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Research Article

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Prevalence of Dyslipidaemia, Comparing Both Serum and Salivary Lipids Among Primary School Children Aged 5 to 12years

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ABSTRACT

Dyslipidaemia is a harbinger cardiovascular disease (CVD) and with the rising prevalence especially in the developing world, where 80% are said to be at risk for dyslipidaemia is alarming. Major factor implicated included adoption of unhealthy lifestyle, consumption of junk food and refined products leading to obesity, and related factor. However pathological factors from diseases such as nephrotic syndromes and familial cases also are implicative. Dyslipidaemia in adult can be traced to childhood and this attract early intervention before complications set in. lipid test is not a routine test, there identification of the at risk for complication may be missed, especially if there no implicative clinical features. The lipid test is often carried out using the serum, however, the use of saliva is secreted by the salivary gland, and as a screening medium, it 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 acceptable by especially children and with this approach lipid test may be offered routinely and can be sustained for screening and follow up basis. This influences this study on the prevalence of dyslipidaemia and sociodemographic characteristics of serum and salivary lipids among apparently healthy primary school children aged 5-12years in Sokoto, Nigeria.

Objectives: To determine the prevalence of dyslipidaemia comparing both serum and salivary lipids among apparently healthy primary school children aged 5-12years in Sokoto, Nigeria.

Settings and Design: Descriptive and cross-sectional.

Materials and Methods: A total of 200 apparently healthy primary school children aged 5-12 years. Who had no medical complaints or any major medical condition were recruited. The parameters assessed included serum and salivary; total cholesterol (TC), triglycerides (TG), high-density lipoproteins (HDL), and low-density lipoproteins (LDL). This was a descriptive study, from 3 public schools and 2 private schools in Sokoto using a multistage sampling technique. A structured study proforma was used for data collection. Lipid test was done using the conventional enzymatic spectrophotometric method of analyzing lipid. p value ≤ 0.05 was taken as statistically significant.

Statistical Methods: descriptive analysis, test for associations and comparing means (ANOVA)

Results: The mean age of the subjects was 8.4 (±2.29) years with a male to female ratio of 1:1.4. The prevalence of dyslipidemia among study group was 3%, 12%, 45%, and 9% for TC, TG, HDL and LDL respectively, with an overall prevalence of 57.0%, for serum fraction. The salivary fraction prevalence obtained was 20.5%, 17.5%, 76.0%, and 25.0%, for TC, TG, HDL, and LDL respectively, with an overall prevalence of 87.5% with variable statistical significance. Statistical significant findings were obtained for TC and TG, for serum lipid fractions. For salivary lipid fraction statistical significance was associated with social class and age respectively.

Conclusion: Prevalence of dyslipidaemia is high using both serum and saliva

Recommendation: screening for dyslipidaemia should be emphasized in primary schools to identify these at risk for dyslipidaemia at an early age.

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Keywords: Apparently Healthy, Serum, Saliva, Prevalence, Socio-Demography

Abbreviations

AAP	:	American Academy of Paediatrics
AHA	:	American Heart Association
APO-A	:	Apo Protein –A
VD	:	Cardiovascular Disease
ERBA	:	Electronic Reagent Biochemical Analyzer
FFA	:	Free Fatty Acids
GmbH	:	German phrase: Gesellschaft mit beschrankter hafting (Company with limited liability)
HDL	:	High Density Lipoproteins
HMG-CoA	:	Beta Hydroxyl-Beta Methylglutaryl-CoA
IDL	:	Intermediate Density Lipoproteins
IHCIS	:	Integrated Health Care Information System
LDL	:	Low-Density Lipoproteins
L-CAT	:	Lecithin Acetyl Cholesterol transferase
LGA	:	Local Government Area
NCEP	:	National Cholesterol Educational Program
NHANES	:	National Health and Nutrition Examination Survey
NHLBI	:	National Heart Lung and Blood Institute
POCT	:	Point of Care Testing
TC	:	Total cholesterol
TG or TGL	:	Triglyceride
UDUS	:	Usman Danfodiyo University Sokoto
UDUTH	:	Usman Danfodiyo University Teaching Hospital
VLDL	:	Very Low-Density Lipoproteins
WHA	:	World Health Assembly
WHO	:	World Health Organization

