ISSN: 2977-6139

Research Article

Open Access Journal of Pediatrics Research

Sociodemographic Characteristics and Serum vs Salivary Lipid Patterns

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Received: August 12, 2025; **Accepted:** August 14, 2025; **Published:** August 25, 2025

ABSTRACT

This is a novel study investigating the relationship between the socio-demographic characteristics and the serum and salivary lipids, in the phase of acquisition of a trend of an unhealthy lifestyle increasing the risk of dyslipidaemia in the new generation.

Prevalence of dyslipidaemia is rising especially in the developing world, where 80% are said to be at risk for dyslipidaemia. Dyslipidaemia can be traced to childhood for any adult suffering complication from dyslipidaemia, and hence, influencing this study on the sociodemographic characteristics of serum and salivary lipids among apparently healthy primary school children aged 5-12years in Sokoto, Nigeria. To ascertain the socio-demographic risk and as well as how it affects the salivary lipids. In an attempt to show the relationship between the 2 parameters and to establish their use interchangeably.

Saliva is secreted by the salivary gland, and as a screening medium, saliva offers more advantages over serum for the determination of lipid levels due to non-invasive nature of collection, reduced infectious risk, and ease with analysis. Its user-friendly nature would be more acceptable especially in children.

Introduction

Saliva can be made a sample of choice for diagnostic and treatment purposes; therefore, it requires investigation to find the biomolecules present in saliva during a normal healthy state. In the human body, lipids are important for the physiological and pathological processes, and laboratory diagnosis of lipid profile is very important, traditionally, it is tested using the serum samples. However, the use of saliva in investigating lipid profile abnormalities is gaining momentum in modern medicine [1, 2].

Lipid profile assay is important in children, due to the rising burden of dyslipidaemia drifting towards the developing world as previous studies have shown an increasing trend 14, %4 - 60% of childhood and adolescent dyslipidemia in the developing world [3-5]. This is attributed to continuous modernization and technological advancement bringing about rapid lifestyle changes, with increasing consumption of fast food, sedentary lifestyle and intake of refined food products [6-10]. Other reasons include lack of exercise, low fiber diet, obesity and smoking, etc [1-3].

The AAP recommends lipid screening of children younger than 9 years only if they have strong family history of lipid [1]. However, the 2011 experts on integrated guidelines for cardiovascular risk reduction on lipid screening in childhood and adolescence endorsed universal screening for all children and adolescents to identify dyslipidemia at an early age of 2 years. For children with obesity, their first cholesterol test should be after 2 years, but not later than 10 years of age [11].

Globally, the prevalence of dyslipidemia worldwide was estimated to be 39% in adults (World Health Organization), 2008 [12]. Overall, it causes 2.6 million deaths (4.5 per cent of total) and 29.7 million disabilities in adults worldwide [12]. Global prevalence in children was not stated in the literature consulted, this claim was also revealed by Sultan et al, in their 2014 study, due to low incidence of complications in children such as hypertension and stroke, which are often seen in adult life, these features are not regularly researched for in children [13,14].

Bibiloni et al in Mexico found that adolescents with high body mass index were more likely to have at least one abnormal lipid

Citation: Taibat A Raji, Usman Muhammad Sani, Modupe Omoshalewa Ugege, Ben Onankpa. Sociodemographic Characteristics and Serum vs Salivary Lipid Patterns. Open Access J Ped Res. 2025. 2(2): 1-7. DOI: doi.org/10.61440/OAJPR.2025.v2.16

level other studies supports this findings [15-19]. However, the results from the above study findings were similar to Furtado et al. findings in Portuguese, where they showed that at least one abnormal lipid parameter was found in 65% of normal weight, 73 % of overweight and 81% of obese [20,21].

These studies only considered the adolescent age groups only which and therefore cannot be representative of all the paediatrics age groups. Moreso, using serum lipid profiling alone for repeated lipid testing may cause a lot of anxiety and can affect compliance to follow-up. The salivary medium approach may offer a user-friendly approach to testing and follow-up.

Latery et al, in Ghana, found that the levels of dyslipidemia (HDL, LDL, and TC/HDL-C ratio) were higher among overweight/obese compared to normal-weight children [22]. The prevalence in the above Ghana study is much lower compared to other African studies [5,23,24].

