Dietary Practices and *Dyslipidemia* in Child Bearing Women in Nairobi City County Kenya: *A Cross-Sectional Study*

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Summary

INTRODUCTION

Cardiovascular disease was one of the leading causes of mortality globally, more so in developing countries. The documentation on determinants and predictors for the cardiovascular disease biomarkers among childbearing women in Sub-Saharan Africa was wanting. Despite the growing burden of Non -Communicable Diseases, Dietary Practices and *Dyslipidemia* seemed to be a major factor of the disease.

OBJECTIVE

The study aimed at establishing the association between determinants and predictors for cardiovascular disease biomarkers particularly Dietary Practices and *Dyslipidemia* in Child Bearing Women in Nairobi City County, Kenya.

MATERIALS AND METHODOLOGY

A household-based cross-sectional study was conducted among 252 women of age 15-49 years. In Two-stage cluster sampling 252 households in 18 clusters (estates) of Mugumoini ward Langata sub-county, Nairobi County were recruited. In the first stage, 252 households were divided into 18 clusters. In the second, random sampling was used to select 14 households per cluster. Kish grid method was used to select the eligible participant to be interviewed in each household. Those eligible had been residents of Mugumoini ward in the previous 12 months. Excluded were pregnant, lactating women, those in school and others with documented medical conditions including cardiovascular disease.

A pretested researcher - administered questionnaire was used to collect information on socio-economic characteristics, saturated fat intake and determinants of food choice. A researcher administered questionnaire collected data for three months from 42 women. Fasting venous blood collection was done using 21 gauge needle then transferred into a coded vacutainer tube for transportation to the laboratory in three hours at room temperature. Blood was allowed to clot and separated into serum or cells. Lipid profile assays; total cholesterol, HDL- C, LDL-C and *triglycerides* were analyzed from serum in automated spectrophotometer Dirui CS 4000 validated by WHO. The participants in the pre-testing did not participate in the main study. Quantitative data collected was analysed using Statistical Package for Social Sciences version 22.0. Logistical regression, Chi-square and Odds –ratio were performed.

RESULTS

Lipid profile level; total cholesterol below 4 *mmol*/L, LDL-C below 1.80 *mmol*/*L*, HDL- C above 1.49 *mmol*/L and *triglycerides* below 1.70 *mmol*/L were all considered normal [53, 13] A third (34%) of the respondents was employed in offices and 60.8% accessed food from supermarkets and fast food outlets. While 41.2% were of the upper- middle class, thus increasing the risk to cardiovascular disease. Respondents consumed more energy-dense nutrient-poor diets characterized by saturated fat intake. Drivers of food choice were; Sensory appeal (95.6%), Emotional reasons (mood) (97.2%) and Convenience (77.2%).

CONCLUSION

Almost half of the participants had high LDL-C and low HDL-C. Transitional diets were significantly associated with biomarkers for elevated LDL-C. Socio-economic characteristics (level of education, Occupation, Source of food, Upper-middle-class, Office work and Bachelor's degree education level) were significantly associated with transitional diets. The odds of determinants for cardiovascular disease were four times (OR 3.66, 95% CI) likely as a predictor of *dyslipidemia* among childbearing women.

RECOMMENDATION

We recommend all the stakeholders, Ministry of Health, both at county and national level to enact a law in support of interventions that promote low-fat foods and physical activities to improve cardiometabolic health. Individually 'Control Poor Dietary Practices avoid *Dyslipidemia*'

Keywords: Dietary Practices, *Dyslipidemia*, Drivers of Food Choice, Socio-Economic Characteristics, Childbearing Women

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Introduction

Dyslipidemia, overweight, obesity and unhealthy diets were modifiable risk factors for cardiovascular disease (CVD). To control the disease, managing risk factors was a priority. The impact of *dyslipidemia* increased with the presence of obesity [6, 33, 48, 46]. Previous studies had linked CVD risk factors with lifestyle changes; sedentary lifestyle due to rapid urbanization, globalization, economic growth and nutrition transition [9, 10, 47]. That was marked by the replacement of traditional diets with energy-dense nutrient-poor foods (junk food) high in fat, sugar, pre-packaged, processed and ready-to-eat meals [2, 12, 41].

The World Health Organization (WHO) associated the more than half global cases of *ischaemic* heart disease and more than 4 million deaths annually with *Dyslipidemi* a. It emerged as a sensitive cardiovascular disease risk factor in Sub -Saharan Africa [50]. Studies had reported that, high cholesterol level above 3.8 *mmo*l/L accounted for 59% of *ischaemic* heart disease and 29% of *ischaemic* stroke burden among adults aged 30 years and over by 2016 [50].

In Kenya, between 2015 to 2017 mortality attributed to cardiovascular disease was reported to be 6.1% to 8%. The estimated prevalence of elevated total cholesterol was at 1.5% while low High-Density Lipoprotein – Cholesterol levels were at 60% among females [23, 37, 50]. Despite Kenya adopting policies in line with vision 2030 and Non-Communicable Diseases (NCD) strategic plan to reduce CVD, the prevalence of overweight and obesity in urban Kenyan setlements was at 39 %, and 25% in Nairobi alone among childbearing women [25, 23,49].

Cardiovascular disease had a negative impact on residents including; increased healthcare costs, lost work productivity, increased morbidity and mortality resulting in reduced social and economic development. Women faced a higher prevalence of *dyslipidemia*

related to an obesogenic environment which initiated comorbidities. Comorbidities had negative implications on the achievement of the Kenyan vision 2030, SDGs and promotion of good health and wellbeing [6, 22, 32].

