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INCIDENCE OF WORK NOISE AND LIGHTING ON INDUSTRIAL SAFETY AND OCCUPATIONAL HEALTH IN A PORT OPERATOR

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Abstract: This research work was carried out at the Operadora Portuaria SERPEPACIFIC S.A located in Manta, in order to propose a prevention plan against physical risks, noise and lighting, analyzing the working conditions of the operational areas. A population of 179 workers was considered, and the critical points by area. Analyzed the results in the discharge area, the noise has an average of 82.13 dB, an acceptable level according to Executive Decree 2393, in the classification area it has an average of 88.31 dB, determining that it is an unacceptable level. The lighting in the unloading area was identified with an average of 86.95 lux, concluding that it is acceptable in accordance with Executive Decree 2393, in the classification area it is 362.87 lux, which is acceptable. Regarding the current situation of work accidents and occupational diseases of the personnel, it was identified that 15 occupational accidents have occurred in the period studied and within the occupational diseases the following were identified: hearing loss, low back pain, asthenopia, scoliosis and sponlondiarthrosis; Applying the t-Student calculation and the Pareto Principle, it was obtained that the noise and lighting risk factors do affect industrial safety and occupational health of workers, requiring a respective management.
Keywords: Work accident, occupational disease, environmental measurements, prevention.

INTRODUCTION

In terms of safety and health at work, the working conditions of the personnel working in the fishing industries are the most deplorable, the fishing activity involves a high risk, both on board the vessels and in the activities carried out in land. The management of industrial safety and occupational health guarantees the reduction of work risks and the prevention of the occurrence of occupational accidents and occupational diseases, in order to provide optimal working conditions in the company and thereby achieve greater productivity.

In Ecuador, the fishing industry is a fundamental source of economic income for the society belonging to the coastal region. In the province of Manabí, artisanal and industrial fishing activities stand out, deriving activities such as loading, unloading, classification and processing of the different sea products, associating import and export processes, having a great opening in both the national and international markets.

This research work is focused on workers exposed to different risk factors such as noise and lighting that cause possible accidents at work or the development of occupational diseases in the future.

GOAL

Evaluate the incidence of noise and lighting occupational risk factors on the industrial safety and occupational health of the unloading and classification personnel of the port operator SERPEPACIFIC S.A.

MATERIALS AND METHODS

Descriptive research was used with the objective of verifying the health status of the personnel involved, quantitative research was used to obtain risk levels, the application of the deductive method was used to understand the formulation of the problem and the direct relationship with the variables. involved, the interpretation was made according to the results obtained, tabulations and the corresponding technical analysis, which allowed obtaining the conclusions of the investigation.

To find the relationship between the occupational risk factors noise and lighting and the industrial safety of the unloading and classification personnel of the port operator

SERPEPACIFIC S.A, the development was carried out using the t-Student hypothesis statistical method, proposing the following hypotheses.

NOISE

- **Null Hypothesis: H_0=** Noise levels affect the industrial safety of unloading and classification personnel at the port operator SERPEPACIFIC S.A.
- **Alternative hypothesis: H_a=** Noise levels do NOT affect the industrial safety of unloading and classification personnel at the port operator SERPEPACIFIC S.A.

LIGHTNING

- **Null Hypothesis: H_0=** Lighting levels affect the industrial safety of unloading and classification personnel at the port operator SERPEPACIFIC S.A.
- **Alternative hypothesis**: **H_a=** Lighting levels DO NOT affect the industrial safety of unloading and classification personnel at the port operator SERPEPACIFIC S.A.

The t-Student calculation was made to compare the result obtained with the t-Student of tables, which will allow accepting or rejecting the hypotheses raised in the investigation focused on the industrial safety part.

$$t = \frac{r\sqrt{n-2}}{\sqrt{1-r^2}}$$

Equation 1 statistical calculation t-Student

$$gl = (n-1)$$

Equation 2 calculation of degrees of freedom

The decisions of the respective hypotheses will be made under the following criteria:

- t-Student (tables) ≤ t-Student (calculated) = H_0 is accepted and H_a is rejected.
- t-Student (tables) ≥ t-Student (calculated) = H_a is accepted and H_0 is rejected.

