Study and Perception of Air Pollution in the City of Manaus-AM

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Abstract— This article aims to obtain the perception of students from a University Center on air pollution in the city of Manaus-AM, located in northern Brazil. Due to the action of man and the exponential growth of the population, there has been an increase in polluting waste released into the atmosphere, and these have brought strong consequences to day-to-day activities and human health. Thinking about this problem, some questions have been drawn up and sent through an online form. The interviewees were the professors of the FAMETRO University Center, located in the region with the highest flow of automotive vehicles and people from the city of Manaus / AM. The results showed that of 100% of the data, 93% answered that they had little perception, 4% answered that they had a lot of perception and 3% had no perception regarding air pollution in the city of Manaus.
Keywords— Air pollution, Welfare, Perception.

I. INTRODUCTION

Located in northern Brazil, the city of Manaus/AM is part of the largest hydrographic basin on the planet and houses the largest rainforest in the world. Due to its great biodiversity the forest is considered a natural treasure, but despite this, the region is constantly suffering from the environmental impacts and environmental damage generated by the growth of industries, urbanization, deforestation and burning accumulating damage from the past to the present (SÁNCHEZ, 2015). Some of them are water pollution, noise pollution, air pollution or air pollution, soil pollution among other types that arise over time (DERISIO, 2016).

All types of pollutions are worrisome, however, air pollution is a type that is attracting society's attention, because with it several diseases such as respiratory and cardiovascular (TUFIK, 2017), which can lead to death children, the elderly, animals, to cause births of stillbirthbabies, in addition to the premature death of vegetation, this showed the work of Drumm and Chagas (2014). The authors showed that air pollution can be caused from incorrect disposal of polluting gases into the atmosphere, anthropic actions.

Among the categories of pollutants are MP (Particulate Matter) which is classified into three types of particles such as: thick particles of diameter greater than 10µm, being directly linked to soil resuspension, inhaled particles (MP_{10}) with diameter less than or equal to 10µm, derived from smoke, large causes of irritations and inflammations and thin inhale particles ($MP_{2,5}$), with a diameter less than or equal to 2.5µm from organic compounds, metals and soot (EPA, 2003; WHO, 2005; BARBOSA, 2014).

Present in abundance in the atmosphere aldehydes, sulfur dioxide, nitrogen dioxide, hydrocarbons, particulate matter, carbon monoxide, ozone, short-lived climate pollutants (PCVC), are some of the pollutants capable of changing quality in mind, the indexes called air quality standard appear that can be defined as a tolerable maximum limit of pollutants in the form of gases, particles and liquids (LISBON and KAWANO, 2007), determined through resolutions nº 491 and nº 492 of the CONAMA.

Como the human being is totally dependent on the air to survive, so the concern about air quality has grown a lot and became known to all, the need forced the population itself to seek knowledge on the subject. Something invisible and extremely important is coveted by all, many countries need to buy carbon credit because in the country itself no longer has quality in its air (BRICKSUS and NETO, 1998).

For Motta (1995), the damage caused by air pollution in human health is several, when fossil fuels are burned directly affects humans in many ways such as: respiratory problems, discomfort, eye irritation, nose in general asthma symptoms, fatigue and chest pain. While Simas's results (2003) add that the population perceives and experienced the effects of air pollution on cities. Furthermore, the authors added that on days the atmosphere presents strong evidence of the presence of pollution, it is normal for people to complain of itching in the eyes and

tearing, and these symptoms are known as indicators of a polluted atmosphere.

Presenting a similarity to this work, Silva e Oliveira (2011). This article will show the results of a survey conducted with students from a private college in the south-central region of Manaus/AM, where the flow of automotive vehicles is very intense during the hours and days of the week. For this, we sought through online questionnaires to analyze the perception of students air pollution.

