Comparison of Serum Concentrations of Total Cholesterol and Total Lipid in Different Groups of Female Tuberculosis Patients

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Abstract

Tuberculosis (TB) is one of the most dangerous tropical diseases that complicates HIV infection in Nigeria to date. Over two million Nigerians are known to be infected with TB and many more are at risk of the infection. Serum concentrations of total cholesterol and total lipid of 117 female TB patients attending chest clinic at the University of Nigeria Teaching Hospital (UNTH), Ituku, Enugu State, Nigeria and 38 female residents of University of Nigeria, Nsukka Campus who had no history of tuberculosis by the time blood was collected (FTBF) were spectrophotometrically evaluated. The 117 female TB patients were made up of twenty seven (27) TB patients not yet on any form of TB drugs (FTBP), 60 TB patients being treated with a combination of normal complements of TB drugs (FTBD) and 30 confirmed female TB-treated persons (FTBT). Results obtained revealed that the mean serum total cholesterol and total lipid concentrations of the FTBP were 136.66 ± 17.32 mg/dl and 4.5 ± 0.88g/l respectively and FTBD (142.22±28.77 mg/dl and 4.6±0.95 g/l respectively) were significantly lower (p<0.05) than those of FTBF (168.5±18.31 mg/dl and 5.24±1.0 g/l) and FTBT individuals (162.96±28.94 mg/dl and 5.15±0.7 g/l respectively), indicating that TB disease could be associated with hypocholesterolemia and hypolipidemia.

Keywords: Cholesterol, Lipids, Tuberculosis patients

Introduction

Tuberculosis is one of the most dangerous tropical diseases as well as the commonest opportunistic infection in HIV/AIDS in Africa to date (Richards *et al.,* 1995). TB in human is normally caused by *Mycobacterium tuberculosis* or *Mycobacterium bovis* (Harris and McClement, 1983). Its treatment could be effected with a combination of a regime of antibiotics such as pyrazinamide, streptomycin, isoniazid, rifampicin, thambutol and ethambutol (Harris and McClement, 1983; Mikinson, 1997). However, it was recently discovered that obese individuals have lower risk of contacting tuberculosis (Leung *et al.,* 2007), while cholesterol rich diets could enhance easy diagnosis and treatment of tuberculosis (Perez-Guzman *et al.,* 2002).

Lipids are important biomolecular components of human body. They are heterogenous group of compounds which are relatively insoluble in water but soluble in non polar solvents (Mayes, 2000). Cholesterol on the other hand is an amphipathic lipid and an important component of human membranes plasma lipoproteins and nervous tissues. It is biochemically significant because it is the precursor of a large number of equally important steroids which include the bile acids, adrenocortical hormones, sex hormones, vitamin D, cardiac glycosides, sitosterols of the plant kingdom and some alkaloids (Mayes, 2000). Nevertheless, excess of cholesterol in the bile can lead to gallstones while its excess in the blood can become deposited on the arterial walls leading to atheroma (Braunstein, 2001).

In this study, total serum cholesterol and total serum lipid concentrations were assayed and compared in different groups of female tuberculosis patients and female normal individuals with a view to assessing the possible effect of tuberculosis disease state on serum cholesterol and total lipid levels.

Materials and Methods

Materials: The chemicals used in this study were of analytical grade and were obtained from Sigma, St. Louis, USA.

Work plan: The investigation involved 117 female volunteer tuberculosis patients (18-70yrs old) who attended chest clinic at University of Nigeria Teaching Hospital Ituku, Enugu State, Nigeria and 38 female healthy volunteer residents of the University of Nigeria, Nsukka community who were known to have no history of tuberculosis infection by the time their blood samples were collected (FTBF). The TB patients were grouped as tuberculosis patients not yet on any TB drug (27, FTBP), the patients on TB drugs (60, FTBD), and TB treated individuals (30, FTBT).

Sample collection: Blood samples (5ml) were collected from the median cubital vein of volunteers into 10ml centrifuge tubes, allowed to stand for 20 minutes and then centrifuged at 3,000 xg for 20 minutes. The upper layer (serum) was collected using fine-tipped dropping pipette and then used immediately for relevant assays or stored in deep freezer (-20^{o}C) in aliquots of 200μl until assayed

Methods: Serum total cholesterol was assayed spectrophotometrically by enzymatic endpoint method as modified by Stein (1986), while serum total lipid concentration was determined by the method of Siroev and Makarova (1989).

