Leucocyte counts, humoral immunity and nitric oxide level in Nigerian consumers of alcoholic beverages

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Abstract: Consumers of alcoholic beverages are susceptible to various forms of infectious diseases and cancers. To provide information about immune status of Nigerians that consume alcoholic beverages, the levels of an oxidant (NO), immunoglobulin classes (IgG, IgA and IgM), acute phase proteins (Transferrin, Caeruloplasmin and Alpha 2 –macroglobulin) and white blood cell (WBC) count were carried out on 15 Nigerians who had been consuming alcoholic beverages for at least 10 years (at least 4 bottles of alcoholic beverages containing 4 percent alcohol daily) and 14 sex/age matched controls. The result shows that NO; transferrin, total WBC count and neutrophils were significantly decreased while IgM was significantly increased in Nigerians that consume alcoholic beverages compared with the controls. The volume of alcohol consumed daily was negatively correlated with transferrin and total WBC while duration of consumption of alcoholic beverage did not show any correlation. The study indicates that consumption alcoholic beverages affect immune status and leucocytes count. Thus, providing information for the susceptibility of alcoholics to infectious agents. [Report and Opinion 2010;2(6):67-70]. (ISSN:1553-9873).

Keywords: Leucocytes, Immunity, Oxidants, Alcohol and Nigeria.

Introduction

Alcohol was found to modulate immune system thus increases a consumer's risk of developing various illness and certain cancers (Roselle et al 1993). This action depend if the consumption is acute, chronic or moderate. Chronic alcohol consumption increases the expression of CD8 molecules on the surface of neutrophils and also increases the infiltration/accumulation of neutrophils and macrophages to liver, thus leading to liver injury (Sheron et al 1993, Anthony et al 1993). In chronic alcohol abusers, especially those with liver diseases, the levels of IFN-alpha, IL-1 and IL-6 in the blood are significantly elevated thus contributing to increased metabolism, fever, weight loss, elevated liver protein and markers of malnutrition (McClain and Cohen 1993). Acute or moderate alcohol consumption reduces the pathogen-induced production of inflammatory cytokines such as TNF-alpha, IL-1 and IL-6 (McClain and Cohen 1993). Acute alcohol exposure increases the production of IL-10 and TGF-beta, which promotes humoral immunity (McClain and Cohen 1993, Spitzer and Bautista 1993).

Alcohol has a dual effect on body's oxygen radical production. First, alcohol inhibits O_2 radical and nitric-oxide production by macrophages in the lung, where these substances are essential for killing micro-organisms. Second, alcohol increases O_2 radical production in liver, where these molecules may cause tissue damage (D'Souza et al 1996). To date, conflicting results exist regarding the effects of alcohol consumption on the number or function for B cells (D'Souza et al 1996). To the knowledge of the authors, literature is not available on the influence of alcohol consumption on immune function or NO level in Nigerian alcohol consumers.

Participants and Laboratory Analysis:

The tests are male participants (26-48 yrs of age), that consume alcoholic beverages while the controls are male participants not consuming alcohol (26-48 yrs of age).

presented by blood, urine and stool tests as described in a standard text (Cheesbrough 1991). Those that declined their consents were also excluded. These strict exclusion criteria lead to the low numbers of alcohol consumers (n = 15) and controls (n = 14). The concentration of alcohol consumption was calculated as % volume of alcohol content X volume of alcoholic beverage X number of bottles consumed. The serum titer of immunoglobulin classes and acute phase proteins were determined using immuno-diffusion method as previously described (Arinola et al 2006). The level of NO was determined using Griess reagents and method (Laudanska et al 1970). Haematological parameters were determined as described in a standard textbook (Cheesbrough 1991).

Statistical analysis: The result was presented as mean and standard deviation. The significances of the

differences between mean values were determined using Students (t) test. Pearson's correlation was used to correlate volume of alcohol consumed or duration of alcohol consumption with humoral factor or NO.

Results

The volume of alcohol consumed by our test subjects per day was approximately 10.21 + 10.66cl per day and they had been consuming alcoholic beverages for 15.8 + 11.8 years. Table 1 show that the level of NO was significantly reduced in Nigerian's that consume alcohol beverages compared with the controls. The levels of IgG and IgA classes were not significantly increased but the level of IgM was significantly increased in Nigerians that consumed alcoholic beverages compared with the control. Moreover, the levels of alpha 2- macroglobulin and caeruloplasmin were not significantly reduced but the level of transferrin was significantly reduced in tests compared with control. In Table 2, total WBCs and neutrophils were significantly reduced while lymphocytes and monocytes were not significantly decreased in the tests compared with control. The volume of alcohol consumed per day was significantly and negatively correlated with transferrin level while duration of alcohol consumption showed no significance (Table 3). Moreso, NO and total WBC count were significantly and negatively correlated with volume of alcohol-consumed daily (Table 4).

Table 1: Mean titer of nitric oxide, immunoglobulin classes and acute phase proteins in Nigerians that consume alcohol beverages compared with the control.

.	Test (n =15)	Control (n = 14)	t	p
NO (millimol/dL)	5.5 ± 1.3	6.6 ± 0.3	2.65	<0.02
IgG (g/L)	20.8 ± 6.5	17.0 ± 8.6	0.90	>0.20
IgA (g/L)	3.3 ± 2.7	2.7 ± 1.5	1.50	>0.02
IgM (g/L)	3.1 ± 3.0	1.5 ± 1.2	2.95	<0.50
A2MG (g/L)	1.5 ± 0.4	2.0 ± 1.2	1.79	>0.50
CLP (g/L)	0.8 ± 0.5	0.9 ± 0.7	0.43	>0.20
TRF (g/L)	2.1 ± 0.5	2.8 ± 1.0	2.21	<0.50

A2MG =Alpha 2-macroglobulin
CLP = Caeruloplasmin
TRF = Transferrin

Table 2: Total WBC, Neutrophil, Lymphocyte and Monocyte counts ($x10^9$) in test and control subjects.