Introduction

Saliva is a clinically informative, biologic fluid that is useful for novel approaches to prognosis, laboratory, clinical diagnosis, monitoring and management of patients with both oral and systemic diseases. It contains many biomarkers which makes it useful for multiplexed assays and for making important clinical decisions for patient care [1]. Lipids are a diverse group of biological and chemical compounds with a common feature of insolubility in water [2]. Their biological functions are as diverse as their chemistry [2]. The lipid profile typically includes total cholesterol (TC), triglyceride (TGL), high-density lipoprotein–cholesterol (HDL), and low - density lipoprotein cholesterol (LDL-C). In children, dyslipidemia is diagnosed when TC> 200mg/Dl, TGL> 130mg/dl, HDL-C <40mg/dl and LDL-C >130mg/dl [3,4].

Saliva can be a sample of choice for diagnostic and treatment purposes, therefore requires investigation to find the biomolecules present in saliva during a normal healthy state [5]. In the human body, lipids are important for the physiological and pathological processes, and laboratory diagnosis of lipid profile is very important, traditionally using the rum. However, the use of saliva in investigating lipid profile abnormalities is gaining momentum in modern medicine [1,5]. The use of saliva for lipid assay is preferred over serum, due to several reasons such as ease of specimen's collection, storage and shipping [2,6]. The use of saliva specimen is more patient- friendly, because it is non-invasive, thus associated with less anxiety and discomfort when taking the sample. The sample is also reproducible over time and this can ease patient monitoring [7].

Saliva is easier to handle for diagnostic procedures due to non-clotting property, thus manipulation required is lessened and no special equipment is needed for the collection. Furthermore, analysis of saliva may provide a cost - effective approach for the screening of large population [2,6]. Saliva contains various substances and could be functionally equivalent to serum in reflecting the physiologic state of the body, including metabolic variations [8]. Positive correlation has been demonstrated in various studies [2,5,7,9]. With this development, it was worth testing the prevalence's using both the serum and salivary lipids in order to understand their similarities and differences, and to able to infer the results. Before saliva can duly replace serum lipid for screening purposes, demonstrating the prevalence's using both give a better interpretation of previous findings on correlation.

In the developed world, saliva has replaced serum as the preferred fluid in use for various laboratory studies, this is not the case in the developing world where serum samples are still the goal standards used for various studies, even locally in Nigeria. It is imperative to ascertain whether this simple, non-invasive medium can be adopted as an effective and useful tool for evaluating lipid profiles in children, Hence, the study aimed to correlate serum and salivary lipids among healthy primary school children aged 5 to 12 years old.

Methods

The study design was cross-sectional and descriptive. Data were obtained using a structured study proforma, which was pretested in a pilot study conducted among subjects that shared similar characteristics but from different locations. Subjects' and parents' socio-demographic details were obtained, as well as the anthropometry measurements of the subjects. Serum and salivary lipid profiles were tested for their TC, TG, HDL and LDL. Quality assurance was ensured. The study proforma was modified following the pilot study and modifications was made on the proforma, as well as more study assistants were recruited for a swifter and better-coordinated event.

Sampling Technique

The participating schools were selected by multistage random sampling technique. Samples were selected from three public and two private primary schools within the study area by 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. Subjects were recruited from both the public and private schools to increase the external validity of the study. Accurate gender representation was ensured based on ratios of both sex in the schools.

Data Collection

Using a proforma, anthropometry of subjects and socio-demographic character of parent were obtained. Furthermore, serum and salivary samples were taken from each subject for lipid profile analysis after obtaining informed consent from the parents as well as assent from subjects above 7 years. The procedure started with educating the parents and subjects about the collection protocol, meaning; all participants were asked to fast overnight from 10 pm-8 am (10hrs). This was to avoid interference of recent meals with measured levels of LDL, and TG, because levels increase with recent meals. Samples were collected in the morning (7:00 am -9:00 am), in order to allow the subjects, feed soon enough, with the very young being considered first for sample collection.

