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Air Quality Environment and Health

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Introduction

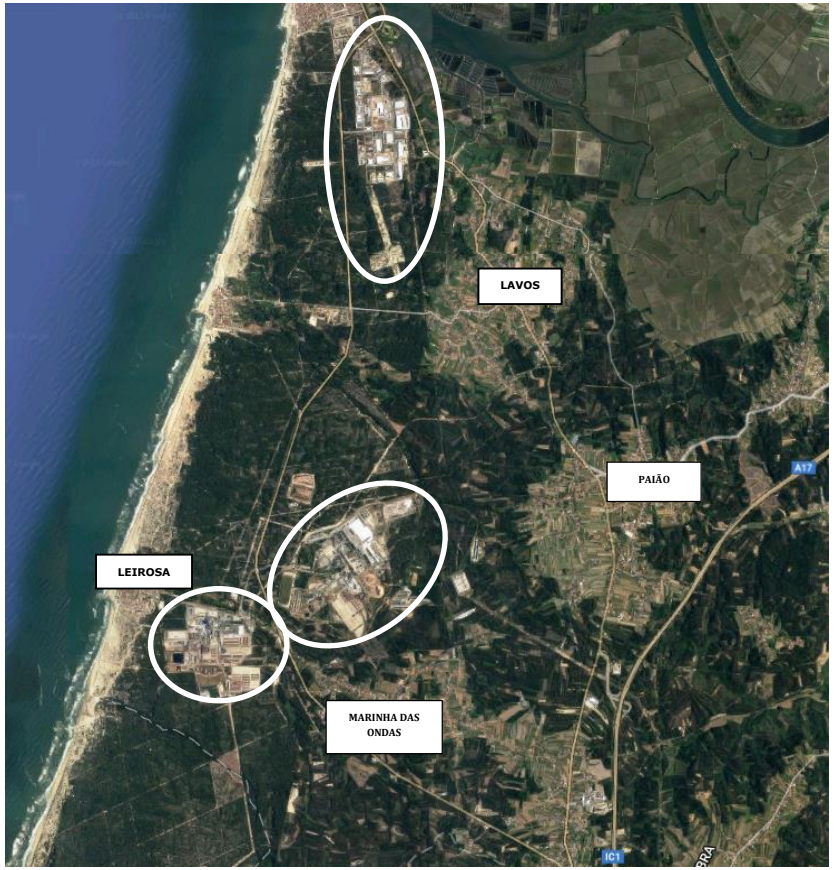
- Air pollution is currently one of the greatest public health problems since it affects a large part of the population and has several health effects.
- Studies have shown evidence of association between concentrations of air pollutants and adverse health outcomes.

- The objective of this study was to evaluate the quality of outdoor air in the southern area of Figueira da Foz County. A questionnaire was applied to residents in order to understand if there are signs, symptoms and pathologies that may be related to air quality and to perceive to what extent proximity to polluting sources influences health.

Material and methods

- Level II study (descriptive-correlational), of the observational and transverse cohort type.
- The type of sampling is probabilistic and the sampling technique is stratified.
- Environmental Parameters Evaluated: CO_2, CO, $PM_{2.5}$, PM_{10}, VOC's, CH_2O, T°, RH, W.
- Equipment: Q-Trak, Particles Couters, Photovac 2020, PPM Formaldemeter
- Software: IBM SPSS Statistic version 24.0
- A questionnaire was also applied in order to verify the presence of signs, symptoms and respiratory pathologies of the residents of the study sites.