II. METHODOLOGY

This study had as object of study the students of the FAMETRO University Center, located in the metropolitan region of the city of Manaus / AM (Figure 1). According to the Brazilian Institute of Geography and Statistics (IBGE, 2010) the city of Manaus is the largest city in the state, and it concentrates most of the population, of about 3,483,985. Despite being next to the largest rainforest in the world, high urbanization makes the region concentrate the highest pollution rates in the northern region (PINHEIRO, 2017).
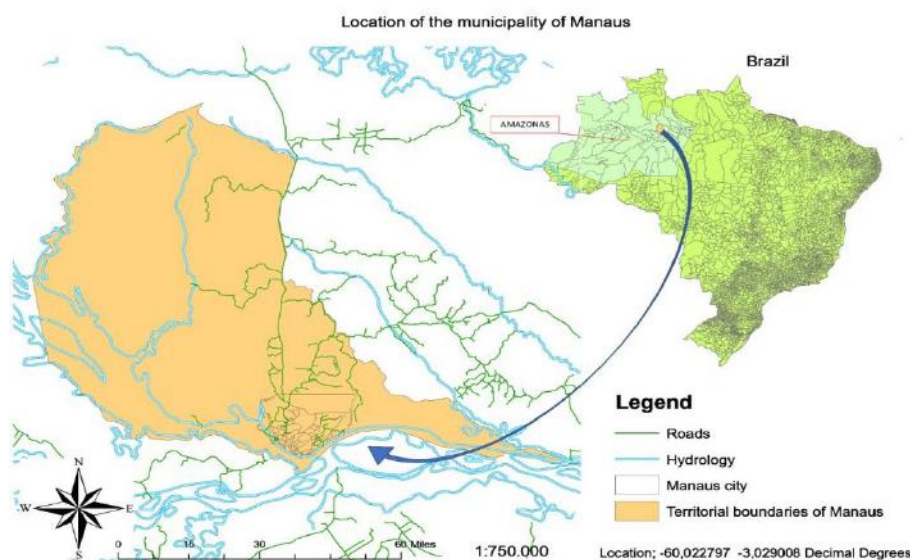

Fig.1: Location of the city of Manaus / AM.

The research universe was the student body of CEUNI-FAMETRO. The IES campus has four units located between the two avenues in the south-central region of the city, one of the areas with the highest concentration of vehicles. In the units circulate about 15,000 registered students daily, who are exposed daily to air pollution. Thus, the methodology built for this work has four basic steps, as shown in Figure 2.

Fig.2: Graphical scheme of the four steps of the methodology

Before starting the research, the units, courses and sectors of the IES were chosen, to which the study was carried out. Subsequently, the group of people and sectors to which the forms were applied was chosen. In this way, the link with the form was disclosed so that selected users could respond to the form, either via desktop, laptop or smartphone.

The forms were sent to units I, II (exact) and III (health and humane), in prior agreement with the coordinators of the main courses of IES, environmental engineering, civil, electrical and production; administration, architecture and urbanism, biomedicine, nutrition, nursing, administration, pedagogy and social work. The search units are in Figure 3.
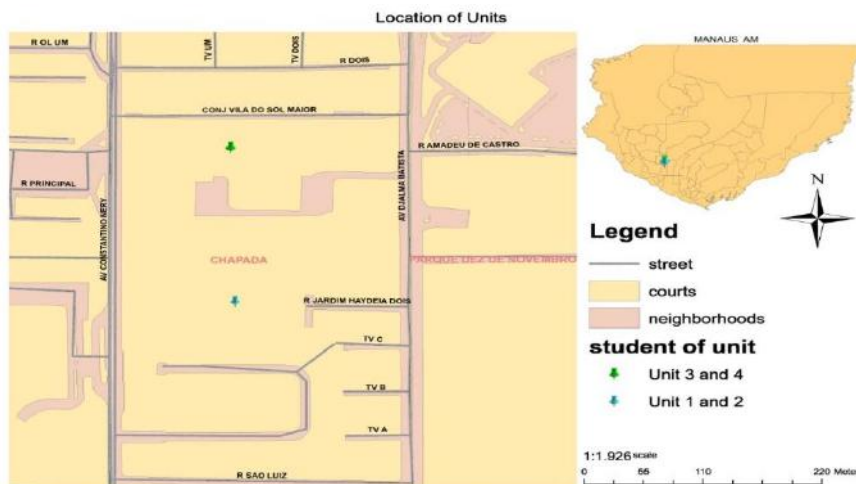

Fig.3: Location of units 1, 2, 3 and 4 of the FAMETRO University Center.