Fasting in this case is partial, as intake of water was allowed in the morning before the procedure. Samples were collected in the morning as stated above. Subjects were asked to avoid the use of toothpaste in the morning and mouth rinsed with distilled water before collection, in order to remove debris. In order to ensure adherence to the protocol, telephone reminder as well as letter reminder were sent to parent days to field work. For those that fail to adhere to other aspect of the protocol on day of sample collection, in order to avoid drop outs, they were further counselled and given a new appointment on other days at their own convenience for a repeat procedure, and with this step, we were able to reach the sample size estimated. Even after consenting and assenting to participate, frequent visits to the schools and sharing of incentives to subjects (books and writing materials, assorted drinks, and sweets) were carried out, to create rapport with the student, making it a friendlier exercise.

Fasting was prescribed for all subjects, though intake of water was allowed, even the youngest ones were encouraged, they were all provided breakfast by the researcher after samples were collected. Usually, in this environment, by 10pm, most children had already gone to bed. Fasting was stipulated between 10 pm-8 am, which does not disturb their normal circadian rhythm to a large extent. We have already built a good rapport with these pupils and term the day of sample collection a day of challenge and feast. On our part, we ensured that sample collection was set on schedule, as early as 8 am, after anthropometry was taken per pupil. No more than 20 samples were taken per day to avoid prolonged waiting. Additionally, the younger pupils were attended to first, because they are weaker in tolerating hunger. Immediately after sample collection, each pupil was given a breakfast package to break their fast. Samples were collected in a compassionate and friendly manner; the youngest children were pacified with sweets and chocolates.

The classical enzymatic and spectrophotometric method for lipid analysis was employed for the laboratory analysis of samples in this study. Parameters for the serum and salivary lipid profiles measured include total cholesterol (TC), Triglyceride (TG), low-density lipoproteins (LDL), high-density lipoproteins (HDL). Enzymatic methods were used to measure the concentrations of all components of the lipid profile, mainly TC, TG and HDL and LDL cholesterol [10]. 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 the withdrawal of blood and saliva in order to maintain accuracy.

Quality assurance was ensured, and to ensure precision in the lab, control sera with known values were included in every batch of samples analyzed. If the same value for the control sera was obtained, then the precision was ensured. Ethics approval was obtained from the Usmanu Danfodiyo University Teaching Hospital and the Ministry of Health. Permission to carry out the research in the schools was also obtained from the Ministry of Education. Consent from parents as well as assent from subjects above 7 years, written in English and translated in Hausa, was also obtained. Data entry and analysis were done using the IBM SPSS version 23.0. Data were cleaned, checked for outliers and wrong entries or duplications of entries.

Summary statistics were presented as means and standard deviations for quantitative variables, while frequencies and percentages were used for qualitative variables. Arithmetic mean calculations for both serum and salivary lipids were determined, frequency distribution tables were used to present the sociodemographic characteristics of subjects, and recording of values were done for the lipid level categorization. Undesirable lipid status (dyslipidaemia) is defined as high levels of TC (≥200mg/dl), TG (≥130mg/dl), LDL(≥130mg/dl) and low level of HDL (≤ 35mg/dl). Findings were defined as desirable, borderline and undesirable. As shown in the table below according to National Heart, Blood and lung Institute (NHLBI) [11].

Results

Table 1 revealed subjects with at least one abnormal value (Undesirable) contributed to dyslipidemia prevalence.

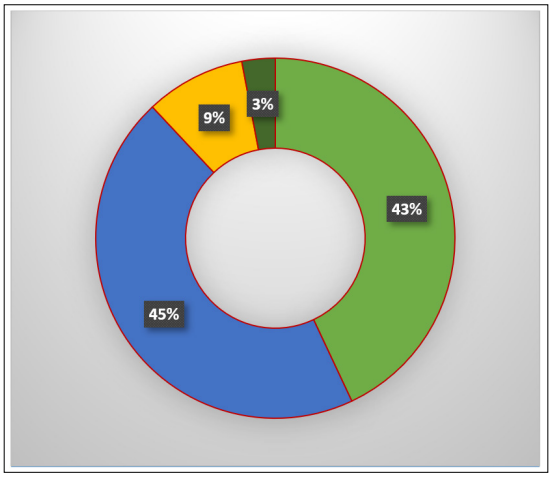
Table 1: Serum and Salivary Lipid Profile Among Subjects