In a related cross-sectional school-based study in Lagos, Nigeria, Disu et al, also showed prevalence to be rising in their study among which cut across socio-economic class and more among the overweight and obese [18]. They also found dyslipidaemia to be preponderant among females, however, this study also contradicts the findings in the above Mexico study which suggested equal gender prevalence [15]. All the studies presented were carried using the traditional serum lipids, some studies in the developed words have already adopted the use of salivary lipids for analyzing lipids profile, but again most of this studies was carried out in adult population [7,9,25-30]. This why we explored the relationship between sociodemographic characteristics with serum and salivary lipids among apparently healthy primary school children aged 5-12years in Sokoto, Nigeria.

Methods

The study design was descriptive cross-sectional among 200 apparenly healthy primary school children from Arkilla ward, Wamakko LGA, Sokoto.

The participating schools were selected through a multistage random sampling technique. Samples were selected from three public and two private primary schools within the study area by a simple random sampling technique. There are 142 public primary schools within the 3 LGAs and 83 private primary schools (1.7:1), all are co-education schools.

Inclusion Criteria

1. Healthy primary school children between the ages of 5-12 years.
2. Signed informed written consent by the parent and assent from the subject beyond 7 years.
3. Children not on any prolonged medications, such as steroids, insulin, and anticonvulsants, to mention but a few, to avoid interference of these drugs with lipid level in saliva, as it was known to affect lipid content in saliva [15].

Exclusion Criteria

1. Children with prolonged illnesses lasting beyond 2 weeks or chronic diseases such as diabetes mellitus, sickle cell diseases, bronchial asthma, cardiovascular diseases, to mention a few.
2. Use of any medication during the time of the study, indicates the child is sick.

Procedure

Socio-demographic features, as well as serum and salivary samples results were recorded in a proforma. The lipid profile analyzed included; total cholesterol (TC), Triglyceride (TG), low-density lipoproteins (LDL), and high-density lipoproteins (HDL).

Overnight fasting was ensured, while subjects were seated calmly after anthropometry measurements.

The very young were considered first for the procedure to enable them break their fast soon enough.

Salivary sample collection always preceded saliva collection to avoid prior anxiety, and alteration of the salivary lipid content. Bottles are coded immediately to avoid a mix-up.

Samples collection in separate rooms to avoid anxiety and hence falsely elevated measurements by on-lookers waiting for their turn.

Lipid Testing

Lipid analysis was carried out using a fully automated analyzer based on a spectrophotometric principle using kits obtained from ERBA diagnostics (Centronic GmbH, Germany, Batch no.85456/Kit LOT CF03201H). The serum and salivary lipid profile were analyzed on the same day of collection of the sample of blood and saliva to avoid damage to the samples. Quality assurance was ensured.

Data Analysis

Data entry and analysis were done using the IBM SPSS version 25.0. Data were cleaned, checked for outliers and wrong entries or duplications of entries.

A frequency distribution table was used to analyze the socio-demographic features, and an X2 test was used to determine the relationship among variables. ANOVA was used to determine the mean values. Regression analysis was used to ascertain the significant relationship between serum and salivary lipids.

Results

The younger aged categories were more represented 42.5%, with slightly. more females 57.5%. the middle class represent 81.5%, while the majority had normal BMI 85.5%

Table 1: Socio-demographic characteristics

Variables		Frequency(n)	Percentages (%)
Age (in years)			
1.	**5-7**	85	42.5
2.	**8-10**	65	32.5
3.	**> 10**	50	25.0
Gender			
1.	**Males**	85	42.5
2.	**Females**	115	57.5

Religion			
1.	**Islam**	161	80.5
2.	**Christianity**	39	19.5
Tribe			
1.	**Hausa**	128	64.0
2.	**Yoruba**	36	18.0
3.	**Igbo**	9	4.5
4.	**Others**	27	13.5
Socio-economic status			
Upper class		11	5.5
Middle class		163	81.5
Lower class		26	13.0
BMI percentile			
<4.9th		9	4.5
5th-84.9th		171	85.5
85-94.9th		20	10
>95th		0	0.00