Material and methods



Map of assessed sites and sources of pollution

Results

Results of the evaluation of the environmental parameters according to the measurement site

		Local de Medição			
		Leirosa	**Marinha das Ondas**	**Paião**	**Lavos**
Média de $PM_{2,5}$ p-value=0,392	Média	**35,53**	14,24	8,97	**35,79**
	Desvio Padrão	33,85	6,65	0,57	38,17
Média de PM_{10} p-value=0,300	Média	**174,89**	31,00	18,80	55,59
	Desvio Padrão	207,87	16,14	1,60	35,07
Média de COV´s p-value=0,112	Média	**3,55**	**3,52**	3,02	2,88
	Desvio Padrão	0,16	0,31	0,07	0,02
Média de CO p-value=0,104	Média	**7,38**	6,58	6,43	5,85
	Desvio Padrão	0,40	0,26	0,09	0,26
Média de CO_2 p-value=0,343	Média	**306,00**	251,00	293,67	262,17
	Desvio Padrão	24,98	12,73	13,67	37,48
Média de CH_2O p-value=0,077	Média	0,00	0,00	0,00	**0,02**
	Desvio Padrão	0,00	0,00	0,00	0,02
Média de T p-value=0,343	Média	15,38	15,63	**16,85**	16,60
	Desvio Padrão	1,96	0,71	0,35	0,42
Média de HR p-value=0,139	Média	**74,82**	69,80	60,13	56,50
	Desvio Padrão	8,89	0,52	4,15	3,06
Média de V p-value=0,161	Média	2.13	1.94	2.04	**2.22**
	Desvio Padrão	0,47	0,47	0,00	0,00

Teste estatístico: *Kruskal Wallis*

However, it was found that the mean values of $PM_{2.5}$ were higher in the Leirosa and Lavos locations, while the mean values of PM_{10} were higher in Leirosa. Regarding VOC's and CO, it was verified that the highest mean values were in Leirosa and Marinha das Ondas. With regard to CO_2, the highest mean values were found in Leirosa and Paião.

For most of the environmental parameters evaluated, namely $PM_{2.5}$, PM_{10}, VOC's, CO, CO_2, the site with the highest values was Leirosa. With the exception of formaldehyde which was only found in Lavos.

When we tried to evaluate the variation of atmospheric pollutants and other air quality indicators in the studied places, we verified that these same parameters did not differ between the different geographic areas ($p > 0.05$)

Results

Relationship between symptoms manifested and place of residence

			Local em que reside				Total
			Leirosa	Marinha das Ondas	Paião	Lavos	
Sintomas Manifestos	Asma p-value=0.190	n	3	1	0	2	6
		% linha	50,0%	16,7%	0,0%	33,3%	
	Bronquite cronica **p-value=0.058**	n	1	0	0	3	4
		% linha	25,0%	0,0%	0,0%	75,0%	
	Pieira/Assobios p-value=0.849	n	1	1	1	2	5
		% linha	20,0%	20,0%	20,0%	40,0%	
	Crise de espirros p-value=1.000	n	3	3	3	3	12
		% linha	25,0%	25,0%	25,0%	25,0%	
	Alergias(Rinite) p-value=0.172	n	0	3	2	3	8
		% linha	0,0%	37,5%	25,0%	37,5%	
	Dores de cabeça p-value=0.414	n	1	1	1	3	6
		% linha	16,7%	16,7%	16,7%	50,0%	
	Tonturas p-value=0.230	n	2	1	0	0	3
		% linha	66,7%	33,3%	0,0%	0,0%	
	Irritação das mucosas **p-value=0.066**	n	3	3	0	4	10
		% linha	30,0%	30,0%	0,0%	40,0%	
	Sensibilidade a odores p-value=0.172	n	3	2	0	3	8
		% linha	37,5%	25,0%	0,0%	37,5%	
	Tosse p-value=0.279	n	2	2	1	4	9
		% linha	22,2%	22,2%	11,1%	44,4%	
	Secura dos olhos e da pele **p-value=0.058**	n	0	1	0	3	4
		% linha	0,0%	25,0%	0,0%	75,0%	
	Dificuldades Respiratórias p-value=0.172	n	0	2	0	2	4
		% linha	0,0%	50,0%	0,0%	50,0%	
Total		n	5	5	4	5	19

Teste Estatístico: *Teste Exato de Fisher*

We can verify that there was no pattern of association between the different symptoms under study (p> 0.05), the execution of the pathology "Chronic Bronchitis", "Dryness of the Eyes" and "Irritation of Mucosa" there was an association between these phenomena (pathologies and symptoms).