Serum Lipids	Desirable (%)	Borderline (%)	Undesirable (%)
TC	128(91)	12(6.0)	6(3.0)
TG	118(59.0)	58(29.0)	24(12.0)
HDL	110(55.0)	--	90(45.0)
LDL	158(79.0)	24(12.0)	18(9.0)
Salivary lipids			
TC	137(68.5)	22(11.0)	41(20.5)
TG	142(71.0)	23(11.5)	35(17.5)
HDL	48(24.0)	-	152(76)
LDL	146(73.0)	4(2.0)	50(25)

TC-Total cholesterol, TG- Triglyceride, HDL- High density lipoproteins, LDL- low density lipoprotein

Prevalence of Dyslipidaemia: Serum

Figure 1 below revealed 45% had I lipid fraction abnormality, while 9% and 3% had 2 and 3 lipid fractions dyslipidaemia respectively. Non individual had all 4-lipid fraction dyslipidaemia.



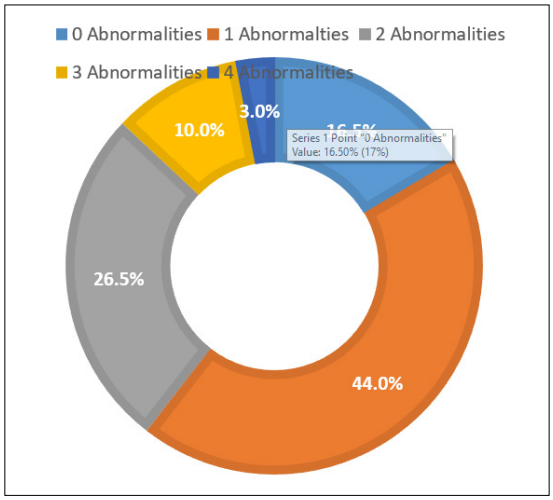
43.0%	No lipid abnormality
45.0%	1 lipid abnormality
9.0%	2 lipid abnormality
3.0%	3 lipid abnormality

Figure 1: Overall serum prevalence among subjects

Prevalence of Dyslipidaemia: Saliva

In figure 2 below, those with 1 lipid fraction dyslipidaemia comprises 44%, 26.55 had 2 combinations of lipid fraction dyslipidaemia, only 10% and 3% had combination of 3 and 4 lipid fraction dyslipidaemia respectively.

In the table 2 below, the prevalence of dyslipidemia by age categories is as shown. Abnormalities of HDL and TG was most prevalent among 8-10 years' age group, 10 (15.3) and 33 (50.8%) respectively, though at a close range with those with ages above 10 years. TC and LDL abnormalities where the most prevalent dyslipidaemia in children above the age of 10 years. However, the differences are not statistically P>0.005.



16.5%	No lipid abnormality
44.0%	1lipid abnormality
26.5%	2 lipid abnormality
10.0%	3 lipid abnormality
3.0%	4 lipid abnormality

The salivary version of dyslipidaemia by age showed that, ages above 10years are more prevalent for all the lipid panels tested, and for TG the findings are statistically significant. Findings are closely similar to that of serum.

Table 2: Prevalence of Serum and Salivary Dyslipidemia by Age Group

Age in years(n)	TC-n (%)	TG-n (%)	HDL-n (%)	LDL n (%)
Serum				
5-7 (85)	3(3.5)	7(8.2)	35(41.2)	8(9.4)
8-10 (65)	1(1.5)	10(15.3)	33(50.8)	4(6.2)
Above 10 (50)	2(4.0)	7(14.0)	22(44.0)	6(12.0)
Total (200)	6(3.0%)	24(12.0%)	90(45.0)	18(9)
$\chi 2$	2.444	4.476	1.396	1.220
P-Value	0.655	0.345	0.497	0.875
Salivary				
5-7	19(22.4)	9(10.6)	67(78.8)	19(22.4)
8-10	9(13.8)	8(12.3)	45(69.2)	14(21.5)
>10	13(26.0)	18(36.0)	40(80)	17(34.0)
$\chi 2$	3.060	18.172	2.443	3.045
P	0.548	0.001	0.295	0.550

TC-Total Cholesterol, TG- Triglyceride, HDL- High density lipoproteins, LDL- Low density lipoproteins, x2- chi square, Df- degree of freedom.