Table 2 : Serum lipids and Age Pattern

LIPIDS	TC n(%)	TG n(%)	HDL n(%)	LDL n(%)
VARIABLES9(Age)				
SERUM LIPIDS				
5-7				
Desirable	78(91.8)	57(67.1)	50(58.8)	67(78.8)
Borderline	4(4.70)	21(24.7)	-	10(11.8)
Undesirable	3(3.50	7(8.20)	35(41.2)	8(9.40)
Total	85(42.5%)	85(42.5)	85(42.5)	85(42.5)
X2	2.444	4.476		
P	0.655	0.345		
8-10				
Desirable	58(89.2)	35(53.8)	32(49.2)	53(81.5)
Borderline	6(9.20)	20(30.8)		8(12.3)
Undesirable	1(1.5)	10(15.4)	33(50.8)	4(6.20)
Total	65(32.5%)	65(32.5)		65(32.5)
>10				
Desirable	46(92.0)	26(52.0)	28(56.0)	38(76.0)
Borderline	2(4.0)	17(34.0)		6(12.0)
Undesirable	2(4.0)	7(14.0)	22(44.0)	6(12.3)
Total	50(25.0)	50(25.0)		50(25.0)
X2	2.444	4.476	1.396	1.220
P	0.655	0.345	0.497	0.875

Salivary lipids and age

Table 3: Salivary lipids and age pattern

SALIVARY LIPIDS				
VARIABLES(Age)				
5-7				
Desirable	56(65.9)	68(80.0)	18 (21.2)	64(75.3)
Borderline	10(11.8)	8(9.40)	-	2(2.40)
Undesirable	19(22.4)	9(10.6)	65(76.5)	19(22.4)
Total	85(42.5)	85(42.5)	85(42.5)	85(42.5)
8-10				
Desirable	49(75.4)	46 (70.8)	45(69.2)	50(76.9)
Borderline	7(10.8)	11(16.9)		1(1.50)
Undesirable	9(13.8)	8(12.3)	20(30.8)	14(21.5)
Total	65(32.5)	65(32.5)	65(32.5)	65(32.5)
>10				
Desirable	32(64.0)	28(56.0)	40(80.0)	32(64.0)
Borderline	5(10.0)	4(8.0)	-	1(2.0)
Undesirable	13(26.0)	18(36.0)	10(20.0)	17(34.0)
Total	50(25.0)	50(25.0)	50(25.0)	50(25.0)
X2	3.060	18.172	2.443	3.045
P	0.548	0.001	0.295	0.550

The serum and salivary pattern showed similar trend with statistical significance for TG

Table 4: Mean age lipid values and lipids

	TC	TG	HDL	LDL
SERUM LIPIDS Age (years)				
5-7	132.11	79.34	47.59	71.74
8-10	132.55	90.06	45.05	65.51
<10	130.26	93.16	49.30	79.56
F- test	0.067	3.760	1.094	1.818
p value	0.935	0.025	0.337	0.153
SALIVA LIPIDS				
5-7	40.31	28.39	12.34	16.45
8-10	38.97	31.37	11.86	18.74
<10	42.18	30.11	13.48	20.42
F- test	1.410	6.979	1.218	1.455
p value	0.545	0.001	0.295	0.550

TC- Total cholesterol, TG- Triglyceride, HDL- High density lipoprotein, F-test -, LDL- low density lipoproteins, p value

Table 5: Serum Lipids and Gender Pattern

LIPIDS	TC n(%)	TG n(%)	HDL n(%)	LDL n(%)
VARIABLES (sex)	**TC**	**TG**	**HDL**	**LDL**
SERUM LIPIDS				
Male				

Desirable	77(90.6)	53(62.4)	52(61.2)	65(76.5)
Borderline	5(5.90)	25(29.4)		12(14.1)
Undesirable	3(3.50)	7(8.2)	33(38.8)	8(9.4)
Total	85(42.5)			
Female				
Desirable	105(91.3)	65(56.5)	58(50.4)	93(80.9)
Borderline	7(6.1)	33(28.7)		12(10.4)
Undesirable	3(2.6)	17(14.8)	57(49.6)	10(8.7)
Total	115(57.5)			
X2	0.144	2.036	2.279	0.700
P	0.930	0.361	0.705	0.705
SALIVARY LIPIDS				
VARIABLES (Gender)				
Male				
Desirable	57(67.1)	70(82.4)	20(23.5)	66(77.6)
Borderline	9(10.6)	5(5.9)		2(2.35)
Undesirable	19(22.4)	10(11.8)	65(76.5)	17(20.0)
Total	85(100)			