To determine if there is an incidence between the occupational risk factors noise and lighting and the occupational health of the unloading and classification personnel of the port operator SERPEPACIFIC S.A, it was carried out using the Pareto principle, to establish if 20% of medical diagnoses 80 % correspond to the risks present in this study.

RESULTS

The noise levels corresponding to the environmental measurements of the discharge area were identified, the noise levels would have an average of 82.13 dB, identifying that this level IS ACCEPTABLE under the current legal regulations Executive Decree 2393 Article 55. (Ecuadorian Institute of Social Security, 2003).

Table 1

The noise levels corresponding to the environmental measurements of the classification area were identified, the noise levels had an average of 88.31 dB, it was identified that this level IS NOT ACCEPTABLE under the current legal regulations Executive Decree 2393 Article 55. (Institute Ecuadorian Social Security, 2003). It is important to establish technical management, to reduce exposure levels, and as such the possible effects on personnel.

Table 2

The lighting levels in the unloading area had an average of 86.95 lux, it was identified that this level IS ACCEPTABLE under the current legal regulations Executive Decree 2393 Article 56. (Ecuadorian Social Security Institute, 2003).

Table 3

The lighting levels in the classification area

PEARSON CORRELATION INDEX (NOISE-ACCIDENTS)														
MONTH	dB	N°	dB Prom (Xi)	Accidents (Yi)	(Xi-X̄)	(Yi-Ȳ)	(Xi-X̄)^2	(Yi-Ȳ)^2	(Xi-X̄)*(Yi-Ȳ)	Sxy	Sx	Sy	r	r²
	82,4													
	81,6													
JANUARY 2022	80,4	1	81,54	1	-0,59	0,00	0,34	0,00	0,000					
	81,3													
	82,0													
	83,1													
	81,7													
FEBRUARY 2022	80,3	2	81,80	0	-0,33	-1,00	0,11	1,00	0,327					
	81,4													
	82,5													
	80,7												0,717	0,51
	83,1													
MARCH 2022	81,2	3	81,84	1	-0,29	0,00	0,08	0,00	0,000					
	82,7													
	81,5													
	81,5									0,194	0,470	0,577		
	82,0													
APRIL 2022	82,5	4	82,40	1	0,27	0,00	0,07	0,00	0,000					
	82,7													
	83,2													
	83,7													
	84,0													
MAY 2022	81,6	5	82,97	2	0,84	1,00	0,70	1,00	0,839					
	82,3													
	83,2													
	82,7												Considerable positive correlation	51%
	80,6													
JUNIO 2022	82,1	6	82,22	1	0,10	0,00	0,01	0,00	0,000					
	83,3													
	82,3													
		Σ=	492,76	6,00	0,00	0,00	1,32	2,00	1,17					
		x̄ =	82,13	1,00										

Table 1 Pearson Correlation Index of Noise in the discharge area

PEARSON CORRELATION INDEX (NOISE-ACCIDENTS)														
MONTH	dB	N°	dB (Xi)	Accidents (Yi)	(Xi-X̄)	(Yi-Ȳ)	(Xi-X̄)^2	(Yi-Ȳ)^2	(Xi-X̄)*(Yi-Ȳ)	Sxy	Sx	Sy	r	r²
	85,8													
	87,3													
JANUARY 2022	89,2	1	87,34	1	-0,97	-0,67	0,95	0,44	0,649					
	86,2													
	88,2													
	89,8													
	87,8													
FEBRUARY 2022	87,5	2	88,62	2	0,31	0,33	0,09	0,11	0,102					
	88,4													
	89,6													
	87,6												0,8408	0,71
	88,1													
MARCH 2022	88,9	3	88,24	2	-0,07	0,33	0,01	0,11	-0,025					
	88,5													
	88,1													
	89,4									0,208	0,524	0,471		
	86,4													
APRIL 2022	87,5	4	88,04	1	-0,27	-0,67	0,07	0,44	0,182					
	88,6													
	88,3													
	89,1													
	89,7													
MAY 2022	88,6	5	88,90	2	0,59	0,33	0,34	0,11	0,196					
	88,5													
	88,6													
	87,8												Considerable positive correlation	71%
	90,0													
JUNE 2022	89,5	6	88,74	2	0,43	0,33	0,18	0,11	0,142					
	88,3													
	88,1													
		Σ=	529,88	10,00	0,00	0,00	1,65	1,33	1,25					
		x̄ =	88,31	1,67										