Table 3 below showed that TG and HDL prevalence were higher among females while LDL and TC prevalence higher among males. These findings are not statistically significant (p>0.005). Salivary prevalence for lipids and sex, shows some similarity with serum lipid values, with the female having higher prevalence for TG and LDL, though findings for HDL are at a close range 75.5% and 76.5% for female and male respectively. Similarly, findings are not statistically significant.

Table 3: Prevalence of Serum and Salivary Dyslipidemia and Sex

Sex n(%)	TC	TG	HDL	LDL
Serum				
Male 85(42.5)	3(3.5%)	7(8.2%)	33(38.8%)	8(9.4%)
Female 115(57.5)	3(2.6%)	17(14.8%)	57(49.6%)	10(8.7%)
χ2	0.144	2.036	2.279	0.700
P value	0.930	0.372	0.131	0.705
Salivary				
Male	19(22%)	10(11.8)	65(76.5%)	17(20%)
Female	22(19.1%)	25(21.7)	87(75.7)	33(28%)
χ2	0.315	9.519	0.018	2.008
P value	0.624	0.090	0.894	0.366

TC- Total cholesterol, TG- Triglyceride, HDL- High density lipoprotein, LDL- low density lipoproteins, x2- chi square, p- p value

In Table 4, dyslipidaemia was generally more common among the upper and middle classes as shown below, abnormal TG and HDL were most prevalent among the upper class, while abnormal TC and LDL was more common among those of the middle class. But except for TC and TG findings was not statistically significant. Salivary version on the other hand revealed upper class having the highest prevalence for TC, and for TG, HDL, and LDL, the lower class are more prevalent, ranking closely with middle class for HDL and LDL. Findings are not statistically significant.

Table 4: Prevalence of Serum and Salivary dyslipidemia in relation to socio-economic classification

	Serum lipids			
Social class(n)	**TC (%)**	**TG (%)**	**HDL (%)**	**LDL (%)**
Serum				
Upper (11)	0(0.0)	2(18.2)	6(54.5)	0(0.0)
Middle (163)	6(3)	18(9.0)	70(35.0)	16(8.0)
Lower (26)	0(0.0)	4(2.0)	14(7.0)	2(1.0)
Total (%)	6(3.0)	24(12.0)	90(45.0)	18(9.0)
χ2	6.163	3.460	0.670	0.726
P –value				
	0.030	0.033	0.513	0.485
Salivary				
Upper	5(45.5%)	1(9.1%)	8(72.7%)	1(9.1%)
Middle	34(20.0%)	26(16.0%)	123(75.5%)	42(25.8%)
Lower	2(7.7%)	8(30.8%)	21(80.8%)	7(26.9%)
Total	41(20.5%)	35(17.5%)	152(76%)	50(25%)
χ2	1.551	1.303	0.696	1.578
P value	0.215	0.274	0.500	0.222

TC- Total cholesterol, TG- Triglyceride, HDL- High density lipoprotein, LDL- low density lipoproteins, Df- degree of freedom, F- Anova.

