TOXICOLOGICAL EVALUATION IN WORKERS OF GAS STATION IN RIO DE JANEIRO

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INTRODUCTION

Benzene is a substance widely used by the industry classified as carcinogenic to humans (IARC, Group 1A) due to its toxicity to the hematopoietic system, is present in high concentrations in fuels such as gasoline. In Brazil, there are about 42,000 fuel resellers, where 40% of them are located in the southeast region, approximately 185,000 individuals work in gas stations throughout the country, where many operate under risky conditions. Therefore, exposure assessment and monitoring of workers health is a crucial step in establishing intervention, prevention, and surveillance strategies. In addition to contributing to the reduction of occupational risks, in order to improve working conditions.

OBJECTIVE

The aim is to evaluate the health conditions of post workers and to correlate with DNA lesions, detected through the Comet Assay.

METHODOLOGY

A cross-sectional study carried out on workers at petrol stations, either occupationally exposed or not to benzene, from Downtown and South Zones of Rio de Janeiro city. All participants are older than 18 years old and signed an informed consent form prior to study enrollment. Clinical, demographic and economic data were obtained by answering a standardized questionnaire. Blood samples were collected to evaluate the hematological and biochemical alterations and genotoxic. Hemogram and automated biochemical analysis were performed according to the hemogram protocol of the hematology section of the clinical pathology laboratory from HCI/INCA. The genotoxic effects were evaluated by the Comet Assay, following the FIOCRUZ institutional protocol.

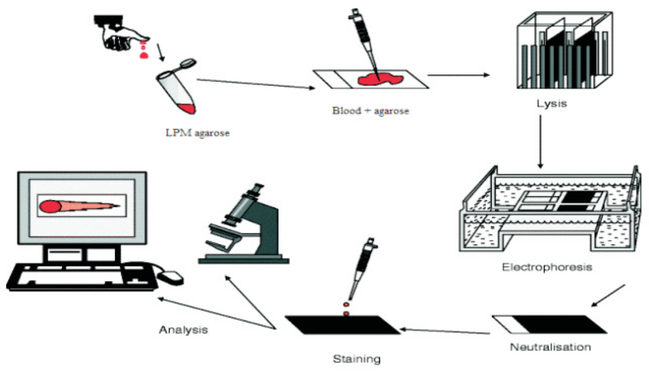


Figure 1. The methodology of the comet assay.

Table 1. Type of DNA damage classification

Figures	Class of Damage	Classification
	Class 0	No Damage
	Class 1	Little Damage
	Class 2	Moderate Damage
	Class 3	Severe Damage

RESULTS

A total of 406 benzene occupationally exposed workers were interviewed. 323 samples were collected of which 210 were directly exposed (attendants, managers) and 113 were exposed indirectly (convenience stores), whereas 166 office labor individuals were considered as the control group

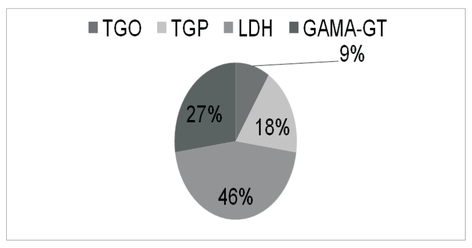
Table 2 - Demographic and socioeconomic characteristics of workers exposed and not exposed to benzene.

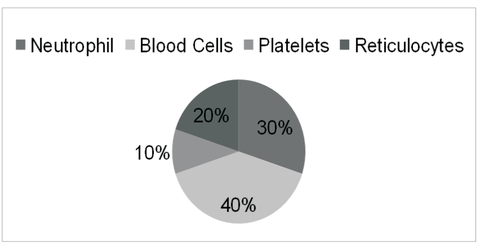
Demographic characteristics		Directly Exposed		Indirectly Exposed		Not exposed		p Value
		N	%	N	%	N	%	
Gender	Male	**212**	**88,3**	49	31,6	87	47,5	<0,01
	Female	28	11,7	**106**	**68,4**	96	52,5	
Age	Up to 24 years	35	14,6	51	33,3	06	3,3	<0,01
	From 25 to 34 years	74	31,0	51	33,3	54	29,5	
	35 years and over	**130**	**54,4**	51	33,3	**123**	**67,2**	
Skin color	Not white	**187**	**77,9**	**118**	**76,1**	**101**	**55,2**	<0,01
	White	53	22,1	37	23,9	82	44,8	
Marital Status	Married	**143**	**59,6**	**60**	**38,7**	**94**	**51,4**	<0,01
	Widowed or Divorced	23	9,6	11	7,1	16	8,7	
	Single	74	30,8	84	54,2	73	39,9	
Education	Elementary School	66	27,5	39	25,2	12	6,6	<0,01
	High school	**157**	**65,4**	**100**	**64,5**	32	17,5	
	Higher education	17	7,1	16	10,3	**139**	**76,0**	

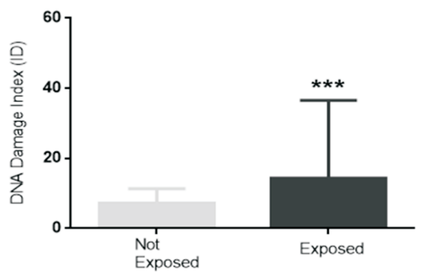
Table 3 - Means and standard deviation of hematological and biochemical parameters in workers from the group not exposed and exposed directly and indirectly to the benzene that performed blood collection. Reference values based on the Brazilian Society of Hematology (SBH).