Strategies to reduce modifiable risk factors for cardiovascular disease should be implemented to reverse the burden of NCDs [24, 22, 49]. This should aim at facilitating the achievement of Sustainable Development Goals in promoting preventive healthcare in maternal health and nutrition [40, 49].

Lang'ata Sub-county is a predominantly high-income middle-class owner-occupied residential suburb in Nairobi, Kenya. It has several attractions including Giraffe centre, freedom gardens, live concert grounds, private airport, restaurants, wildlife national park, cultural villages and universities [28]. Lifestyle in Lang'ata suits multiple needs including tourism hence may be an obesogenic environment. There was a gap in data collection on the prevalence of *dyslipidemia* among childbearing women in Kenya. It is against this background that this study was conducted.

Materials and Methodology

Research Design

This was a household-based cross-sectional study conducted from July to October..... in the middle and upper-middle-class estates in Nairobi, Kenya. Nairobi is the capital city of Kenya, metropolitan with a 4.3% rate of urbanization and home to Kenyan businesses, major international companies and organizations. Nairobi generates about 60% of the entire nation's GDP [26].

Study Population

The study population was childbearing women of age 15-49 years. They included middle and upper-middle -class with daily per capita expenditure between USD 8 to USD 20 and USD 21 to USD 64 in a 30 days month, in a population size of 15,981 [26]. The inclusion criteria comprised of women who had been residents of Mugumoini ward in Lang'ata sub-county, Nairobi in the previous 12 months before the study who gave voluntary informed consent to participate.

The study excluded pregnant, lactating women, those in school and other women with documented medical conditions including cardiovascular disease. Those conditions and their medication alter lipid profile level despite the dietary practice and physical activity level.

Sampling Techniques and Sample Size

Mugumoini ward which is part of Kibra slum was purposively selected since a previous study in Langata constituency reported prevalence of 27.3% obesity among women of reproductive age [18]. Two-stage cluster sampling was used to sample 252 households in 18 clusters (estates) of Mugumoini ward. In the first stage, 252 households were divided into 18 clusters. In the second stage, random sampling was used to select 14 households per cluster. Kish grid method was used to select the eligible participants to be interviewed in each household.

Data Collection Instrument and Procedures

A pretested researcher-administered questionnaire was used to collect information on socio-economic characteristics, saturated fat intake and determinants of food choice.

Fasting venous blood collection was done using 21 gauge needle, 5 millimetres syringe, 5 millimetres vacutainer tube and holder for transportation. Blood was drawn from participants at household level. A blood sample was obtained by inserting a 21 gauge needle into the brachial vein in the arm and collected 4 millimetres of blood in 5 millimetres syringe then transferred into a coded vacutainer tube for transportation to the laboratory in three hours at room temperature. Blood was allowed to clot and separated into serum or cells. Lipid profile assays; total cholesterol, HDL- C, LDL-C and *triglyceride* were analyzed from serum in automated spectrophotometer Dirui CS 4000.

The validity of the instruments was guaranteed by using standard indicators and tools validated by WHO [53].

Socio -economic characteristics were adapted and modified from the Kenya Demographic and Health Survey questionnaire [20]. To ensure reliability, the test re-test method was used during a pre-test that was conducted before the main study at a different locations with similar characteristics as the participants.

Research instruments were administered twice in an interval of three days to the same participants during the pre-testing. A coefficient correlation for reliability of (CL: 95%; P<0.05) was achieved and this was found to be adequate since it was more than 0.7 [8]. The participants in the pre-testing did not participate in the main study.

Statistical Analyses

Quantitative data collected from this study was analysed using Statistical Package for Social Sciences version 22.0. Logistical regression, Chi-square and Odds –ratio were performed to establish the association of determinants and predictor for the cardiovascular disease biomarkers. A p-value of less than 0.05 was considered significant.

Lipid profile level; total cholesterol below 4 mmol/L was considered normal, LDL-C below 1.80 mmol/L was normal, HDL-C above 1.49 mmol/L was normal and triglyceride below 1.70 mmol/L was normal [53, 13].

Ethical Considerations

Ethical considerations were granted from Kenyatta University Ethics and Review Committee (KU/ERC/APPROVAL/VOL.1 (173) and Kenya Medical Research Institute, Scientific and Ethics Review Unit (KEMRI/RES/7/3/1 NON KEMRI 614). A research permit was obtained from the National Commission for Science Technology and Innovation. The researcher sought permission from the County government of Nairobi City and Nairobi City County Health Services administration. Written voluntary informed consent was also obtained from the participants. Confidentiality was ensured by the use of codes instead of names and password protected files.

Results

Socio-Economic Characteristics

Factor analysis was used to calculate a wealth index and classified the participants into three economic levels namely:

1. Lower-middle class
2. Middle class
3. Upper-middle class

Majority of the participants were classified as upper-middle-class (41.2%) as evidenced by ownership of all household possessions. Regarding, occupation (34.0%) were employed as office workers, whom (60.8%) obtained food from fast food outlet and supermarket. Most of the participant's (43.2%) spent Kenya Shillings 10,000- 20,000 (1 USD = 101 Kshs) on food ***(Table 1).***

Table 1: Socio-Economic Characteristics

Social Economic Characteristics	Frequency (N=250)	Percentage
Level of education		
Secondary	73	29.2
Certificate	29	11.6
Diploma	84	33.6*
Bachelor's degree	46	18.4
Master's degree	18	7.2

