

The occupational safety awareness questionnaire¹⁷ was used to measure employees' awareness of operational hazards in the workplace environment. The questionnaire has 8 questions and has five Likert type, strongly disagree (1), disagree (2), Neutral (3), agree (4) and strongly agree (5) and evaluates employees' awareness of operational hazards in a single factor.

The occupational safety scale, which was developed by Williamson et al.¹⁸ and which was tested for validity and reliability by adapting into Turkish by Atay²⁸ was used in order to measure the occupational safety perceptions

of the wastewater plant employees participating in the research. There were 32 questions in total on the scale that has five Likert type, strongly disagree (1), disagree (2), Neutral (3), agree (4) and strongly agree (5) and evaluates employees' perceptions of occupational safety in a single factor.

Results

The data regarding the demographic characteristics of the employees participating in the research at the wastewater treatment plant is given in Table 1. The results show that 95% (n=153) of the participants are men, the age range of 36-50 years is 47.2% (n=76), 64.6% (n=104) of employees have education level as high school, 79.5% (n=128) are married and 78.9% (n=127) have monthly income between 3000-4000 TL.

Distribution of the participants according to their working experience is shown in Figure 1. The majority of the participants, 46.0% (n=74) have working experience between 5-10 years and 23.6% of them are working more than 11 years in the wastewater treatment plant.

The results of the analysis of the hypotheses are given in Table 2. In the research, 17 hypotheses were analyzed according to SPSS results and 5 hypotheses were accepted. Since the distributions are normal, independent sample t tests and One-Way Analysis of Variance were applied to the hypothesis. Hypotheses were accepted or rejected as shown in Table 2 according to their statistical significance in order to determine the job satisfaction levels and occupational safety perceptions of employees differ according to the parameters.

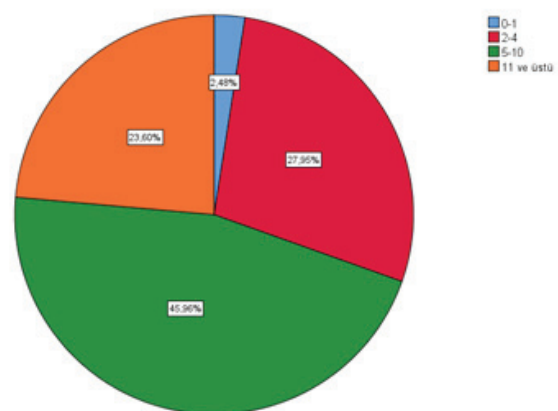


Figure 1: Distribution of the participants according to their working experience in the sector

Table 1: Data on demographic characteristics

Age Range	N	Percentage (%)
16-25	7	4.3
26-35	75	46.6
36-50	76	47.2
51-65	3	1.9
Educational Status	N	Percentage (%)
Primary School	4	2.5
Secondary School	20	12.4
High School	104	64.6
University	29	18.0
Post Graduate	4	2.5
Marital Status	N	Percentage (%)
Married	128	79.5
Single	33	20.5
Monthly Income	N	Percentage (%)
2000-3000 ₺	17	10.6
3000-4000 ₺	127	78.9
4000 ₺ and above	17	10.6
Work Experience	N	Percentage (%)
0-1	4	2.5
2-4	45	28.0
5-10	74	46.0
11 and above	38	23.6