Table 6: Mean lipids values and Gender

The serum and salivary lipid values characteristically show similar trend

Lipids	TC	TG	HDL	LDL
Gender				
Male	133.42	83.65	47.33	70.95
Female	130.58	88.23	47.09	72.20
t- test	0.679	-1.007	0.08	-0.226
p value	0.411	0.315	0.914	0.822
SALIVA LIPIDS				
SEX				
Male	40.31	28.39	12.34	16.45
Female	38.97	31.37	11.86	18.74
t- test	0.601	-1.481	0.563	-1.296

The table below showed dyslipidaemia to be more prevalent with the HDL fraction, with the upper class having the most undesired fraction (54%), closely followed by the lower class (53.8%)

Table 7 : Serum Lipids and Socio-economic statuses pattern

Social class	TC mg/ dl(%)	TG mg/ dl (%)	HDL mg/ dl (%)	LDL mg/ dl (%)
Upper				
Desirable	7(63.6)	5(45.5)	5(45.5)	9(81.8)
Borderline	0(00.0	4(36.4)		2(18.2)
Undesirable	4(36.4)	2(18.2)	6(54.0)	0(0.00)
Total	11(100)			
Middle				
Desirable	149(91.4)	103(63.2)	93(57.1)	129(79.1)
Borderline	8(4.9)	42(25.4)		18(11.0)
Undesirable	6(3.7)	18(11.0)	70(42.9)	16(9.8)
Total	163(100)			
Lower				
Desirable	26(100)	12(46.2)	12(46.2)	20(76.9)
Borderline	0(0.00)	14(53.8)		4(15.4)
Undesirable	0(0.00)	0(0.00)	14(53.8)	2(7.7)
Total	26(100)			
X2	21.288	6.840	1.505	1.909
P	0.00	0.100	0.471	

Similarly, using the saliva HDL had the highest dyslipidaemia fraction cutting across all the social classes

Table 8 : Salivary Lipids and SES patten

Upper class				
Desirable	6(54.5)	9(81.8)	3(27.3)	10(90.9)
Borderline	0(0.00)	1(9.1)	-	0(0.00)
Undesirable	5(45.5)	1(9.1)	8(72.7)	1(9.1)
Total	11(100)			
Middle class				
Desirable	107(65.5)	117(71.8)	40(24.5)	117(71.8)
Borderline	22(13.5)	20(12.3)	-	4(2.5)
Undesirable	34(20.9)	26(16.0)	123(75.5)	42(25.7)
Total	163(100)			
Lower class				
Desirable	24(92.3)	16(61.5)	5(19.2)	19(73.1)
Borderline	0(0.00)	2(7.7)	-	0(0.00)
Undesirable	2(7.7)	8(30.8)	21(80.8)	7(26.9)
Total	26(100)			
P value	0.011	0.370	0.813	0.624
X2	13.084	4.274	0.415	2.615

Mean Values of serum and salivary lipids with the socio-economic status shows similar trend

Table 9 : Mean values of lipids and SES

	TC	TG	HDL	LDL
SERUM LIPIDS				
Social class				
Upper Class	159.01	100.36	52.27	66.73
Middle Class	132.36	97.69	47.05	70.70
Lower Class	116.69	86.28	45.92	79.85
F- test	6.163	3.460	0.670	0.726
p value	0.003	0.033	0.513	0.485
SALIVA LIPIDS				
Social class				
Upper	40.64	30.64	13.18	12.00
Middle	40.26	29.41	11.83	17.85

Lower	34.54	34.19	13.08	19.69
F- test	1.551	1.303	0.696	1.518
p value	0.215	0.274	0.500	0.222