Table 2 Pearson Noise Correlation Index in the classification area

				PEARSON CORRELATION INDEX (LIGHTING-ACCIDENTS)										
MONTH	LUX	N°	LUX Prom (Xi)	Accidents (Yi)	(Xi-X̄)	(Yi-Ȳ)	(Xi-X̄)^2	(Yi-Ȳ)^2	(Xi-X̄)*(Yi-Ȳ)	Sxy	Sx	Sy	r	r²
	77,0													
	84,6													
JANUARY 2022	74,2	1	83,24	1	-3,71	0,00	13,77	0,00	0,000					
	91,1													
	89,3													
	87,5													
	102,1													
FEBRUARY 2022	83,7	2	83,1	0	-3,81	-1,00	14,53	1,00	3,811					
	68,5													
	73,9													
	69,4												0,7811	0,61
	94,7													
MARCH 2022	101,8	3	86,2	1	-0,80	0,00	0,64	0,00	0,000					
	75,3													
	89,6													
	74,3									1,627	3,607	0,577		
	115,6													
APRIL 2022	78,8	4	90,47	1	3,52	0,00	12,41	0,00	0,000					
	94,2													
	89,5													
	96,2													
	103,7													
MAY 2022	77,9	5	92,90	2	5,95	1,00	35,39	1,00	5,949					
	89,3													
	97,4													
	76,2												Considerable positive correlation	61%
	79,6													
JUNE 2022	83,4	6	85,8	1	-1,15	0,00	1,33	0,00	0,000					
	87,5													
	102,3													
		Σ=	521,71	6,00	0,00	0,00	78,06	2,00	9,76					
		x̄=	86,95	1,00										

Table 3 Pearson's Correlation Index of Illumination in the unloading area

				PEARSON CORRELATION INDEX (LIGHTING-ACCIDENTS)										
MONTH	LUX	N°	Lux (Xi)	Accidents (Yi)	(Xi-X̄)	(Yi-Ȳ)	(Xi-X̄)^2	(Yi-Ȳ)^2	(Xi-X̄)*(Yi-Ȳ)	Sxy	Sx	Sy	r	r²
	364,4													
	364,0													
JANUARY 2022	359,6	1	362,82	1	-0,05	-0,67	0,00	0,44	0,036					
	362,8													
	363,3													
	363,8													
	364,4													
FEBRUARY 2022	362,9	2	363,92	2	1,05	0,33	1,09	0,11	0,349					
	363,8													
	364,7													
	365,2												0,7472	0,56
	361,7													
MARCH 2022	362,4	3	363,56	2	0,69	0,33	0,47	0,11	0,229					
	364,3													
	364,2													
	360,4									0,337	0,957	0,471		
	361,7													
APRIL 2022	361,3	4	360,91	1	-1,97	-0,67	3,88	0,44	1,313					
	359,7													
	361,4													
	361,8													
	362,3													
MAY 2022	364,7	5	362,94	2	0,07	0,33	0,00	0,11	0,022					
	363,5													
	362,4												Considerable positive correlation	56%
	361,2													
	363,2													
JUNE 2022	364,8	6	363,10	2	0,23	0,33	0,05	0,11	0,075					
	362,4													
	363,9													
		Σ=	2177,25	10,00	0,00	0,00	5,50	1,33	2,02					
		x̄=	362,87	1,67										

Table 4 Pearson's Correlation Index of Illumination in the classification area

had an average of 362.87 lux, it was identified that this level IS ACCEPTABLE under the current legal regulations Executive Decree 2393 Article 56. (Ecuadorian Social Security Institute, 2003). However, its management is considerable to avoid future health conditions for employees.