Table 5 showed the regression analysis, where positive correlation was revealed for all parameters with a statistical significance. The TG had the strongest relationship with both fraction (0.651), followed by HDL (0.536). the LDL had the weakest relationship. All parameters lie within the confidence interval range

Table 5: Regression Analysis Test

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

In this study, prevalence of dyslipidaemia was TC- 3.0%, TG-12.0%, HDL%- 45.0 and LDL- 9.0% for serum lipids and TC-20.5%, TG-17.5%, HDL- 76.0% and LDL- 25.0% for salivary lipids. High density lipoproteins had the highest preponderance using both medium. The values showed higher prevalence for the salivary fraction in a ratio of ratio of 1:1.6 serum: saliva. Aside HDL, Other fractions were also higher in saliva compared to serum values, and major factors implicated could be as a result of presence of lipids in the saliva that are not due to ultrafiltration from plasm, such as from major exfoliation from salivary gland mucosal membranes [12,13]. Contributions also from minor salivary glands was identified in previous studies, high density lipoproteins were most prevalent concurrently for both medium, this could also be attributed to protein balance, as interactions are found to exist between lipids and proteins as revealed by Slomniany et al [14]. High density lipoproteins are protein bounded, and requires significant proteins to be transported, negative protein balance may therefore affect the ability of HDL to be transported, which could also be a reason for the higher preponderance, as it is the only fraction with this feature.

To further support this, many other studies recorded HDL as the most prevalent lipid type both in local and international studies [4,15-18]. The high prevalence of low HDL as shown by Yanai et al in Japan is attributed to less consumption of the poly unsaturated fats [19]. In Nigeria, Oguejiofor et al has demonstrated that low HDL and high LDL cholesterol were the most consistent pattern of dyslipidemia in all the geopolitical zones of the country, though in adults [20]. Contrary to the above findings Jaja and Yarhere found predominance of TG fraction (86.4%) although in children and adolescent with Diabetes Mellitus However, Bulut et al in Turkey also found total cholesterol and triglyceride as the most prevalent lipid abnormalities in their study [21]. Differences in the prevalence in specific lipid abnormality among studies may be due to variations in the nature of study population and prevalent risk factors, as well as differences in sample size and cut-off criteria for the definition of dyslipidemia [15]. When subjects having at least one or more abnormal lipid panel were considered, the overall prevalence of dyslipidemia in current study using the serum was high (57%) and much higher using the saliva medium (87.5%). Using the serum, prevalence of up to a combination of 3 lipid panel was obtained from some subjects, however, using the saliva, up to a combination of 4 lipid abnormalities were detected in a few subjects.

The reason for higher saliva prevalence can further be explained due to the aforementioned reason; other lipid fraction exists in saliva that were not ultra-filtrate from plasma. The overall prevalence by and large conceded with earlier stated fact "dyslipdaemia is upraising in our setting" This finding was comparable to the 60% prevalence rate observed among apparently healthy Nigerian adults [20]. Such close similarity in the prevalence rates may allude the tracking effect of dyslipidemia in childhood, a phenomenon that has been well described in literature [2,15,22]. However, this is not the case in the developed worlds on prevalence of dyslipidaemia, as observed in a large united state medical insurance database and National Health and Nutritional Examination survey (NHANES), prevalence of dyslipidemia in children, was found to be 22.9 and 23.9 respectively [23-25]. Bulut in Turkey, also revealed overall prevalence of 26.2% from healthy children. In Mexico, Bibiloni et al revealed an overall prevalence as high as of 48.8%. The findings in current study suggested and support the fact that developing worlds, including Nigeria are demonstrating an increasing burden of dyslipidemia than it is anticipated. This could be as a result of lack of awareness and failure to adhere to preventive measures. The developing world lack better screening and treatment programs, especially for children. Generally, developing countries have a weaker health system.

Previous study on dyslipidemia did highlight a causal link between dyslipidemia and a number of genetic and environmental factors [18,22,25]. From current study, prevalence of dyslipidaemia revealed a statistically significant difference existing, especially as it relates to age and salivary TG, as well as socioeconomic status and serum TC, and TG. The age group >10 years having higher prevalence for TG fractions using the saliva, it is expected in this age group as studies showed in those above 2 years lipids appear to be relatively stable, as against approaching adolescent age, due to pubertal hormonal spurt [24,26,27]. However, using the serum and saliva, it revealed age category 10-12 years being more prevalent for undesirable fraction for TG and LDL, while saliva medium still shows predominance of this age category for the remaining fraction [28-30]. Contrarily, serum medium for TG and HDL revealed a predominance of age category 10-12 years. Looking at sex and prevalence of dyslipidaemia, findings revealed both serum and saliva, gave an equal preponderance for TC and TG, in favor of male and the female respectively. However, they gave an inverse preponderance for HDL and LDL, with prevalence of HDL more in female and LDL more in males using serum fraction and the reverse for the saliva [31-34]. Findings are not statistically significant. Bibilino et al also revealed no statistically significant sex findings.