Table 10 : Serum Lipids and BMI

BMI Serum	TC mg/ dl(%)	TG mg/ dl(%)	HDL mg/ dl(%)	LDL mg/ dl(%)
<4.9th				
Desirable	8(88.9)	4(44.4)	5(55.6)	7(77.8)
Borderline	1(11.1)	3(33.3)		1(11.1)
Undesirable	0(0.00)	2(22.2)	4(44.4)	1(11.1)
Total	9(100)			
5th -84,9th				
Desirable	156(91.2)	103(60.2)	92(53.8)	134(78.4)
Borderline	9(5.30)	49(28.7)		20(11.7)
Undesirable	6(3.50)	19(11.1)	79(46.2)	17(9.9)
Total	171(85.5)			
85th -94,9th				
Desirable	18(90)	11(55.0)	13(65.0)	17(85)
Borderline	2(10.0)	6(30.0)		3(15)
Undesirable	0(0.00)	3(15)	7(35.0)	0(0.00)
Total	20			
>95th	0(0.00)	0(0.00)	0(0.00)	0(0.00)
X2	2.105	1.540	0.909	2.284
P	0.716	0.820	0.635	0.684

Table 11 : Salivary lipids and BMI

BMI	TC	TG	HDL	LDL
<4.9th	6(66.7)	5(55.6)	3(33.3)	6(66.7)
Desirable	1(11.1)	2(22.2)	0(0.00)	0(0.00)
Borderline	2(22.2)	2(22.2)	6(66.7)	3(33.3)
Undesirable				
Total	9(100)			
5-84.9th				
Desirable	121(70.8)	119(69.6)	42(24.6)	122(70.8)
Borderline	14(8.19)	21(12.3)	0(0.00)	4(2.3)
Undesirable	36(21.1)	31(18.1)	129(75.4)	45(26.3)
Total	171(100)			
85-94.9th				
Desirable	10(50.0)	18(90.0)	3(15.0)	18(90.0)
Borderline	7(35.0)	0(0.00)	0(0.00)	0(0.00)
Undesirable	3(15.0)	2(10.0)	17(85.0)	2(10.0)
Total	20			
>95th	0(0.00)	0(0.00)	0(0.00)	0(0.00)
P value	13.168	5.454	1.348	3.752
X2	0.010	0.244	0.510	0.441

Mean values showed similar trend, though no statistical significance

Table 12 : Mean values of lipids and BMI

	TC	TG	HDL	LDL
SERUM LIPIDS				
BMI percentile				
<4.9th	130.56	96.22	46.67	64.56
5-84.9th	131.80	85.12	46.51	73.62
85-94.9th	132.30	91.75	53.25	58.20
F- test	0.008	0.850	1.680	1.605
p value	0.992	0.429	0.189	0.203
SALIVA LIPIDS				
BMI percentile				
<4.9th	38.11	30.00	14.44	15.67
5-84.9th	39.53	30.25	11.77	18.39
85-94.9th	40.20	27.55	13.50	13.40
F- test	0.055	0.524	1.515	1.596
p value	0.946	0.593	0.222	0.205

Table 13 shows moderate an fair correlations for the serum and salivary lipids which is statistically significant.

Table 13: Regression analysis of serum and salivary lipids

Lipid test (Serum Vs salivary)	Constant (a)	Unstandardized coefficient (b)	Standardized coefficient (beta)	P	95% CI Upper/lower boundary
TC	11.049	0.216	0.483	<0.001	3.564/5.534
TG	5.198	0.289	0.651	<0.001	0.860/4.536
HDL	2.446	0.204	0.536	<0001	0.207/4.684
LDL	6.838	0.152	0.434	<0.001	3.611/5.064

Discussion

This study highlights the importance of friendly approach to clinical practice, while identifying the relationship between serum and salivary lipids and emphasizing on the migration from the use of the traditional serum medium of lipid testing to a more acceptable approach of using the salivary lipids, which is easier and more reproducible as much as needed without causing any form of anxiety to the clients.

