Nitrite-induced oxidative stress in agricultural workers

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Introduction

- Massive utilization of nitrogenous fertilizers in agricultural practice has contaminated water and soil.
- Drinking nitrate-contaminated water is the main cause of acquired methemoglobinemia [1].
- Although occult methemoglobinemia is rare, subclinical methemoglobinemia may be a concern in agricultural workers indicating nitrite-induced methemoglobin formation.
- Nitrite is generated from nitrate in human body and it can oxidize hemoglobin and generate free radicals [2].
- An antioxidant enzyme, superoxide dismutase, plays a role in methemoglobin metabolism [3,4].
- The significance of nitrite-induced oxidative stress and antioxidant defence in farmers is still clear.

Objectives

- To determine the levels of blood nitrite, erythrocyte SOD activities and methemoglobin levels in agricultural workers and control population
- To analyse linear regression on methemoglobin level using predictor variables – blood nitrite and erythrocyte SOD activities

Models and methods

- A cross-sectional comparative study was conducted on 60 agricultural workers in two villages of Magway and 60 controls in two quarters of Magway city.
- After obtaining written informed consent, a brief interview was performed and about six millilitres of venous blood were taken.
- Biochemical parameters were analysed by spectrophotometric methods.
- Student-t test and multiple linear regression were analysed.
- Statistical significance was determined if p-value of the test was less than 0.05.

Results

Table (1) Baseline characteristics and biochemical parameters of agricultural workers and control (mean ± SD)

Baseline characteristics	Agricultural workers (n = 60)	Control (n = 60)
Age (years)	34.07 ± 9.68	32.53 ± 9.36
Hemoglobin (g/dL)	12.95 ± 2.36	13.08 ± 2.04
Nitrite (nmol/L)	567 ± 137	516 ± 138
Methemoglobin (%)	1.98 ± 0.65	1.73 ± 0.79
SOD (Unit/ g Hb)	680 ± 260	889 ± 323

Figure (1) Blood nitrite level in agricultural workers and control — p 0.044

Figure (2) SOD activity in agricultural workers and control — p 0.002

Figure (3) Methemoglobin level in agricultural workers and control — p 0.010

Table (2) Coefficient of determination of methemoglobin level in linear regression

	R	R^2	Adjusted R^2	Std. error of estimate
Agricultural workers	0.650	0.422	0.402	0.50082
Control	0.611	0.373	0.351	0.71407

Predictors – Blood nitrite and erythrocyte SOD
Dependent variable – Methemoglobin

Table (3) Beta estimates and significance levels of methemoglobin in linear regression

		Unstandardized B	Coefficients Std. error	Standardized Coefficients B	p
Agricultural workers	Constant	0.744	0.317		0.023
	Nitrite	0.003	0.000	0.617	0.000
	SOD	-0.001	0.000	-0.243	0.019
Control	Constant	0.064	0.433		0.884
	Nitrite	0.004	0.001	0.605	0.000
	SOD	0.000	0.000	-0.116	0.276

Conclusion

- Significant nitrite-induced oxidative stress was observed in agricultural workers as compared with control
- SOD is a preventive factor against nitrite-induced oxidation of hemoglobin in agricultural work

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