In terms of chronic bronchitis and eye dryness, it was found that Lavos residents showed the most (75%) compared to the rest of the inhabitants of the study sites. As for mucosal irritation, the residents of Lavos, followed by those of Leirosa and Marinha das Ondas, were the ones who complained the most compared to the inhabitants of Paião.

All the sites present the same number of symptoms, standing out Paião for having a lower value of symptoms compared to the other places.

Discussion

- $PM_{2.5}$ and PM_{10} generally emitted by industries showed higher values in the localities of Leirosa and Lavos, places closer to the industries

- We know its effects range from coughing, asthma attacks and reduced lung function.
- Through the questionnaires we also saw that cough and asthma are the most reported symptoms by the residents of Lavos and Leirosa.

Discussion

- VOC's originates from the combustion of fossil fuels by motor vehicles.
- The highest values of VOCs were found in Leirosa, Marinha das Ondas, this can be justified by the existence of a road with a lot of traffic, not counting the traffic associated with the industries.
- Exposure to this material can cause headache, skin allergy, irritation of the eyes, nose and throat, shortness of breath, fatigue, dizziness and poor memory.
- Some of these symptoms are reported by residents in Leirosa namely headaches and mucosal irritation such symptoms may be associated with the recorded VOC values.

Discussion

- CO is extremely toxic and is directly related to the emission of gases by motor vehicles as well as to the combustion and smoking of tobacco.
- The highest values of CO were found in Leirosa, the closest locality to the pulp and paper industries
- At high levels, symptoms of exposure include, headaches, waking state, flu-like symptoms, nausea, fatigue, rapid breathing, chest pain, confusion, and diminished reasoning.
- It is in the locality of Leirosa that the highest values of CO are verified and also a greater percentage of people with dizziness, a symptom associated with exposure of CO.

Discussion

- From the average values of CO_2 it is possible to observe once again that the highest value is recorded in Leirosa.
- CO_2 is a gas that results from combustion processes in heating sources, energy production and metabolizing reactions of living beings. The industries located in Leirosa are pulp and paper industries, of which combustion processes are part of what justifies the fact that Leirosa is the place with the highest values of CO_2.
- Among the symptoms and consequences are increased incidence of asthma and bronchitis, increased asthma attacks
- It has been found that 50% of people who have asthma are resident in Leirosa, thus asthma may be related to the CO_2 values recorded in Leirosa due to its proximity to the industries.

Discussion

- The pollutant CH_2O is in pressed wood, non-sealed plywood, urea-formaldehyde foam insulation, fabrics, glue, carpets, furniture, chemical paper.
- We could see that we only found formaldehydes in Lavos, which can be explained by the fact that the Lavos industries are of a different type from the industries located next to Leirosa. In Lavos there is a greater quantity and diversity of smaller industries namely of tiles, mosaics, ceramic plates, resins among others.
- Exposure to formaldehyde may cause eye and mucous membrane irritation.
- Lavos is the site with the highest number of respondents reporting mucosal irritation and dry eyes, such symptoms are associated with exposure to formaldehyde.
- Long-term exposure to low concentrations of formaldehyde may cause respiratory distress. 50% Of those who reported having difficulty breathing were residents in Lavos

Conclusion

- Living close to the industries influences the health of residents.
- The localities closest to the industries (Lavos and Leirosa) were those with the highest mean values of pollutants and a higher percentage of manifestation of symptoms.
- It was noticed that the various symptoms reported by the respondents may be related to the various pollutants studied, because in the places with higher average values of a given pollutant were found symptoms related to the exposure of the same, which can demonstrate a relation between the pollutants and the human health.
- There is a need for legislation to control the quality of outdoor air, especially for regions near industrial areas, as these are more susceptible and are easily forgotten by all

Thank you for your attention!