Statistical analysis: Data collected were subjected to analysis of variance (ANOVA) using statistical package for social sciences (SPSS). The mean ± SD of each parameter was calculated for each group. Test of significance of mean differences for age and weight on the tested parameters were by ANOVA. The accepted level of significance was 0.05.

Results

The FTBF group (control) exhibited the highest mean serum total cholesterol concentration (168.50 ± 10.31mg/dl) while FTBP group showed the lowest concentration (136.66 ± 6.33mg/dl) (Fig. 1). FTBP and FTBD groups, manifested significant decrease ($p<0.05$) in concentration from those of FTBF and FTBT groups. However, the decrease in the cholesterol concentration of FTBP group was not significant from that of FTBD group.

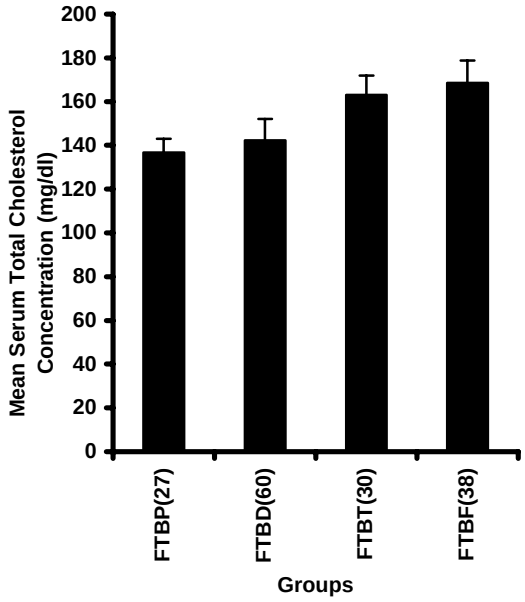

Fig. 1: Mean Serum Total Cholesterol for Different Groups of TB Patients and Control (number in bracket = number sampled)

Similarly, the mean serum total lipid concentration of FTBP and FTBD groups were observed to be significantly decreased ($p<0.05$) when compared with those of the FTBT and FTBF groups (Fig. 2). There was no significant decrease in the mean total lipid concentration of TB treated persons (FTBT) ($p>0.05$) when compared with that of TB free control group (FTBF) nor was it in FTBD and FTBP groups.

The result displayed in Table 1 shows that the mean serum total cholesterol concentrations increase as the age ranges of the individual increase, indicating direct relationship. Furthermore, the concentration of the total cholesterol of FTBP and FTBD groups were consistently and significantly lower ($p<0.05$) than those of the FTBT and FTBF groups.

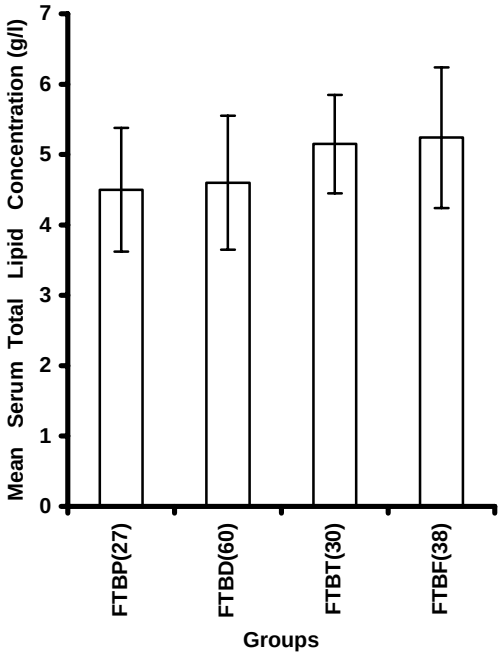

Fig. 2: Mean Serum Total Lipid Concentrations for Different Groups of TB Patients and Control (number in bracket = number sampled)

Although there were differences in concentrations between FTBP and FTBD and between FTBF and FTDT, these differences were not significant ($p>0.05$).