Table 1: *Socio-Economic Characteristics*

Social Economic Characteristics	**Frequency (N=250)**	**Percentage**
Occupation		
Employed skilled manual labour	42	16.8
Employed unskilled manual labour	13	5.2
Employed office work	85	34.0*
Self-employed skilled manual labour	54	21.6
Self-employed unskilled manual labour	47	18.8
Student	9	3.6
Source of food		
Market, fast food outlet, supermarket, street vendor	152	60.8*
Market, fast food outlet, supermarket	70	28
Own Farm and market, fast food outlet, supermarket	28	11.2
Money spent on food per month in Kshs**		
<10,000	9	3.6
10,001-20,000	108	43.2*
20,001-30,000 100	100	40.0*
30,001- 40,000	33	13.2
Wealth index		
Lower middle class	69	27.6
Middle class	78	31.2
Upper middle class	103	41.2*
*Majority of the participants		
* *1USD=101 Kenya shilling		

Frequency of Intake of Saturated Fat

The foods were grouped into 12 food types consumed daily, once or twice a week or rarely eaten. About half of the participants (56.8%) ate out or takeout food twice or more times in a week. Additionally, 66.8% and 54.8% consumed red meat and high-fat cuts respectively 3 times a week or more. Another 50.4%, 67.7% and 69.6% daily consumed sausages, chicken with skin and deep-fried chicken respectively. Majority of the respondents (80.0%) used margarine or butter daily, 83.6% consumed crisps, cakes, cookies and doughnuts (mandazi) daily ***(Table 2).***

Table: *Frequency of Saturated Fat Intake as per Rate Your Plate (Heart)*

Food Types	Frequency/ Amount	Frequency (N=250)	Percentage
Meat, chicken, fish	usually eat > 6 oz a day	198	79.2*
	sometimes eat > 6 oz a day	32	12.8
	rarely/ never eat > 6 oz a day	20	8
Eating out/ takeout food	twice a week or more	142	56.8*
	once a week	27	10.8
	less than once a week	81	32.4
Red meat	3 times a week or more	167	66.8*
	twice a week	42	16.8
	once a week or less	41	16.4
Red meat choices	usually eat high fat cuts	137	54.8*
	Sometimes	36	14.4
	rarely eat meat	77	30.8
Cold cuts- sausages, hotdogs	usually eat/often	126	50.4*
	sometimes eat	48	19.2
	rarely eat	76	30.4
Chicken and other poultry	usually eat with skin	169	67.6*
	sometimes eat with skin	69	27.6
	usually eat without skin	12	4.8

* *Majority of participants fatty foods intake patterns*

Table 2: *Frequency of Saturated Fat intake as Per Rate Your Plate (Heart) Continued…….*

Table: *Frequency of Saturated Fat Intake as per Rate Your Plate (Heart)*

Food Types	Frequency/ Amount	Frequency (N=250)	Percentage
Chicken and fish choices	usually eat fried fish/chicken	174	69.6*
	sometimes eat fried	56	22.4
	usually eat grilled/roasted	20	8
	rarely eat	40	16
	usually eat< 2 a week	139	55.6*
	usually eat twice or more a week	70	28
	System	1	0.4
Oil, butter, margarine, palm oil	usually add	245	98*
	sometimes add	3	1.2
	use palm oil	2	0.8
Butter. Margarine	usually put butter at table	200	80*
	usually put margarine	6	2.4
	eat them plain	44	17.6
Crisps	usually eat	209	83.6*
	sometimes eat	16	6.4
	Low fat	25	10
Cake, chocolate, cookies, pie (Mandazi)	usually eat	189	75.6*
	sometimes eat	32	12.8
	low fat	29	11.6

**Majority of participants fat intake pattern by self-rate of plate*

Drivers of Food Choice

The driving factors of food choice attributed to why participants ate what they ate included ; sensory appeal (80.4%), convenience (77.2%) and emotional reasons (mood) (97.2%) (Table 3).

Table 3 : *Drivers of Food Choice*

Drivers of food choice	Frequency (N=250)	Percentage
Convenience		
Bought in shops	193	77.2*
Shops, market	191	76.4*
Simply cooked	146	58.4
Easy to prepare	128	51.2
Takes no time to prepare	95	38.0
Sensory appeal		
Smells nice	239	95.6*
Looks nice	237	94.8
Tastes good	236	94.4*
Pleasant texture	209	83.6
Emotional reasons		
Cheers me up`234	97.2*	
Makes me feel good	237	94.8
Helps me cope	227	90.8
Keeps me awake	225	90.0
Helps me relax	225	90.0
Cope with stress	158	63.2

**Majority of the participants attributes for food choices*

Lipid Profile of Study Participants

A third of the participants (33.3%) had a high total cholesterol level of more than 4.00 *mmol*/L. Further, 54.8% had high Low-Density *Lipoprotein*-Cholesterol level of more than 1.80 *mmol*/L. Majority of the participants (81.0%) had low High-Density *Lipoprotein*- Cholesterol level less than 1.49 *mmol*/L. A small percentage (26.2%) had a high *Triglyceride* level of more than 1.70 *mmol*/L, n=42 *(Figure 1).*