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The forms were created on the "Google Forms" platform, where a spreadsheet in Excel stored all the information in real time. From the properly tabulated questions, a statistical treatment of the information was performed, so that the results could be interpreted and analyzed. For the analysis of the results, the graphs generated by the platform itself were elaborated, where the statistics of the number of responses and user are presented. In addition, the platform provided the percentage of each question answered.

The link containing the with the questions was sent via SmartPhone Whatzapp app (https://docs.google.com/forms/d/e/1FAIpQLSe259gxjgFI qR9IGP5VGP1Dqe2916H6Q9SH3ZgSTN-R2Qa4w/viewform?usp=sf_link) to all class representatives of ceuni's 12 courses, which redirected to classmates. As the student began filling out the questions on the form, their respective answers were stored in a database.

During the application of the form the term Air Pollution was replaced by Air Pollution. The form applied consists of ten objective questions, which question the interviewee's perception of the current state of the atmosphere in relation to pollution, and additionally issues related to age group, gender and general knowledge on the subject.

III. RESULTS

The results presented in Figure 3a show that of all students of Ceuni FAMETRO who answered the questionnaire, 98% of the interviewees answered that they did not have any kind of knowledge about the theme, and that only 2% among the interviewees understand the theme. At the same time, Figure 3b shows that among the 98% of the interviewees, 44% are female, 58% male and only 2% did not respond. This shows that although media presented information about air pollution and its health implications, students have not shown any kind of information.
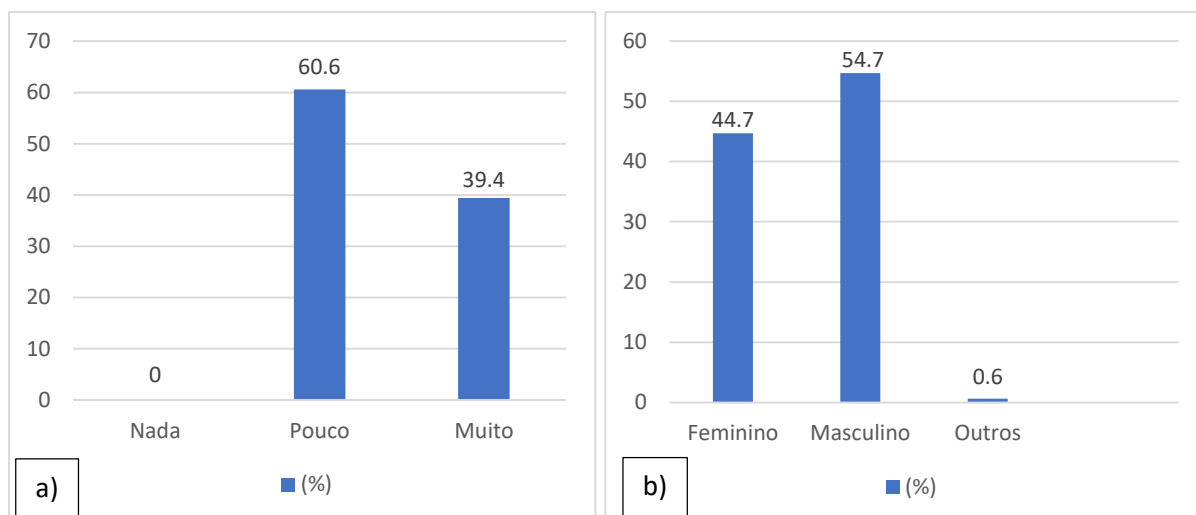
Fig.3: a) Percentage of students who have knowledge about air pollution; b) Percentage of men and women who answered the questionnaire.