Once the Pearson Correlation coefficient of noise and lighting in the unloading and classification area was concluded, the t-Student statistical calculation was carried out where the following results were obtained to determine if the hypotheses proposed are accepted or rejected.

Table 4

$$gl = (6 - 1) \quad gl = 5$$

Noise:

Download area

$$t = \frac{0.717\sqrt{6-2}}{\sqrt{1-0.717^2}} = 2.057$$

$$t - Student\ (tables) = 2.015\ \leq\ t - Student\ (calculated) = 2.057$$

Equation 3 Calculation t-Student noise p. download

Classification area

$$t = \frac{0.841\sqrt{6-2}}{\sqrt{1-0.841^2}} = 3.106$$

$$t - Student\ (tables) = 2.015 \leq t - Student\ (calculated) = 3.106$$

Equation 5 Calculation t-Student noise p. classification

Illumination:

Download area

$$t = \frac{0.781\sqrt{6-2}}{\sqrt{1-0.781^2}} = 2.502$$

$$t - Student\ (tables) = 2.015 \leq t - Student\ (calculated) = 2.502$$

Equation 4 calculation t-Student illumination p. download

Classification area

$$t = \frac{0.747\sqrt{6-2}}{\sqrt{1-0.747^2}} = 2.249$$

$$t - Student\ (tables) = 2.015 \leq t - Student\ (calculated) = 2.249$$

Equation 6 calculation t-Student lighting p. classification

Regarding occupational health, it was determined that in the unloading area there are 45% and in the classification area, 52% of the personnel have a diagnosis of occupational disease. Which corresponds to 53 stevedores and 32 classifiers.

Table 4

Through the Pareto principle, the diagnoses of occupational diseases of the unloading area personnel were verified, which include low back pain (43%), hearing loss (43%), sponlondiarthrosis (1%), scoliosis (4%) and asthenopia (9 %).

Graph 1

In the Pareto diagram it was observed that two medical diagnoses are the ones that occurred most frequently, it was established that low back pain and hearing loss are the occupational diseases that cause discomfort in the unloading personnel of the port operator, it was determined that there is a higher incidence of low back pain due to the characteristics of the tasks performed by the unloading staff; however, it was not established that the other diagnoses are of minor importance, but priority was given to those two that represented a higher level of risk.

In the classification area, the diagnoses of the personnel were verified using the Pareto principle, which includes occupational diseases such as low back pain (54%), hearing loss (26%) and asthenopia (20%).

Graph 2

In the Pareto diagram it was observed that the medical diagnosis of hearing loss is the one that represented 80%, therefore, it was determined that hearing loss is the occupational disease that causes discomfort in the port operator's classification personnel, reiterating that the Other diagnoses have their level of attention due to the type of activity carried out by the company, but priority was given to the one that represented a higher level of risk.

DISCUSSION

Using statistical tools, t-Student (tables) and t-Student (calculated) were determined in order to determine the incidences of the variables involved in this investigation, the following results were obtained, noise issue, the null hypothesis is accepted and rejected the alternative hypothesis, obtaining that the noise levels DO affect industrial safety in the unloading and classification personnel, for the lighting aspect the null hypothesis is accepted and the alternative hypothesis is rejected, reaching the conclusion that the lighting levels They do affect the industrial safety of unloading and classification personnel at the port operator.