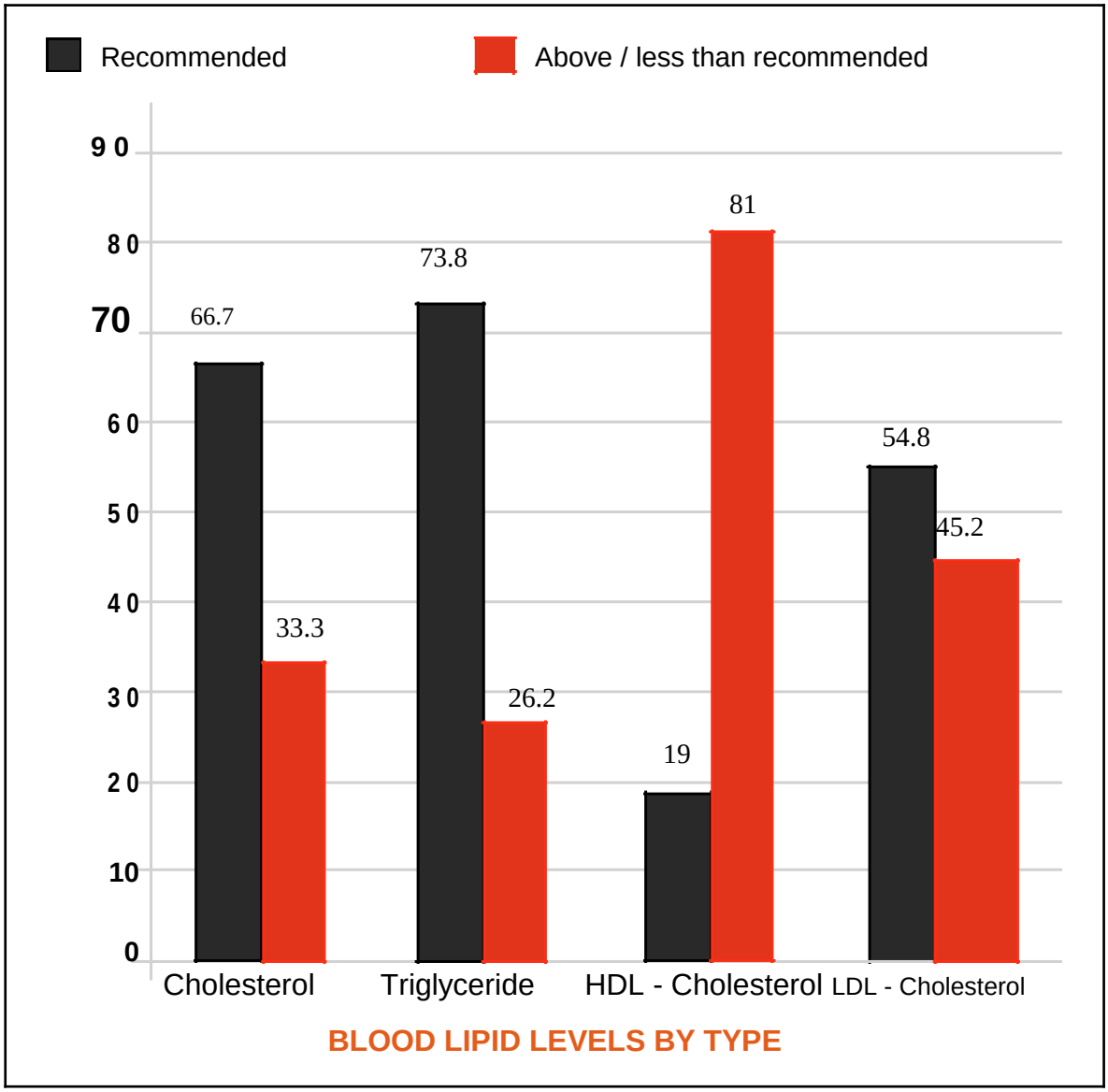

Figure 1: *Lipid Profile Level of Study Participants*

Associations among Determinants, Predictors and Cardiovascular Disease Biomarkers

A Chi-square test was performed to identify socio-economic characteristics associated with selected saturated fat intake. Significant associations were found between education level and consumption of red meat ($\chi2=36.654$; $p<0.001$), chicken with skin ($\chi2=34.582$; $p<0.001$) and cheese ($\chi2=46.342$; $p<0.001$). Money spent on food was associated with consumption of chicken with skin ($\chi2=47.983$; $p<0.001$), deep-fried chicken ($\chi2=35.350$; $p<0.001$) and cheese ($\chi2=31.132$; $p<0.001$).

Wealth index was associated with consumption of deep-fried chicken ($\chi2=22.540$; $p<0.001$), chicken with skin ($\chi2=42.593$; $p<0.001$), cheese ($\chi2=30.827$; $p<0.001$) and red meat cuts high fat ($\chi2=20.361$; $p<0.001$). Food bought from fast food outlet and a supermarket was associated with consumption of deep-fried chicken ($\chi2=15.102$; $p<0.001$) and cheese ($\chi2=38.186$; $p<0.001$). Type of occupation was associated with consumption of chicken with skin ($\chi2=20.019$; $p<0.001$), cheese ($\chi2=62.936$; $p<0.001$) and spreads ($\chi2=32.133$; $p<0.001$) *(Table 4)*.

Table 4: *Association between Socio-economic Characteristics and Saturated Fat Intake*

Socio- Economic Characteristics	Chi- Square Value (N=250)	P value
Education level vs Consumption of red meat, Chicken with skin and cheese	36.654	≤0.001*
Money spent on food vs Chicken with skin, Deep fried chicken, Cheese	47.983	≤0.001*
Wealth index vs chicken with skin, Cheese, Red meat high fat cuts, Deep fried chicken, Spreads, Cakes	42.593	≤0.001*
Source of food vs Deep fried chicken, Red meats, Cheese	17.372	≤0.001*
Occupation vs deep fried chicken, red meat high fat cuts,	35.335	≤0.001*
Sausages, Chicken with skin	8.355	
Wealth index vs Palm oil	2.585	0.213

**Significant at p= values < 0.05*

Association between Saturated Fat Intake and Biomarkers for Cardiovascular Disease

A Chi-square test was performed to identify selected saturated fat intake associated with biomarkers for cardiovascular disease. Consumption of red meat cuts high fat was associated with elevated LDL-C above 1.80 *mmol*/L ($\chi 2$=10.81; p<0.001), sausages ($\chi 2$=11.51; p<0.001), chicken with skin was associated with high total cholesterol ($\chi 2$=7.06; p=0.02) *(Table 5)*.