Furthermore, it was possible to characterize the profile of the interviewees by age group, as shown in Figure 4. When it is observed, it is observed that about 50% of the interviewees are within the age group from 17 to 22 years. In a way, this high percentage of post-adolescents may explain the lack of knowledge and the implications of air pollution, because people in this age group do not have the habit of obtaining information through the news in the written environment and Internet. Still 32% between 23 and 28 years, a very young audience. Although the teachers belonging to the latter are mostly finalist students, they do not also present a mature profile for understanding the theme.
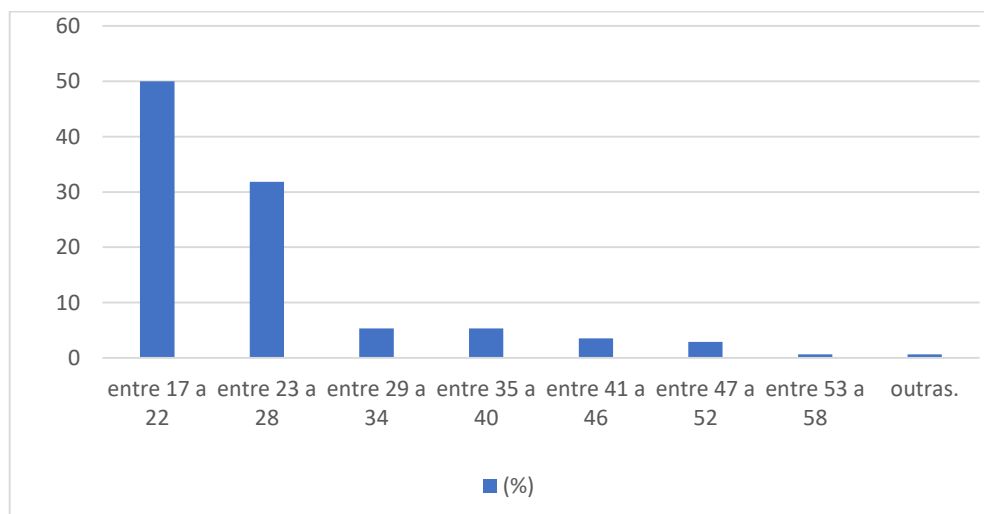

Fig.4: Data from the Ceuni-Fametro community, by age group.

Regarding the place of residence of the students of Ceuni-Fametro, it was possible to observe that 26% of the students are residents of the north, while 17% in the south-central area. Also obtained in Figure 5, it verified a percentage of 15% south zone, 15% west zone, 15% midwest zone and finally, 12% live in the east zone. The region can influence responses because it is related to the degree of exposure to pollutants. In a study on the displacement of pollutants in the city of Manaus, Dutra et. al., (2019) showed that one of the regions most affected by the concentration of particulate matter was the west zone. Nevertheless, the questionnaire shows that students (15%) that inhabit in that region are unaware of such information. It is also known that, according to the results shown in Figure 6, 92% stated that the influence of air pollution intensified due to the increase of automotive vehicles in the urban area, while only 4% deforestation, 2% burned and 2%

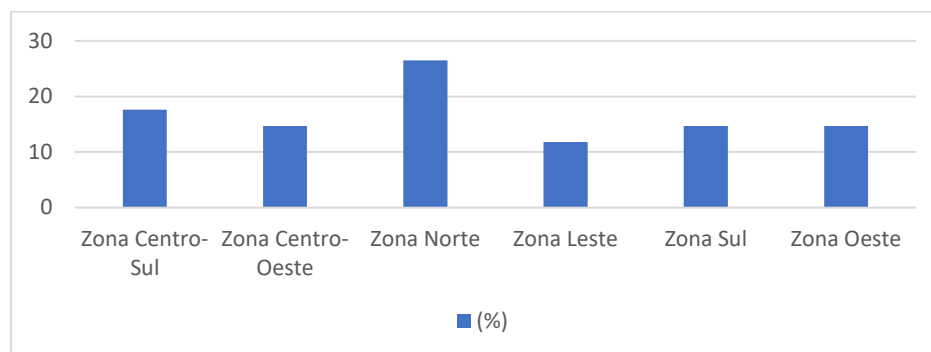industries, believe that air pollution can be derived from other origins.