Table 2: Hypothesis analysis table

Hypotheses	Variables	Results of statistics	Acceptance (A) / Rejection (R)
Hypothesis 1	Occupational safety perception vs. marital status	F= 0.837 and p=0.404 >0.05	R
Hypothesis 2	Occupational safety perception vs. age	F=1.142 and p=0.334 >0.05	R
Hypothesis 3	Occupational safety perception vs. educational status	F= 0.551 and p=0.698 >0.05	R
Hypothesis 4	Occupational safety perception vs. monthly income	F=0.550 and p=0.578, >0.05	R
Hypothesis 5	Occupational safety perception vs. professional experience	F=0.778, and p=0.508, >0.05	R
Hypothesis 6	Occupational safety perception vs. job satisfaction level	F=0.096 and p=0.227 >0.05	R
Hypothesis 7	Job satisfaction level vs. marital status	F=1.517 and p=0.131 >0.05	R
Hypothesis 8	Job satisfaction level vs. age	F=2.358 and p=0.002 <0.05	A
Hypothesis 9	Job satisfaction level vs. educational status	F=1.354 and p=0.253 >0.05	R
Hypothesis 10	Job satisfaction level vs. monthly income	F=4.126 and p=0.008 <0.05	A
Hypothesis 11	Job satisfaction level vs. work experience	F=2.164 and p=0.004 <0.05	A
Hypothesis 12	Awareness of operational hazards vs. marital status	F=0.528 and p=0.598 >0.05	R
Hypothesis 13	Awareness of operational hazards vs. age	F=2.037 and p=0.111, >0.05)	R
Hypothesis 14	Awareness of operational hazards vs. educational status	F=1.943 and p=0.106 >0.05	R

Hypothesis 15	Awareness of operational hazards vs. monthly income	F=2.669 and p=0.050 <0.05	A
Hypothesis 16	Awareness of operational hazards vs. work experience	F=0.105 and p=0.957 >0.05	R
Hypothesis 17	Awareness of operational hazards vs. operational risk	F=0.260 and p=0.001 <0.05	A

Discussion

Hypothesis (H1). Is there a significant difference between occupational safety perception and marital status?

It is found that there is no significant difference between occupational safety perception and marital status of employees. These results show similarities with the research conducted in different enterprises in Turkey.^{19, 20-24} Contrary to the findings of this research, another study among healthcare workers in a public hospital in Burdur, showed that the perception of security climate varies significantly according to the marital status.²⁵

H2. Is there a significant difference between occupational safety perception and age?

There is no significant relationship between occupational safety perception and age. In line with our research findings, no significant difference was found between the age groups and the occupational safety perception as Uslu²⁰ among the employees working in the metal industry in Eskişehir, by Kılıç¹⁹ among healthcare workers, by Çalışır²⁶ among the employees working in the shipyard, and by Gündüz²² among the employees of Gebze Organized Industrial Zone. Furthermore, another study conducted by Bergheim et al²⁷ on workers working in a maritime company in Norway, showed that there is no significant relationship between occupational safety perception and age. However, in some scientific studies, it was found that the occupational safety perception varies significantly by age groups.^{24,25,28-30} There is an increase in the ability to predict the outcome of the work in direct proportion with the increase in the experience as well age of employee to see or feel the dangers beforehand and to see or feel the dangers beforehand. With this situation, it is expected that older employees will increase their probability of displaying a more confident and safer attitude.³¹

H3. Is there a significant difference between occupational safety perception and educational level?

In this study, no significant difference is found between occupational safety perception and education level, similar results are seen in the literature.^{22,32} However, contrary to our findings in the literature, it has been found that the perception of occupational safety culture differs according to the educational status and the perception of occupational safety culture increased with the level of education.^{19,20,21} As the education level and the attitude of skilled workers increase, their occupational safety perception levels are expected to be higher than the other employees.

H4. Is there a significant difference between occupational safety perception and monthly income?

No significant relationship is found between the occupational safety perception and monthly income of the plant employees. Similar to our research findings, no significant difference was found in the studies conducted by Özkurt and Üzümlü as well as Saraç.^{33,23} Contrary to our research findings, in the research conducted on employees working in the forest industry, a significant difference was found between work security perception and monthly income. It was concluded that the occupational security perception decreased with the decline in monthly income.²¹

H5. Is there a significant difference between occupational safety perception and professional experience?