The comparison of mean serum total cholesterol concentrations of individual groups with different weight ranges (Table 2) indicates that people of 76kg and above displayed elevated mean serum total cholesterol concentration in all the groups. Mean serum total cholesterol concentrations of FTBP group in all the weight ranges were significantly lower than that of FTBF group ($P < 0.05$). In FTBD group the mean serum total cholesterol concentrations of the members is significantly lower ($P < 0.05$) than that of members of FTBF group at weight ranges 31-45, 46-60 and 61-75kg.

The comparison of the mean serum total lipid concentrations of different groups at different age ranges (Table 3) revealed that FTBF and FTBT groups consistently had higher mean total lipid levels in all the age ranges except at 31-45 years, where the FTBD group manifested the highest mean total lipid concentrations. It was also observed that among all the age ranges, there were significant decreases ($P< 0.05$) of the total lipid in FTBP group when compared to that of the control (FTBF). Significant decrease ($P< 0.05$) in total lipid levels was also observed in FTBD group when compared with that of the FTBF group at age ranges 16-30, 46-60, and 61 and above years. There was also a significant decrease ($P< 0.05$) in lipid levels of FTBT group when compared to FTBF group at the age range of 16-30 years. However, the decrease observed in patients who are not yet under treatment (FTBP) does not show any

Table 1: Mean serum total cholesterol concentrations of tuberculosis patients for different groups at different age ranges

Age Range (Years)	Total Cholesterol concentration for different groups (mg/dl)			
	FTBF	FTBP	FTBD	FTBT
16-30	155.82 ± 10.28	140.74 ± 8.77*	136.29 ± 9.92*	155.33 ± 13.45
31-45	166.67 ± 12.82	136.50 ± 12.36*	154.16 ± 11.85*	162.56 ± 14.28
46-60	185.19 ± 11.20	132.10 ± 8.69*	142.15 ± 10.24*	172.22 ± 16.85
61 & above	189. 54 ± .10.32	141.55 ± 930*	144.72 ± 7.86*	166.67 ± 10.43

Asterisk (*) indicates values that were significantly lower (p<0.05) than their corresponding controls.

Table 2: Mean serum total cholesterol concentrations for different groups at different weight ranges

Weight Range (Kg)	Total Cholesterol for Different Groups in (mg/dl)			
	FTBF	FTBP	FTBD	FTBT
31-45	165.10 ± 15.57	141.65 ± 7.44*	141.00 ± 10.57*	159.5 ± 16.20
46-60	168.00 ± 18.34	132.40 ± 10.00*	132.00 ± 9.79*	168.00 ± 17.50
61-75	168.50 ± 18.75	133.30 ± 9.07*	143.00 ± 13.10*	159 ± 13.20
76 &Above	187.80 ± 17.37	155.80 ± 9.90*	188.00 ± 6.03	163.00 ± 19.00

Asterisk (*) indicates values that were significantly lower (p<0.05) than their corresponding controls.

Table 3: Mean serum total lipid concentrations for different groups at specific age range

Age Range (Years)	Total Lipid Levels for Different Groups in (g/l)			
	FTBF	FTBP	FTBD	FTBT
16-30	5.32 ± 0.64	4.55 ± 0.69	4.37 ± 0.79	4.84 ± 0.84
31-45	5.37 ± 0.65	4.46 ± 0.39	5.52 ± 0.54	4.99 ± 0.47
46-60	5.73 ± 0.81	4.33 ± 0.58	3.82 ± 0.86	5.86 ± 0.78
61 & Above	5.64 ± 0.78	4.22 ± 0.80	5.00 ± 0.67	5.86 ± 0.78

Asterisk (*) indicates values that were significantly lower (p<0.05) than their corresponding controls.

Table 4: Correlations existing between age and total serum cholesterol level for different groups of tuberculosis patients

		Age	FTBF	FTBP	FTBD	FTBT
Age	Pearson Correlation	1.000	.977*	-.058	.230	.793
	Sig. (2-tailed)	.	.023	.942	.770	.207
	N	4	4	4	4	4
FTBF	Pearson Correlation	.977*	1.000	-.239	.158	.893
	Sig. (2-tailed)	.023	.	.761	.842	.107
	N	4	4	4	4	4
FTBP	Pearson Correlation	-.058	-.239	1.000	-.232	-.650
	Sig. (2-tailed)	.942	.761	.	.768	.350
	N	4	4	4	4	4
FTBD	Pearson Correlation	.230	.158	-.232	1.000	.244
	Sig. (2-tailed)	.770	.842	.768	.	.756
	N	4	4	4	4	4
FTBT	Pearson Correlation	.793	.893	-.650	.244	1.000
	Sig. (2-tailed)	.207	.107	.350	.756	.
	N	4	4	4	4	4

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

significant difference (p>0.05) when compared with those under drugs (FTBD).