Biochemical Parameters	Not Exposed (Mean e DP)	Indirectly Exposed (Méan e DP)	Directly Exposed (Mean e DP)	p-Value	Reference Value
TGO (UI/L)	17,00(±7,37)	23,28(±8,35)	21,32(±8,62)	0,683	Até 40
TGP (UI/L)	20,00(±14,32)	27,34(±15,61)	21,37(±16,30)	0,340	Até 41
Gama-GT (UI/L)	25,00(±28,60)	48,91(±75,93)	31,27(±36,13)	0,738	10 a 71
Creatinine (mg/dl)	0,80(±0,96)	1,00(±0,21)	0,90(±0,18)	0,478	0,3 – 1,3
Total Bilirubin (mg/dl)	0,39(±0,39)	0,43(±0,21)	0,41(±0,17)	0,042	Até 1.2
Direct Bilirubin (mg/dl)	0,16(±0,10)	0,17(±0,07)	0,13(±0,05)	0,777	Até 0,2
Indirect Bilirubin (mg/dl)	0,21(±0,13)	0,29(±0,15)	0,22(±0,13)	0,935	Até 0.8
LDH (UI/L)	351(±103,16)	384(±73,25)	362,0(±109,23)	0,005	240 à 480
C-reactive Protein (mg/dl)	0,19(±0,22)	0,16(±1,60)	0,21(±0,40)	0,884	<0.5
Hematological Parameters					
Red Blood Cell (milions/uL)	4,70(±0,95)	5,04(±0,45)	4,60(±0,52)	0,311	4.50-6.50
Hemoglobin (g/dl)	13,90(±2,94)	14,7(±1,10)	13,10(±1,10)	0,608	13.5-18
Hematocrit (%)	42,10(±10,55)	44,60(±3,41)	40,40(±3,16)	0,776	40-54
VGM (fL)	89,10(±16,75)	88,7(±5,36)	89,20(±16,03)	0,011	76-96
HGM (fL)	29,70 (±43,12)	29,7(±2,26)	36,70(±2,30)	0,818	27-32
CHGM (g/dL)	33,10 (±51,45)	33,15(±1,17)	32,70(±1,14)	0,916	32-36
Leukocytes(mm³)	7145 (±2266)	6985(±2012)	7558(±1947)	0,028	4000 – 10000
Neutrophil (uL)	4953(±1666)	5094(±995,4)	5265(±874,2)	0,066	1600-7500
Eosinophils (uL)	1,80 (±2,88)	2,30 (±3,72)	2,72 (±3,96)	0,466	40 - 600
Basophils (uL)	0,43 (±0,24)	0,46 (±0,68)	0,52 (±0,90)	0,029	0- 100
Typical lymphocyte (uL)	29,33 (±23,90)	31,16 (±15,92)	31,59 (±27,64)	0,139	800 – 4500
Monocytes (uL)	4,69 (±2,66)	7,40 (±2,99)	6,65(±1,84)	0,651	80 – 100
Platelets (mil/uL)	242 (±76,77)	247 (±60,56)	267(±56,79)	0,369	150 – 400
Reticulocytes (%)	0,99(±0,59)	1,18(±0,32)	1,29(±0,49)	0,392	0,5 - 2,00

The frequency of main altered parameters on the group exposed to benzene at gas station.







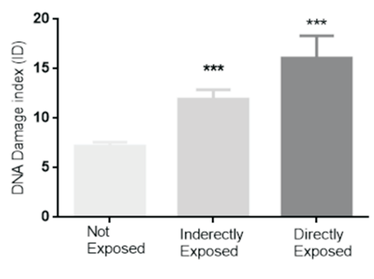


Figure 2. Altered Biochemical (A) and Hematological (B) parameters on exposed group and DNA damage index (DI) (C) in workers exposed (directly or indirectly) or not to benzene at gas stations using Comet Assay.

Table 4 - Distribution in the percentage of the class of DNA damage in the participants with direct, indirect occupational exposure and without exposure to gasoline.

DNA Damage Class[1]	Groups		
	Not Exposed (n=100)	Indirectly Exposed (n=100)	Directly Exposed (n=150)
Class 0	**95,5±0,2**	92,6±0,6[a]	89,9±1,4[b]
Class 1	4,2±0,2	7,1±0,6[b]	**9,6±1,3[b]**
Class 2	0,2±0,0	0,2±0,0	**0,4±0,1[c]**
Class 3	0,1±0,0	0,1±0,0	0,1±0,0

1Values expressed as mean and standard error mean. [a]Mann Whitney, P <0.0001, compared to the control group; [b]Mann Whitney, P <0.01, compared to the control group; [c]Mann Whitney, P <0.05, compared to the control group.

CONCLUSION

This work has shown that the exposure to benzene in workers at gas stations causes different damages, such as genetic, hematological and biochemical changes leading to a health damage in these workers.

REFERENCES

RUIZ, M. A. *et al.* Alterações hematológicas em pacientes expostos cronicamente ao benzeno. Revista de saúde pública, v. 27, n. 2, p. 145-151, 1993

Zhang, L., Lan, Q., Ji, Z., Li, G., Shen, M., Vermeulen, R.,& Rothman, N. Leukemia-related chromosomal loss detected in hematopoietic progenitor cells of benzene-exposed workers. *Leukemia*, *26*(12), 2494-2498, 2012.

DA COSTA, M. A. F., & DA COSTA, M. D. F. B. Benzeno: uma questão de saúde pública. *Interciência*, *27*(4), 1-9.,2002.

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