Table 5: *Association*

Food Types: Saturated Fat Intake	N=42 Lipid profile P value	$\chi 2$
Meat, chicken, fish > 6 ounces in a day vs Total Cholesterol	0.575	1.10
Eating out/ take out > twice a week vs Total Cholesterol	0.529	1.27
Red meat > 3 times a week vs Total cholesterol	0.087	4.87
Red meat high fat cuts often/usually eat vs LDL-C	≤0.001*	10.81
Sausages often/usually eat vs LDL-C	≤0.001*	11.51
Chicken with skin often/usually eat vs Total cholesterol	0.029*	7.06
Deep fried chicken, fish often/usually eat vs HDL-C	0.398	1.84
Cheese often/usually eat vs HDL-C	0.233	2.91
Palm oil usually added vs Triglycerides	0.089	2.88
Butter/ margarine added at table vs LDL-C	0.112	4.37
Crisps often/usually eat vs Triglycerides	0.544	1.21
Cakes, cookies, chocolates, donuts (mandazi) often/usually eat vs HDL-C	≤0.001*	2.33

**Significant at p=values <0.05*

Predictors of Biomarkers for Cardiovascular Disease

The study used Logistical regression to identify predictors of biomarkers for cardiovascular disease. The socio-economic characteristics that predicted *dyslipidemia* profile level were occupation, source of food and education level. Participants employed for office work were 4 times more likely to have elevated total cholesterol (OR 3.66, 95% Cl). Those who bought food from a supermarkets and fast food outlets were twice more likely to have elevated *triglyceride* (OR 2.40, 95% Cl). Participants of higher education level were thrice more likely to have elevated *triglyceride* (OR 2.84, 95% Cl).

The selected saturated fat foods that predicted lipid profile level was the consumption of red meat and cheese for more than 3 times a week. Participants who consumed red as such were 3 times more likely to have high total cholesterol (OR 2.50, 95 Cl) while those who ate cheese were 3 times more likely to have high total cholesterol (OR 3.15, 95% Cl) *(Table 6).*

Table 6: *Predictors of Biomarkers for Cardiovascular Disease (Dietary Practices and Dyslipidemia)*

Predictors	Multivariate analyses OR (95% cl)	Confidence interval	N=250 p-value
Socio-Economic characteristics			
Occupation	3.66	14.61-0.92	0.082
Source of food	2.40	22.55-0.25	0.654
Wealth Index	6.46	24.25-0.51	0.313
Education level	2.84	15.46-0.52	0.283
Money spent on food	0.72*	1.20-0.44	0.252
Saturated Fat Intake			
Meat chicken fish > 6 ounces a day	1.87	7.45-0.47	0.505
Eating out / take out	1.51	2.50-0.91	0.125
Red meat ≥3 times a week	2.50	9.89-0.63	0.321
Red meat high fat cuts	1.80	6.74-0.48	0.515
Sausages	2.88	11.43-0.72	0.191
Chicken with skin	6.60	29.35-1.48	0.020
Deep fried chicken , fish	2.50	11.23-0.55	0.292
Cheese	3.15	4.94-2.01	0.333
Palm oil	1.58	9.67-0.26	0.678
Butter margarine	1.87	7.45-0.47	0.505
Crisps	1.72	3.40-0.87	0.126
Cake, chocolate, cookies donut (*mandazi)*	3.05	15.05-0.62	0.235

**Correlation is not significant at OR<1(95% Cl)*

Discussion

The global report emphasizes on the promotion of healthy lifestyles and implementation of interventions that reduce the modifiable risk factors for Non-Communicable Diseases (NCDs); unhealthy diets, obesity and *dyslipidemia* [51]. Intake of fats not exceeding 30% of total energy, saturated fats less than 10% and trans -fats less than 1% have been shown to reduce the risk of Cardiovascular Disease (CVD) [51].

Furthermore, consumption of most dietary fats as PUFA 10% or MUFA 10 -15%, regular physical activity and reduced-energy diet to control weight. That was recommended as strategic to reduce 25% premature mortality by 2025 [52]. Similarly, reduction of total cholesterol <4.00 *mmol*/L and LDL-C < 2.00 *mmol*/L was recommended [13, 52].

Socio - economic characteristics are major determinants of dietary practices. Studies in Sao Paulo, Poland and Iran showed that transitional diets were associated with higher educational level and high socio -economic status of women [14, 35, 45]. Similarly, other studies in Europe, America, Australia, Brazil, Poland and Canada associated higher education level and stress related to occupation and less available time for cooking with consumption of more ready to eat food and fast foods. Moreover, the middle and upper-middle-class women were positively associated with the consumption of calorie-dense foods, processed foods high in salt and sugars and less consumption of fruits and vegetables [19, 34, 44].

Saturated fat intake was another determinant of predictors for cardiovascular disease biomarkers. Studies in Zambia, America, Australia and Denmark reported a positive association of excessive consumption of energy, red meat, processed meats, chicken with skin, salt/ sodium, added sugar, saturated fat/ trans-fat with increased CVD risk factors [5, 27, 38, 39, 43, 42].