Furthermore, prevalence of TC, and TG dyslipidaemia in relation to socioeconomic status showed a statistically significant difference with only serum lipids, the middle class having all the undesirable fraction. However, the middle class are the majority of the population 81.5%, findings may be due to chance. Triglyceride and HDL revealed social class 1 having the highest preponderance of dyslipidaemia (18.2%), for the 2 lipid parameters using serum sample. Contrarily, salivary findings did not show any statistically significant findings to these panels [35]. Using the saliva, Lower class had higher prevalence for the all the lipids tested by social class except for TC, which appear more for in upper class as it is with the serum medium. Similarly, other studies, also revealed no statistically significant difference with age, sex, and socio-economic status of the subjects [15,22,21]. The regression analysis of serum and salivary lipids revealed a positive relationship between the

2 parameters. However, the strength of the association differs, with TG sharing the strongest relationship, followed by HDL, and LDL having the weakest relationship.

The strong relationship of TG was also established by Al-Rawi et al, Singh et al also shows moderate correlation with TC, TG and HDL. in most studies correlation with LDL was said to be poor [2,4,5]. These findings suggest salivary can substitute serum lipids especially where TG, TC, and HDL are the requisite. Furthermore, the confidence interval falls within the range, showing a statistical significance finding. This supports the potential use of salivary lipids as a biomarker substitution for serum lipid, especially for screening exercises and to monitor lipid profile [36]. There is a dearth in salivary lipid prevalence in the Paediatrics population, even more so for the apparently healthy, such study will enable evidence based driven desire to further identify how salivary lipid profile would safely and accurate be in-cooperated into practice in replacing the use of serum samples due to aforementioned benefit, especially in resource poor setting [37]. The higher prevalence of dyslipidaemia in the apparently healthy subjects using both serum and salivary lipids, based spectrophotometric and enzymatic method, is a clear indication that lipid profile test needs to be advocated routinely in order to identify at risk subjects early [38].

Conclusion

1. In conclusion, prevalence of dyslipidaemia was high among children of ages 5 – 12 years in Sokoto metropolis among apparently healthy children.
2. There are no significant differences between sex and serum 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
3. Saliva can be employed to determine the lipid levels in the body, though a different nomenclature is required to ascertain the accurate levels of lipids in the saliva

Recommendations

1. Screening of children of school children should incorporate periodic lipid screening exercise to identify at risk children early.
2. Saliva samples should be adopted for lipid profile screening.
3. The study can serve as a future reference

Limitations

1. Inability to objectively quantify and separate salivary lipids de novo, from ultra-filtrated plasma fractions.

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Authors' Contribution

Dr Taibat Raji carried out the research analysis, wrote the original draft, review and edited the draft. Dr Usman Muhammad Sani, Dr Omoshalewa M. Ugege and Professor Ben Onankpa supervised and contributed to the draft. Dr Ismail Raji reviewed the statistical tools and data analysis aspect. All authors revised all drafts and approved the final version of the manuscript.

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Availability of Data and Materials

Public access to the data analyzed in this study is closed. However, the data is available from the corresponding author on request.

Declarations: Consent for Publications
Not applicable

Ethics Approval and Consent to Participate

Ethics approval was obtained from ethics committee of Usmanu Danfodiyo University Teaching Hospital with reference number NHREC/30/2019 and also Ministry of Health, Sokoto., with reference number SMH/1580/V. IV. Permission was also obtained from Ministry of Education to go to the primary schools. All guardian and participants above 7 years were given informed consent and assent respectively, both written in English and translated Hausa languages. We maintain the confidentiality of the patients by removing the personal identifying information from the database. Also, access to database was limited by storing it in a password protected only to the authorized team members. All methods are carried out in accordance with relevant guidelines and regulations.

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