Fig.5: Percentages of students interviewed by the city areas;
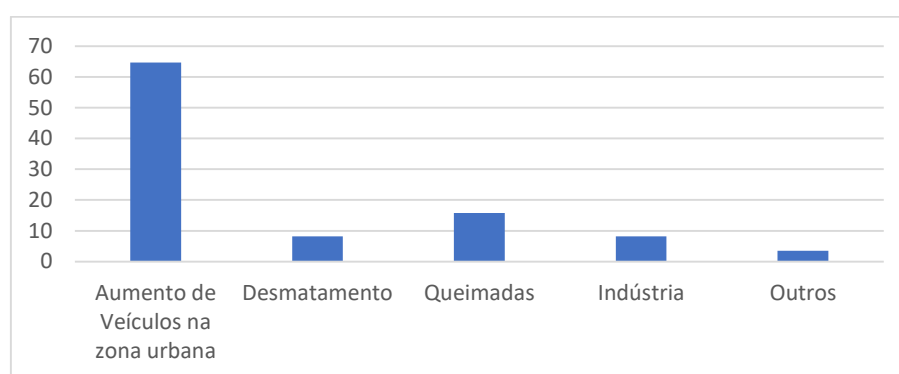

Fig.6: Influence of the type of air pollution on the lives of the inhabitants of the city.

Data on academics felt air pollution, and how it would affect people who worked exposed to it or not, if they perceived any change. Dutra et. al., (2019), clearly shows that particulate matter is concentrated where the flow of cars is stronger, such as at peak times, or on avenues that are very busy, thus people who are exposed where the particulate matter is concentrate is more conducive to acquiring diseases such as influenza, asthma, rhinitis, sinusitis among others, at the same time Santos (2019), states that from the increase in outbreaks of fires, more toxic particles can be detected to humans, reaching directly the health and well-being of the population of Manaus city. Approximately 64% who work yes exposed, 25% did not work and 11% maybe, and about 48% have had flu or have, 22% have rhinitis, 12% have sinusitis, 9% have asthma and other diseases that are linked to air pollution.
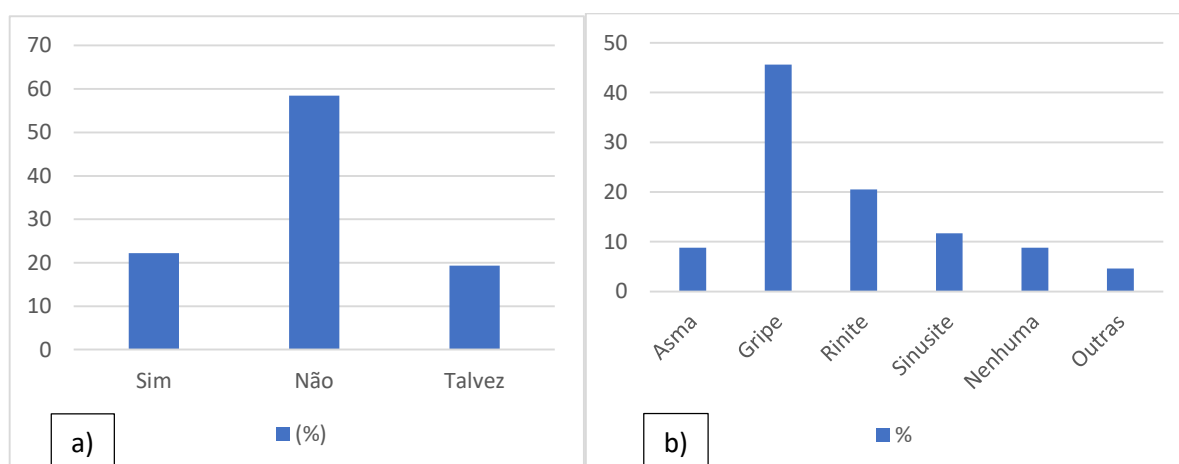

Fig.6: a) If people work exposed to air pollution, b) Diseases related to air pollution.