Other determinants of dietary practices were drivers of food choice including sensory appeal, emotional reasons (mood) and convenience. A study in Zambia reported association of transitional dietary practices with food and taste preference that participants had developed throughout their lives [5, 27, 38, 39, 43, 42]. Other studies in America, Cameroon, Europe, Ghana and Kenya reported a positive association of taste preference for sweet, salty, fatty foods and convenient; nearness to grocery stores with influence to food choices [3, 4, 17, 29, 31].

Dyslipidemia has been identified as a predictor for cardiovascular disease biomarker. In this study, saturated fat intake was positively associated with elevated LDL-C. Studies in America, Germany, Sweden and Kenya positively associated transitional dietary practices with elevated cholesterol level [1, 7, 11, 15, 16, 21, 30, 35, 36].

The study established a significant positive association between determinants of biomarkers for CVD an/d a predictor of biomarkers. Participants who consumed chicken with skin, red meats more than 3 times in a week, cheese and sausages were more likely to have elevated *triglyceride* and total cholesterol. Participants who were employed for office work bought food from supermarkets and fast food outlets. Upper - middle - class and higher educational level respondents, were more likely to have elevated total cholesterol and *triglyceride.*

Conclusion and Recommendation

Childbearing women of higher educational level and high socio- economic status consumed more transitional diets and had elevated lipid profile level. Theose diets correlated with cholesterol levels, as a predictor of biomarkers for cardiovascular disease.

We recommend all the stakeholders, Ministry of Health, both at county and national level to enact a law in support of interventions that promote low-fat foods and physical activities to improve cardiometabolic health. Individually 'Control Poor Dietary Practices avoid Dyslipidemia'

Statement of Competing Interest

The authors declare that they have no competing interests.

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List of Abbreviations

CVD - Cardiovascular Disease
HDL-C – High Density Lipoprotein- Cholesterol
KDHS - Kenya Demographic Health Survey
KNBS - Kenya National Bureau of Statistics
LDL-C– Low Density Lipoprotein – Cholesterol
MOH - Ministry of Health
mmol/L - Millimole per Liter
MUFA - Mono Unsaturated Fatty Acids
NCDs - Non Communicable Diseases
OZ - Ounces
PUFA - Poly Unsaturated Fatty Acids
SDGs - Sustainable Development Goals
WHO - World Health Organization
USD - United States of America Dollar

References

1. **Ahmad S, Moorthy M, Demleer O, Hu F, Ridkler P, Chasman D & Moora S** (2018): Assessment of Risk Factors and Biomarkers associated with Risk of Cardiovascular Disease among Women Consuming a Mediterranean Diet. Nutrition Obesity and Exercise. *JAMA Netw. Open.2018;*1 (8): e 185708 doi:10.1001/jamanet workopen.2018.5708

2. **Alhabib FK, Batais AM, Almigbal HK, Alshamiri QM, Altaradi H, Rangajaran S & Yusuf S** (2020): Demographic, Behavioural and Cardiovascula Disease Rsik Factors in the Saudi Population: Results from the Prospective Urban Rural Epidemiology Study (PURE-Saudi). *BMC Public Health* 20, 1213 (2020) https://doi. org/10.1186/s 12889-020-09298-w

3. **Amore L, Buchthal V O & Banna C J** (2019): Identifying Perceived Barriers and Enablers of Healthy Eating in College Students in Hawai: a Qualitative Study using Focus Groups. *BMC Nutrition* 5:6

4. **Annan A R, Apprey C, Oppong K N, Petty-Agamatey V, Mensan L & Thow A M** (2018): Public Awareness and Perception of Ghana's restrictive policy of Fatty Meat as well as Preference and Consumption of Meat Products among Ghanian Adults living in the Kumasi Metropolis. *BMC Nutrition* 4:2

5. **Bowen J, Sulivan K, Kris-Etherton M & Petersen K** (2018): Nutrition and Cardiovascular Disease-an Update. *Curr Artheroscler Rep* (2018) 20: 8 https:// doi.org/10.1007/s11883-018-0704-3

6. **Bezorra A K M, Carvalho FE, Oliveira SJ, Cesse P AE, Lira C I P, Carvalcante TGJ & Saleal V** (2018): Health Promotion Initiatives at School related to Overweight Insulin Resistance, Hypertension and Dyslipidemia in Adolescents: A Cross-Sectional Study in Recife, *Brazil. BMC Public Health* 18, 223 (2018). https:///doi. org/10.1186/s 12889-018-5121-6

7. **Chege Peter Maina** (2016): Multiple Cardiovascular Disease Risk Factors in Rural Kenya: evidence from a Health and Demographic Surveillance System using the WHO STEP-Wise Approach to Chronic Disease Factor Surveillance. *South African Family Practice 2016* (58) 2: 54-61 https:// doi.org/10.1080/20786190.2015.11140703

8. **Davidshofer O.G** & **Murphy R.K** (2005): *Psychological Testing: Principles & Applications, 6 th Edition*. www.pearsom.com PGM 190901

9. **Elmadfa I & Meyer A** (2016): Developing Suitable Methods of Nutritional Status Assessment: A Continous Challenge. *American Society for Nutrition. Advances in Nutrition*; an international *Review Journal.*

10. **Ettarh R, Van de Vijver S, Oti S & Kyobutungi C** (2013): Overweight, Obesity and Perception of Body Image among Slum Residents in Nairobi, Kenya: *Preventing Chronic Disease* 10:130198 https://www.cdc.gov

11. **Fernstrom M, Fernberg U & Hurtig-Wemlof A** (2019): Insulin Resistance (HOMA-IR) and