The sociodemographic characteristics of subjects considered the relationship between age, sex and SES with serum and salivary lipids. Using the serum, age categories 1 (5-7years) had the highest count for those without disease for all the lipid parameters, except for HDL which has preponderance for age category 3 (>10 years) though not statistically significant. However, using the saliva, similar pattern was observed in this age category (1), only for TG fraction of the panel, other lipid panel shows variable age categories with higher normal values without statistical significance. Aage category 2 (8-10 years) had the highest normal values for TC and HDL and age category 3 had the higher normal values for LDL. age category 1 years had the largest study population (42.5%) for the age groups, this could account for the drift in their favor. furthermore, age category 2, had the higher figure for diseased fraction for TG, and HDL. These findings are not statistically significant (p> 0.005. Other studies. studies are in stated similarly, however, Chandar et al showed a statistically significant findings across all the socio-demographic features tested, though statistical tools were similar, fasting was stated for only 2 hours and these gave a different overall finding [14,18,31].

Relationship between gender and serum lipids revealed the females having higher mean values for TG and LDL, male had higher mean values for TC, however, findings are not statistically significant (p> 0.005) and hence as female outweigh the male in population (57.5%), This could account for the drift in their favor. Similarly, other studies also revealed similar findings, and concluded that the higher findings in female may be due to higher numerical figure as compared to the male counterparts, but not necessarily due to an intrinsic factor, male to female ratio in current study was 1:1.4 [4, 5, 32, 33]. using the saliva, similarity exist with only the TG and HDL also showing male preponderance for normal values, as against the serum version, male also top the remaining lipid fractions fir normal ranges. Findings here are also not statistically significant.

Hence, to a large extent there are no differences between socio economic class and lipid profile, except for TC, TG, HDL and SES, with serum and salivary lipids, as well as age and TG and salivary lipids. The higher undesirable values observed in the upper class (especially for HDL) could be attributed to lifestyle and nutrition.

The mean salivary lipid profile reflects serum lipid values. An increase in the mean serum lipid values will lead to a corresponding increase in salivary mean values.

Serum and salivary lipids where correlated, and there were statistically significant positive moderate correlations between serum and salivary lipids; TC, HDL, and LDL, and a significantly strong correlation between serum and salivary TG. In essence, as the serum lipids rises there was a commensurate rise in salivary lipids. This strength of rise is higher with TG fraction of lipid panel, followed by HDL, TC and LDL had similarly moderate strength of association. These finding was similar to Singh et al, where they found moderate correlations between serum and salivary TC, TG, HDL. Though they found a low, but still positive correlation between serum and salivary LDL. Similarly, their findings were statistically significant. The strong correlation with TG also conforms with Al-Rawi et al3 and Rageswari et al112 study and suggested that lipid fractions especially the TG can be assessed in saliva and may be used alone or in combination with other lipid parameters for monitoring disease activity and severity in such studies.3 this level of association can be applied clinico-labouratory wise, salivary lipids can used to assess client/patients who needs lipid profile test. Therefore, the need to prick the child may be abolished since the level of association is strong enough. The level of rise depends on factors such as ill health, especially from protracted illnesses, chronic diseases such as diabetes mellitus, asthma, surgery, oral diseases, malignancy least are in exhaustive. In a healthy state, the correlation is also affected by eating, brushing, medications. Levels of LDL, and TG assay needs at least a 12 hours fast for accurate detection either as an isolation study or in combination with other lipid profile test. Though other lipid parameters (TC, HDL) can be assessed alone without fasting, but if as a combination test that combines all other parameters, 12 hours fasting is requires.

Conclusion and Recommendation

In this study, the relationship between serum and salivary lipids showed similar but non-statistical relationship.

There are no significant differences between sex and serum and salivary lipid, however, to some extent there was statistically significant difference as related to age and socio-economic status (SES) with lipid level, especially for TC and TG, using both serum and saliva.

Means values shows similar trend across all boarders

Correlation analysis shows significant moderate correlation

Recommendation

- Saliva medium may be employed for lipid testing
- There is need to design a nomenclature for salivary lipid testing
- A collaborative study may be required for validation of use of saliva, implementation and evaluation.
- Involvement of the governmental bodies and major stakeholders is required early in order to achieve a sustainable project.

Limitation of Study

1. The need to prove without reasonable thought that all subjects fasted especially the younger age (< 10years), a more reliable and evidence-based approach such as admitting the child in hospital to be directly observed, is required.
2. Inability to separate salivary lipids de novo, from ultra-filtrated plasma fractions.

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