	Test (n =15)	Control (n = 14)	t	p
Total WBC	5.5 ± 1.6	6.9 ± 1.0	2.86	<0.01
Neutrophils	2.9 ± 1.1	3.8 ± 0.8	2.25	<0.05
Lymphocytes	2.3 ± 0.7	2.7 ± 0.5	1.81	>0.05
Monocytes	0.3 ± 0.8	0.31 ± 0.1	0.05	>0.20

Table 3: Correlation of parameters of humoral immunity with volume of alcohol consumed per day (VA) and duration of alcohol consumption (DA).

		IgA	IgG	IgM	A2MG	CLP	TRF
VA	r-values	0.43	-0.10	-0.30	0.21	-0.01	-0.66*
	p-values	0.12	0.89	0.33	0.47	0.92	0.02
DA	r-values	0.42	-0.04	0.39	0.30	0.28	-0.17
	p-values	0.13	0.89	0.19	0.28	0.41	0.53

*Correlation is significant at the 0.05 level (2-tailed).
A2MG = alpha -2- macroglobulin
CLP = Caeruloplasmin
TRF = Transferrin

Table 4: Correlation of haematological parameters with volume of alcohol consumed per day (VA)

.		NO	Lymphocytes	Monocytes	Neutrophils	Total WBC
VA	r-values	-0.54*	-0.49	-0.45	-0.48	-0.94*
.	p-values	0.04	0.07	-0.07	0.07	0.02 .

*Correlation is significant at the 0.05 level (2-tailed).

Discussion

The normal immune responses to invading pathogens involve inflammatory reaction and development of T- or B- lymphocyte mediated immunity. The present study showed that these two aspects were affected in opposite directions by alcohol consumption in Nigerians. The levels of the three immunoglobulin classes (IgG, A and M) were increased but the increase in the level of IgM was significant while the levels of the three acute phase proteins and NO were reduced but the reduction in the levels of transferrin were significant in Nigerian alcohol consumers compared to non alcohol consumers.

Decrease level of NO could be due to low number of phagocytes that produces NO as shown in this study where low numbers of total – and differential – WBCs were found in alcohol consumers. The cause of low WBC number in alcohol consumers might be related to proliferation-inhibiting effects of alcohol as a result of reduced production of cytokine and mediators such as TGF – beta, IL-10 and PGE 2 (Szabo et al 1995). We also hypothesis that alcohol-induced apoptosis of the WBCs might explain low WBC count in alcohol consumers. Low numbers of total WBCs and neutrophils in alcohol consumers might also be related to accumulation of neutrophils in the liver since it was found by Szabo et al 1999 that Kupffer cells of alcoholics produce elevated levels of IL-8, which attract neutrophils to the liver where they cause damage.

Also, it is possible that alcohol inhibits gene expression for inducible nitric oxide synthase, the enzyme that is responsible for generation of nitric oxide in macrophages and neutrophils in response to bacterial stimulation (D'Souza et al 1996) leading to decreased level of NO in alcohol consumers. The implication of reduced plasma NO in Nigerian alcohol consumers will be impaired antimicrobial defense which may contribute to previously observed (Szabo et al 1999) high incidence of tuberculosis in alcoholics.

We found in this study that the level of IgM was significantly raised in Nigerian alcohol consumers compared with controls. This did not support the finding of Roselle (Roselle 1992) who found signicantly elevated levels of serum IgG and IgA in chronic alcoholics. Differences in the result of our study and that of Roselle (Roselle 1992) may be the choice of subjects, duration of alcohol consumption and the brand of alcohol consumed. Considering that immunoglobulin classes are produced by cells of B lymphocyte lineage, the differential elevation in the levels of immunoglobulin classes in alcohol consumers indicate B cell dysfunctions. After alcohol, there is decreased IL–12 and raised Th 2 – type of immune response (Roselle 1992). Since Th 2 type of immune response is humoral mediated immunity therefore raised level of immunoglobulin classes is expected in alcohol users. Moreover, in response to some antigens, B cells response differently. Carbohydrate antigens stimulate predomint production of IgM (Linder and Huldt 1980). The major component of alcoholic beverage in Nigeria is carbohydrate in nature. It is therefore possible that the continuous assimilation of carbohydrate products in alcoholic beverages might have stimulated B cells to preferentially produce predominantly IgM.

The mean levels of acute phase proteins (Transferrin, Caeruloplasmin and Alpha 2-macroglobulin) were lower in alcohol users compare with the controls. This observation suggests a decrease production as a result of compromised liver function or gradual liver damage. The consequences of significant decreased transferrin in Nigerian alcohol users is susceptibility to infection because there will be free unbound Fe in circulation which bacteria need for proliferation.

The implication of low plasma concentration of caeruloplasmin in alcohol users is that there will be free Cu in circulation. Cu excess may be accumulated in organs especially liver in organs where damages may occur. Also, both caeruloplasmin and transferrin are antioxidants (Lukasewjc and Prohaska 1990). Reductions in their levels may be due to reduced need of antioxidants to quench free – radical generation as shown in the present study where significantly reduced level of NO was observed in alcoholic subjects.

The present study shows that alcohol has adverse effect on certain aspects of humoral immune system. The effects of alcohol on antioxidant – oxidant balance requires further consideration.

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