Body Fat (%) are Associated to Low Intake of Fruit and Vegetables in Swedish, Young Adults: the Cross-sectional Lifestyle, Biomarkers and Atherosclerosis Study. *BMC Nutrition 2019* (5): 15 https://doi.org/10.1186/s 40795-019-0279-6 Biomed Central.com

12. **Ford DN, Jaacks ML, Martorell R, Mehta KN, Perrine GC, Ramirez-Z M & Stein DA** (2017): Dietary Patterns and Cardio-Metabolic Risk in a Population of Guatemalan Young Adults. BMC Nutr 3, 68 (2017). https://doi.org/10.1186/s 40795-017-0188-5

13. **Guy G De Backer** (2018): Prevention of Cardiovascular Disease: Much More is Needed. https://doi.org/10.1177/2047487318770297 volume: 25 issue: 10, page (s): 1083-1086 *European journal of preventive cardiology*

14. **Hajianfar H, Esmaillzadeh A, Feizi A, Shahsahan Z, Azadbakht L** (2018) : Major Maternal Dietary Patterns during Early Pregnancy and their Association with Neonatal Anthropometric Measurement. Bio Med Research International 2018 (4692193) 11 https:// doi. org/10.1155/2018/4692193

15. **Haregu TN, Nanayakkara S, Carrington M, Kaye D** (2020): Prevalence and Correlates of Normal Body Mass Index Central Obesity among People with Cardiovascular Diseases in Australia. *Public Health volume 183,* 2020 pages 126-131 https://doi.org/10.1016/j.puhe.2020 https://globalheartjournal.com

16. **Jaacks L, Sher S, De Staercke C, Porket M, Alexander W, Jones D, Vaccarino V, Ziegler T & Quyymi A** (2018): Pilot Randomized Controlled Trial of a Mediterranean Diet or Diet Supplemented with Fish Oil, Walnuts and Grape Juice in Overweight or Obese US Adults. *BMC Nutrition 2018*, 4:26 https://doi.org/10.1186/s 40795-018-0234-y

17. **Jilani S H, Intemann T, Bogl H L, Eiben G, Molnar D, Moreno A L, Pala V, Russo P, Siani A, Solea A, Veidebaum T Ahrens W & Hobestreit A** (2017): Familial Aggression and Socio-demographic correlates of Taste Preferences in European Children. *BMC Nutrition* 3: 87

18. **Kaduka Lydia** (2013): Obesity and the associated cormobidities among Urban Residents of Karen/ Langata and Kibra Constituencies in Nairobi, Kenya. http://www.omicsgroup.com

19. **Kalucka S, Kaleta D, Dabrowka T** (2019): Prevalence of Dietary Behaviour and Determinants of Quality of Diet among Beneficiaries of Government Welfare Assistance in Poland. *International Journal of Environmental Research and Public Health 2019*, 16, 501; doi 10.3390/ ijerph 16030501 www.mdpi.com/journal/ijerph

20. **KDHS** (2014): Kenya Demographic and Health Survey 2014- The DHS program. https:// dhs program.com

21. **Kenya National Guidelines for Cardiovascular Disease Management** (2018). www.health.go.ke

22. **Kenya National Strategy for the Prevention and Control of Non-Communicable Diseases 2015-2020. www.health.go.ke**

23. **Kenya Step** wise Survey for **Non-Communicable Diseases Risk Factors,** 2015 Report

24. **Kenya Vision 2030** (2007): A Globally Competitive and Prosperous Kenya: Economic Social and Political Pillars. www.fao.org

25. **Kimiywe J, Mbochi R, Kuria E, Ocholla A & Steyn N.** (2012): Predictors of Overweight and Obesity in Adult Women in Nairobi Province, Kenya .*BMCpublic health*.(12):823 www.ncbi.nih. gov.

26. **KNBS** (2009): Kenya Population and Housing Census Statistics. Knbs.or.ke

27. **Liu A, Ford N, Hu F, Zelman K, Mozaffarian D & Kris-Etherton P** (2017): A Healthy Approach to Dietary Fats: Understanding the Science and Taking Action to Reduce Consumer Confussion. *Nutrition Journal 2017*, 16; 53 https://doi. org/10.1186/s 12937-017-0271-4 Biomed Central. com

28. **Mitullah Winnie** (2004): Understanding Slums:

Case Studies for the Global Report on Human Settlements 2003. The Case of Nairobi, Kenya. Ucl.ac.uk/dpu-projects/Global-report/pdfs/ Nairobi.pdf

29. **Mbithe D. K., Loechi C., Moleah T., Macharia-Mutie C W & Ndungu Z.** W. (2015): Nutrition Knowledge, Attitude and Practices among Urban Primary School Children in Nairobi City, Kenya: a KAP Study. *BMC Nutrition* 1: 44

30. **Mwenda V, Mwangi M, Nyanjau L, Gichu M, Kyobutungi C & Kibachio J** (2018): Dietary Risk Factors for Non-Communicable Diseases in Kenya: findings of the Steps Survey, 2015. *BMC Public Health* 2018 (**3**):1218, 18 https:// doi. org/10.1186/s 12889-018-6060-y

31. **Niba L. L., Atanga M. B. & Narti K .L.** (2017): A Cross Sectional Analysis of Eating Habits and Weight Status of University Students in Urban Cameroon. *BMC Nutrition* 3:55

32. **Ogada A.I, Kimiywe J, Cherono R.** (2019): Weight Status at Postpartum: Being Normal Weight Yet Centrally Obese! *Food and Nutrition Sciences vol. 10 No. 09* (2019), Article ID: 94893, 11 pages 10.4236/fns.2019.109078

