

Table 3. Malondialdehyde levels, in human papillomavirus positive and negative women

HPV	Itaituba median; Q1-Q3	p value*	Limoeiro do Ajuru median; Q1-Q3	p value*	Bragança median; Q1-Q3	p value*
HPV positive	(n=17) 8.02; 1.54-8.05	0.003	(n=8) 0.54; 0.13-0.88	0.313	(n=5) 3.90; 2.50-4.70	0.161
HPV negative	(n=109) 1.70; 0.85-4.41		(n=60) 0.51; 0.27-1.40		(n=38) 2.42; 1.40-3.60	

* p<0.05 statistically difference (Mann-Whitney test).

Q1: first quartile; Q3: third quartile; HPV: human papillomavirus.

HPV-positive women living in Itaituba had significantly ($p<0.05$) higher MDA levels compared to HPV-negative women (8.02nmols/mL and 1.70nmols/mL, respectively, *i.e.*, almost five-fold increase) (Table 3). Malondialdehyde levels did not differ significantly ($p>0.05$) between HPV-positive and HPV-negative women living in remaining communities.

Total GSH levels differed significantly ($p<0.05$) between HPV-positive (8.20 μ g/mL) and HPV-negative (1.47 μ g/mL) women living in Bragança only (Table 4). In contrast, total GSH and GSSG levels were higher in HPV-positive compared to HPV-negative women living in Limoeiro do Ajuru and Bragança, although not in Itaituba.

High-grade squamous intraepithelial lesions (HSIL) were not detected in women in this sample.

Table 4. Total glutathione and oxidized glutathione levels, in μ g/mL, in human papillomavirus positive and negative women

Total GSH	Itaituba median; Q1-Q3	p value*	Limoeiro do Ajuru median; Q1-Q3	p value*	Bragança median; Q1-Q3	p value*
HPV						
Positive	(n=17) 1.95; 1.43-2.32	0.650	(n=8) 3.80; 3.37-5.52	0.789	(n=5) 8.20; 3.20-8.60	0.021
Negative	(n=109) 1.80; 1.43-2.25		(n=60) 3.77; 2.83-6.50		(n=38) 1.47; 1.04-4.07	
GSSG						
HPV positive	1.43; 1.36-1.87	0.599	4.10; 2.80-6.35	0.076	1.40; 1.21-1.60	0.690
HPV negative	1.55; 1.29-2.29		1.86; 0.99-3.46		1.30; 0.85-1.78	

* p<0.05 statistically difference (Mann-Whitney test).

Q1: first quartile; Q3: third quartile; HPV: human papillomavirus; GSH: total glutathione; GSSG: oxidized glutathione.

DISCUSSION

The relation between oxidative stress and cervical cancer has been extensively investigated.^(2,3,7,8) Still, studies examining similar relations in populations living along Amazon rivers are lacking.

Higher MDA levels in women with LSIL and HPV-positive women living in Itaituba compared to those living in remaining communities investigated may reflect exposure to hazardous substances, such as mercury, given the intense local mining activity. High levels of mercury exposure have been reported in this population due to consumption of fish contaminated with methylmercury. Methylmercury is poisonous to humans and has been associated with neurological changes,⁽¹²⁾ genotoxicity⁽¹³⁾ and increased oxidative stress.⁽¹⁴⁾

However, MDA concentrations were measured using the TBARS assay. Although a widely used, inexpensive and user-friendly test, this assay is non-specific and may be impacted by several substances, such as sugars, amino acids and bilirubin. Malondialdehyde is thought to be an important marker of oxidative stress-induced cell membrane lipid peroxidation.^(4,15)

In Limoeiro do Ajuru and Bragança, MDA levels were lower in women with LSIL compared to unaffected women. Contrasting evidence indicating malignant neoplasms are able to release free radicals into the bloodstream have been given elsewhere.^(8,16) In Itaituba, higher levels were documented in women with LSIL. However, there were no significant differences between affected and non-affected women in these communities.