Water hardness and its impact on arterial stiffness and carotid atherosclerotic burdens; insights from the 'Corinthia study'

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Introduction: It has been long investigated the potential role of water quality in cardiovascular health.

Purpose: The aim of this study was to examine the association between water hardness, arterial stiffness and atheromatic burden in carotid arteries.

Design and methods: Corinthia study is a cross-sectional epidemiological study conducted in subjects aged 40–99 years. Intima media thickness (IMT) was measured in the left and right common carotid artery, carotid bulb and internal carotid artery. The average of the measurements (mean IMT) and the maximum IMT were determined as the representative value of carotid atherosclerosis burden. Pulse wave velocity (PWV) was used to evaluate arterial stiffness. Tap-water samples were collected from the study area, and analyzed for major, minor and trace elements, as well as pH and total hardness.

Results: In this analysis we included data from 1.404 participants. In subjects consuming water with a hardness above 250mg/dL, especially in those above >65 years old maximum and mean IMT was significantly increased compared to those consuming water with a hardness above 250mg/dL (1.61mm vs. 1.34mm respectively, p<0.001 and 1.15mm vs. 1.05, p=0.005 for WH ≥250mg/dL and WH <250mg/dL, respectively). Similarly, the prevalence of atheromatic plaques was higher in subjects of the first category (15,2% vs. 7,6%, p=0.004). No differences emerged for the arterial stiffness in the individual subgroups. statistically significant correlation was revealed (p=0.004).

Conclusions: There seem to be a negative association between extra hard water and carotid atheromatic burden highlighting the possible impact of water quality in cardiovascular health.

Linear regression analysis of the association between mean and maximum cIMT with the hardness of the water after adjustment for confounders.

	Mean cIMT			Maximum cIMT		
	b coefficient	95% CI	p	b coefficient	95% CI	p
Age (years)	0.012	0.011, 0.014	<0.001	0.019	0.016, 0.022	<0.001
Gender (male)	0.186	0.146, 0.227	<0.001	0.286	0.208, 0.364	<0.001
BMI (kg/m²)	0.004	0.001, 0.007	0.007	-0.002	-0.008, 0.004	0.61
Current smoking	0.129	0.084, 0.174	<0.001	0.198	0.111, 0.284	<0.001
Hypertension	0.027	-0.016, 0.071	.215	0.037	-0.047, 0.121	0.389
Diabetes Mellitus	0.097	0.045, 0.149	<0.001	0.207	0.106, 0.309	<0.001
Hypercholesterolemia	0.052	0.011, 0.093	0.014	0.086	0.006, 0.166	0.034
Water hardness	0.082	0.042, 0.121	<0.001	0.192	0.115, 0.269	<0.001

Abbreviations: cIMT, carotid intima-media thickness; CI, confidence intervals; BMI, body mass index

Table 1