33. **Opoku S., Gan Y., Lu Z**. (2019): Prevalence and Risk Factors for Dyslipidemia among Adults in Rural and Urban China: Findings from the China National Stroke Screening and Prevention Project (CNSSP) *BMC Public Health 19*, 1500 (2019). https://doi.org/10.1186/s 12889-019-7827-5

34. **Psaltopoulou T, Hatzis G, Papageorgiou N, Androulakis E, Briasous A, Tousoulis D** (2017): Socioeconomic Status and Risk Factors for Cardiovascular Disease: Impact of Dietary Mediators 2017 *Hellenic Society of Cardiology* (2017), 58, 32-42 http://www.journals.elservier. com/hellenic-journal-of-cardiology

35. **Prentice R, Huang Y, Neuhouser M, Manson J, Rahamani Y, Thomas F, Tinker L, Allison M, Johnson K, Seth S, Rossouw J, Shikeny J, Herring B & Horn L** (2017): Associations of Biomarkers-Calibrated Sodium and Potassium Intakes with Cardiovascular Disease Risk among Postmenopausal Women. *American Journal of Epidemiology*, 186(**9**) 2017: 1035-1043 https://doi. org/10.1093/aje/kwx238

36. **Ritcher A, Rabenberg M, Truthmann J, Heidemann C, Roosen J, Thiele S & Mensink M** (2017): Associations between Dietary Patterns and Biomarkers of Nutrient Status and Cardiovascular Risk Factors among Adolescents in Germany: Results of the German Health Interview and Examination Survey for Children and Adolescents in Germany (KIGGS). *BMC Nutrition* 3:4

37. **Sang V.K., Kaduka L., Kamano J., Makworo D** (2017): Prevalence of Dyslipidemia and the Associated Factors among Type 2 Diadetes Patients in Turbo Sub-County, Kenya. *S Endocrinol Diab* 4(5): 1-9. DOI: 10.15226/2374-6890/4/5/00190

38. **Shridhar k, Satija A, Dhillon P, Agrawal S, Gupta R, Bowen L, Kinra S, Bharati A, Prabhakaran D, Reddy K, Ebrahim S** & for the Indian Migration Study Group. *Nutrition journal 2018*, 17:15 https://doi.org/10.1186/s 12937-018-0327-0 Biomed central.com

39. **Stacks M, Lichtenstein H, Wu Y, Appel J, Creagar A, Kris-Etherton M, Miller M, Rimm B, Rudell L, Robinson G., Stone J. & Van Horn V.**(2017): Dietary Fats and Cardiovascular Disease: A Presidential Advisory from the American Heart Association. Circulation 2017 18; 136(3):e1-e23. doi:10.1161/CIR.0510

40. Sustainable Development Goals (2015): 2015-2030| *United Nations. Una-gp.org*

41. **Singh A, Gupta V, Ghosh A, Look K & Jerath-G** S (2015): Quantitative Estimates of Dietary Intake with Secial Emphasis on Snacking Pattern and Nutritional Status of Delhi. Impact of Nutrition Transition. *BMC Nutr 1*, 22 (2015) https://doi. org/10.1186/s 40795-015-0018-6

42. **Taspell C, Neale E & Probst Y** (2019): Dietary Patterns and Cardiovascular Disease: Insights and Challenges for Considering Food Groups and Nutrient Sources. Rep (2019) 21:9 https:// doi. org/10.1007/s 11883-019-0770-1

43. **Tateyama Y., Musumari M, Techasrivichien T, Suguimoto P., Zulu R., Dube C., Feldman M., Kihara O. M. & Kihara M.** (2019): Dietary Habits, Body Image and Health Service Access related to Cardiovascular Diseases in Rural

Zambia: A Qualitative Study. *PLOS ONE* 14 (**2**); e 0212739https://doi.org/10.1371/journal.pone.0212739

44. **Teixeira J, Castro T, Grant C, Wall C, Silva Castro L, Francisco V, Veira S, Saldiva S & Marchioni D** (2018): Dietary Patterns are Influenced by Socio demographic Conditions of Women in Child Bearing Age: a Cohort Study of Pregnant Women. *BMC Public Health (2018)* 18 (1): 301 https://doi.org/10.1186/s 12889-018-5184-4

45. **Wadolowskah L, Kowalkowsaka J, Czarnocinska J, Babicz-Zielinska E** (2018): The effect of Socioeconomic Status on Dietary Patterns in Polish Female. *The GEBa Health Study. 2018 12 th European Nutrition Conference FENS 2015.* Ann. Nutr. Metab,, 2015,67 (supp 1) pp. 106-107

46. **Wekesa FM, Grobusch KK, Grobbee DE, Kadengye D, Asiki G, Kyobutungi C.K** .(2020): Determinants of Mortality from Cardiovascular Disease in the Slums of Nairobi, Kenya.

47. **WHO** (2013)**:** Global action plan for the prevention and control of NCDs 2013-2020. www.who.int

48. **WHO (2014), KDHS (2014):** Global Nutrition Country Profile, Kenya. www.globalnutritionreport.org

49. **WHO (2015)**: Non Communicable Diseases. www.who.int

50. **WHO** (2016): Effects of Saturated Fatty Acids on Serum Lipids and Lipoproteins: *A Systematic Review and Regression Analysis.* www.who.int

51. **WHO** (2017): Cardiovascular Disease Fact Sheet.

52. WHO (2020): Healthy Diet Fact Sheet. https:// www.who.int

53. **WHO.** Prevention of Cardiovascular Disease, Guidelines for Assessment and Management of Cardiovascular Risk (2007).