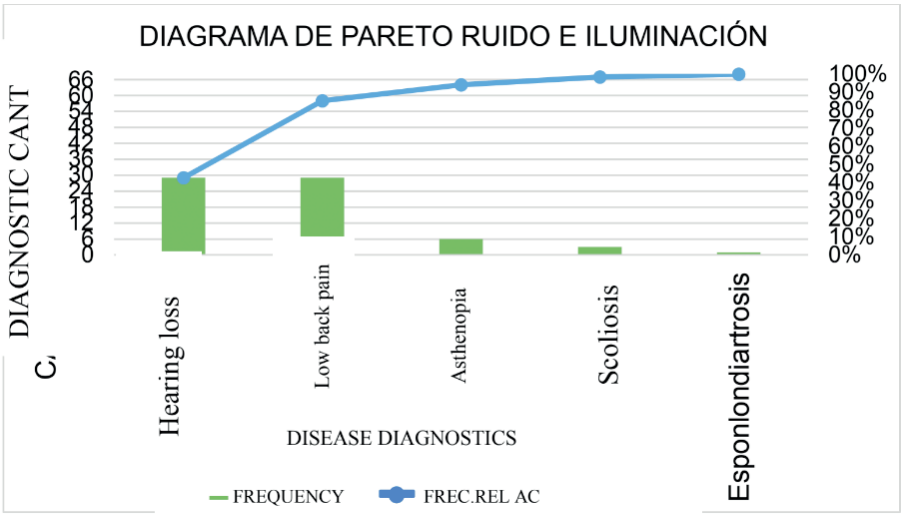
To determine the incidence of noise and lighting risk factors on the occupational health of the personnel, the Pareto principle was applied, in the unloading personnel it was determined that there is NO incidence of noise and lighting and in the classification personnel that, IF there is incidence of noise, but not lighting, on occupational health in the classification personnel at the port operator.

CONCLUSIONS

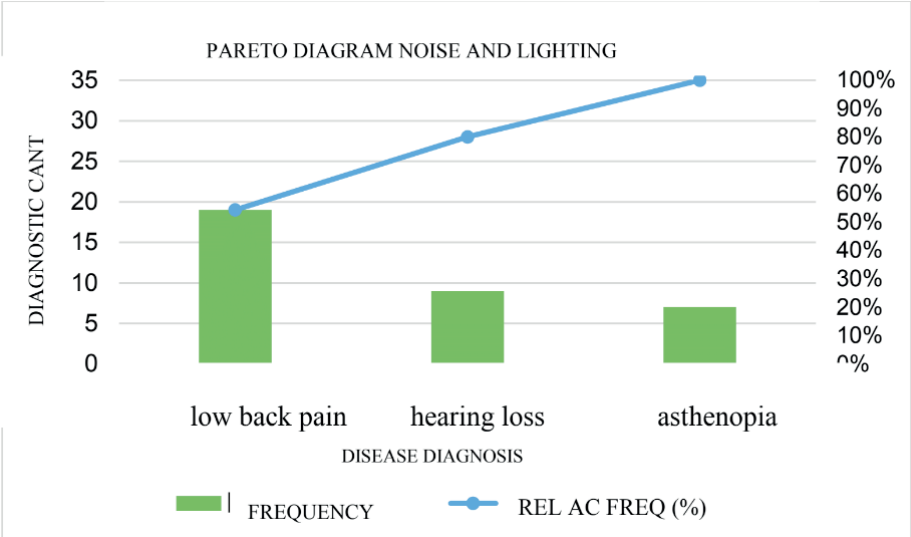
- In the unloading and classification area it was shown that the risk factors noise and lighting do affect the industrial safety of the personnel, in the unloading area it was observed that the relevant occupational diseases are low back pain and hearing loss, in the classification area it was that the relevant occupational disease is hearing loss, concluding that noise does affect occupational health, but lighting does not;
- Based on noise and lighting levels and their impact on industrial safety and occupational health of unloading

Options	Unloading personnel	%	Sorting staff	%
YES	53	45%	32	52%
NO	64	55%	30	48%
TOTAL	117	100%	62	100%

Table 4 Selection of population diagnosed with occupational disease



Graph 1 Pareto diagram noise and lighting with occupational diseases- discharge area



Graph 2 Pareto diagram noise and lighting with occupational diseases- classification area

and classification personnel, a noise and lighting physical risk prevention plan was prepared as a management proposal for the port operator, which involves responsibilities, procedures, recommendations and management alternatives.

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