Tables 4 and 5 indicate that weight and age are positively correlated to total serum cholesterol level for all the groups of TB patients except for FTBP group where total serum cholesterol was negatively correlated to age. This indicates that as people advance in age and increase in weight, their serum cholesterol levels tend to increase.

Discussion

Results of this study indicate that hypocholesterolemia is a common characteristic symptom of tuberculosis. This corroborates the earlier works done by Perez-Guzman *et al.* (2002).

Hypocholesterolemia in tuberculosis patients is not surprising, given that cholesterol is one of the major constituents of the plasma membrane and of plasma lipoproteins which could be attacked by excess reactive oxygen species (ROS) generated during tuberculosis infection (Nwaka and Uzoegwu, 2005) since reduced levels of cholesterol in cells during other disease states such as in sickle erythrocyte membrane could be enhanced by its susceptibility to free radical attack (Das and Nair, 1980). But according to Leung *et al.,* (2007), obesity is associated with lower risk of tuberculosis while cholesterol rich diet accelerates treatment of tuberculosis (Perez-Guzman *et al.,* 2002). From the above observations, cholesterol could therefore be depleted during the progress of tuberculosis while hypocholesterolemia could also be a predisposition of tuberculosis patients.

Table 5: Correlations existing between weight and total serum cholesterol level for different groups of tuberculosis patients

		Weight (kg)	FTBF	FTBP	FTBD	FTBT
Weight (kg)	**Pearson Correlation**	1.000	.851	.516	.781	.047
	Sig. (2-tailed)	.	.149	.484	.219	.953
	N	4	4	4	4	4
FTBF	**Pearson Correlation**	.851	1.000	.860	.966*	.147
	Sig. (2-tailed)	.149	.	.140	.034	.853
	N	4	4	4	4	4
FTBP	**Pearson Correlation**	.516	.860	1.000	.938	-.111
	Sig. (2-tailed)	.484	.140	.	.062	.889
	N	4	4	4	4	4
FTBD	**Pearson Correlation**	.781	.966*	.938	1.000	-.089
	Sig. (2-tailed)	.219	.034	.062	.	.911
	N	4	4	4	4	4
FTBT	**Pearson Correlation**	.047	.147	-.111	-.089	1.000
	Sig. (2-tailed)	.953	.853	.889	.911	.
	N	4	4	4	4	4

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

In this situation tuberculosis patients may be excluded from heart attack or atherosclerosis, which could be caused by hypercholesterolemia. Cholesterol rich diet could therefore be incorporated in the treatment/management of tuberculosis patients. The observation of higher mean serum cholesterol level in the patients above 60 years of age could be attributed to the general rise of cholesterol level associated with ageing, or genetic factors (Wyler, 1982) or dietary factor (Eluwa *et al.*, 1987).

Also in this study, it was observed that cholesterol level is directly proportional to body weight in both tuberculosis patients and normal individuals (Table 2). This is in consonance with the general observation that increase in weight is associated with increased cholesterol level. This result has lent support to the association of hypocholesterolemia with tuberculosis disease. Moreover, the result of this study further indicates that there were reduced mean serum total lipid levels in the TB patients of groups FTBP and FTBD when compared with those of treated (FTBT) and the normal control (FTBF) groups. The effect of the lipid peroxidation on tuberculosis patients (Nwaka and Uzoegwu, 2005) could have led to the significant depletion of their total lipids which in turn, could have led to loss of weight, one of the most outstanding symptoms usually observed in tuberculosis diseases state.

Furthermore, as could be observed in Table 2 there was reduction of total lipid concentration in older tuberculosis patients than in younger ones. However, such a reduction is more pronounced in older patients who were not yet given any drug. This result could suggest enhanced lipid peroxidation in older than in younger TB patients. Moreover, in the normal controls and treated patients, the level of total lipid seem to increase from younger to older people indicating gradual accumulation of lipids in the individuals as they advance in age.

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