Figure 7a shows how, or how they felt about air pollution. Where 93% answered that they had little perception regarding the theme addressed, 4% answered that they had a lot of perception and 3% had no perception. Oliveira (2019), says that it is necessary to have a development of technologies for constant monitoring of pollutants as a precautionary form, this observation is

related to Figure 7b who sought to analyze the level of discomfort felt by the population of Manaus/AM in order to understand if society can feel differences levels of air pollution in the city of study, where 60% answered that they feel very discomfort, 37% feel little and 3% do not feel discomfort.
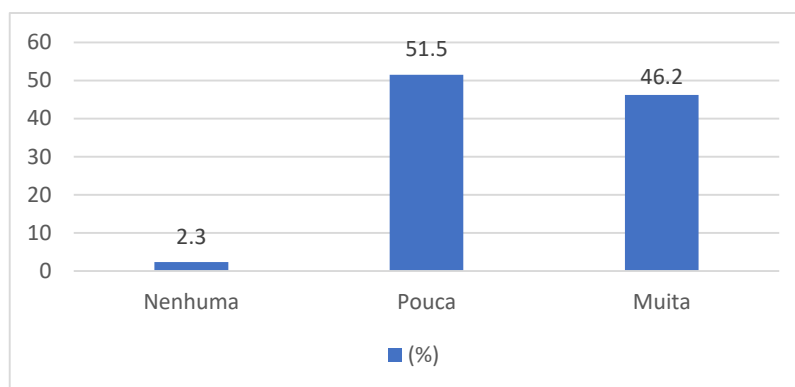

Fig.7: Perception of the level of discomfort felt of the interviewees in Ceuni FAMETRO.

Although previous results showed that the individuals interviewed have a low perception of the theme, they were asked how they would imagine the situation of air quality in 10 years. The results shown in figure 8 indicate that 73% of respondents answered that they imagine a future where air pollution is unpleasant, 24% believe that it may be unpleasant and only 3% think it would be very pleasant.

Although previous results show the lack of familiarity with the environmental issue and air pollution, it is perceived that a sample of students analyzed, is on alert about the future of air quality. climate change is intensifying more and more and this factor associated with rising fires and urbanization can get much worse, and thus contribute to the growth of large-scale air pollution.
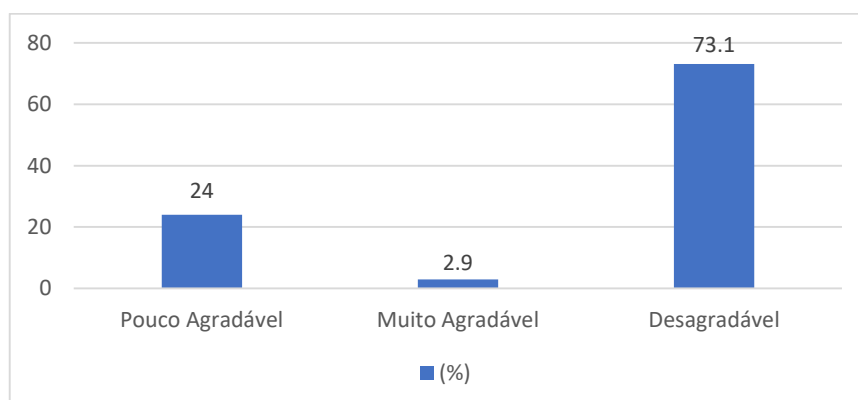

Fig.8: How do respondents imagine air quality in 10 years.

IV.   FINAL CONSIDERATIONS

During the development of the project, information was obtained about the sensitivity of the Amazon population, more specifically those who frequent Ceuni-Fametro assiduously, in relation to air pollution in the city of Manaus /AM, to know in fact whether the Fametro community know what air pollution is and whether it is affecting their lives. Based on how society can feel and observe the effects of air pollution, this study clearly

showed the perception of the Ceuni-Fametro community, when the questionnaires were applied and through them, statistical analyses can be developed in order to show results.

With the answers of the 664 forms it can be understood that the population of Manaus understands and understands little about the pollution of the air, that is, they have little perception. The perception of each individual showed how they felt or perceived air pollution, where 93% answered that they had little perception regarding the theme

addressed, 4% answered that they had a lot of perception and 3% had no perception.

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