According to the results of the study, there is no significant difference between the occupational safety perceptions and professional experience of the plant employees. Similar to the research findings, there was no significant difference between experience and occupational security perception in the literature studies.^{20,22,23} Contrary to our findings, in a study conducted among healthcare workers, a negative, weak and significant relationship was found between the occupational safety perception and work experience.¹⁹ In another study, it has been shown that as the experience of the workers increases, their occupational safety perceptions increase.³⁴ Another

study on the forest industry showed that there is a significant relationship between the occupational safety perception and professional experience, and that the employees who is working between 1-5 years have higher occupational safety perception.²¹ Similarly, Johnson³⁵, Gürbüz and İbrakovic³² found that there is a significant difference between the occupational safety perceptions and the professional experience in their research.

H6. Is there a significant difference between job satisfaction level and occupational safety perception?

In this study, no significant relationship is found between job satisfaction and occupational safety perceptions of plant employees. In other words, a linear relationship cannot be mentioned between the job satisfaction and the occupational safety perceptions of the employees working in the wastewater treatment plant. In the literature, contrary our findings, a positive and strong relationship between job satisfaction and occupational security perception is found.^{36,37,38,39,40,41,42}

H7. Is there a significant difference between job satisfaction level and marital status?

It is found that there is no significant difference between the job satisfaction level and marital status of the plant employees. Similar to our findings, Ergin⁴³ and Kılıç⁴⁴ did not find any significant results in the marital status that affects job satisfaction. Unlike the results found in our research, a study conducted by Yeter and Demirli⁴⁵ on the job satisfaction of women workers, showed that the job satisfaction of female employee is high.

H8. Is there a significant difference between job satisfaction level and age?

It is found that there is a significant difference between the job satisfaction level and ages of the plant employees. Similar to our research findings; a study of Tekir et al. among health workers, showed that job satisfaction is higher at older ages and stated that similar situation is also observed in studies conducted in Pakistan and Japan.⁴⁶ As a result, it is seen that the increase in experience and job satisfaction is directly proportional.

H9. Is there a significant difference between job satisfaction level and educational level?

According to the results, there is no significant difference between the job satisfaction level and educational level of the plant employees. Contrary to our research

findings; in some studies, it was found that higher educated people had higher job satisfaction.^{45,47,48,49}

H10. Is there a significant difference between job satisfaction level and monthly income?

An important result of the study is that there is a significant difference between job satisfaction level and monthly income of the plant employees. Similar to our research findings, Ünal found that there is a positive relationship between income level and job satisfaction.⁵⁰ As another similar research result, Kılıç stated that wage is one of the important factors affecting job satisfaction of teachers.⁴⁴

H11. Is there a significant difference between job satisfaction level and work experience?

There is a significant difference between the job satisfaction level and work experience of the employees. Similar to our research results, Kılıç stated that professional experience is among the factors that affect job satisfaction in his study on teachers.⁴⁴ As the seniority of the teachers increases, they do not see the current problems and negativities as problems, and their job satisfaction increases as they progress in the profession.⁴⁴

H15. Is there a significant difference between employees' awareness of operational hazards and monthly income?

Another important result is that there is a significant difference between plant employees' awareness of operational hazards and monthly income. There is a strong positive relationship between the employees' awareness of operational hazards and their occupational safety perceptions. In other words, as the awareness of the operational hazards of the plant employees increases, their occupational safety perception becomes stronger.

Conclusion

Consequently, there is a positive relationship between age and job satisfaction; job satisfaction and monthly income, job satisfaction and professional experience; awareness of operational hazards and income level, awareness of operational hazards and occupational safety perception. In addition, it is found that there was no significant relationship between job satisfaction and occupational security perception. In other words, a linear relationship cannot be mentioned between the job satisfaction and the occupational safety perception

of the employees in the wastewater treatment plant.

Two important conclusions are proposed to this research. Firstly, the occupational safety perception increases with the knowledge of the hazards existing in the treatment plant. It is suggested to explain the hazards about ongoing work in maximum detail to the employees in order to increase the awareness of the workers. Periodic occupational health and safety educations are recommended from the beginning of the job. Workers should be made aware and educated

regarding the hazards and the safety measures so that many accidents may be prevented. Secondly, the increase in the income level causes increase in job satisfaction positively. It is suggested to maintain an increase in wages to increase job satisfaction.

Conflict of Interest

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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