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Original Article

Dyslipidemia: Prevalence and Associated Risk Factors among undergraduate Students of Wellspring University, Benin City, Edo State, Nigeria

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Abstract

Background: Dyslipidemia, characterized by abnormal blood lipid levels, is a major risk factor for cardiovascular disease, contributing to an estimated 4.2 million deaths and disabilities globally. This study aimed to assess the prevalence and factors associated with dyslipidemia among undergraduate students of Wellspring University, Benin City, Edo State, Nigeria. ***Methods:*** A cross-sectional study was conducted among 107 undergraduates (aged 16–40 years; mean age 20.33 ± 4.14 years) at Wellspring University using purposive sampling. Sociodemographic data were collected via self-administered questionnaires. Total cholesterol (TC), triglycerides (TG), high-density lipoprotein-cholesterol (HDL-C), and low-density lipoprotein-cholesterol (LDL-C) were analyzed using a Spectrumlab MF-21D spectrophotometer. Data were analyzed with IBM-SPSS version 23.0 at $p < 0.05$ significance level. ***Results:*** Of the participants, 80 (74.8%) were females, and the overall prevalence of dyslipidemia was 59.8%. Prevalence of abnormal TC, HDL-C, and LDL-C were 9.3%, 52.3%, and 14.9%, respectively. There were significant associations between age and TC; access to affordable healthy food and HDL; hours of weekly physical activities and LDL ($P < 0.05$) respectively. ***Conclusion:*** Dyslipidemia prevalence was high among subjects. Age, physical activities and healthy food intake significantly influenced dyslipidemia. Promoting physical exercise, and healthy food consumption including fruit and vegetable may reduce dyslipidemia risk.

Keywords: ***Cholesterol, Dyslipidemia, HDL, LDL, Lipid Profile, Triglycerides***

Introduction

Dyslipidemia is a disorder of lipid metabolism characterized by abnormal levels of total cholesterol (TC), low-density lipoprotein cholesterol (LDL-C), triglycerides (TG), or high-density lipoprotein cholesterol (HDL-C). It is classified as primary (genetic)[1] or secondary (acquired through lifestyle or medical conditions). LDL-C ("bad" cholesterol) promotes arterial plaque formation, while HDL-C ("good" cholesterol) removes LDL-C and protects against atherosclerosis. Elevated triglycerides and total cholesterol further increase cardiovascular risk [2]. Dyslipidemia is a major modifiable risk factor for cardiovascular disease (CVD), a leading global cause of morbidity and mortality, accounting for about 4.2 million deaths (42.5%) in 2019 [3]. Its prevalence is rising, particularly in developing nations [4]. Common risk factors include age, sex, high body mass index (BMI), central obesity, poor diet, physical inactivity, and smoking [5,6]. Dyslipidemia often coexists with hypertension and diabetes, amplifying CVD risk [3,4,7]. An imbalance between LDL-C and HDL-C contributes to myocardial infarction and stroke, while high LDL-C drives atherosclerosis and ischemic heart disease [8].

Clinical signs may include xanthelasma, arcus senilis, lipemia retinalis, angina, and limb ischemia [9,10]. Although appropriate treatment can reduce CVD risk by up to 30% within five years,[11] awareness, treatment, and control of dyslipidemia remain poor globally, including Nigeria [12,13]. Identifying population-specific risk factors is crucial for targeted prevention and health education. Given the absence of existing data among students in the

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study area, this survey aims to determine the prevalence and associated risk factors of dyslipidemia among undergraduates of Wellspring University, Benin City, Edo State, Nigeria with emphasis on lifestyle factors such as diet, physical activity, and sleep that may influence lipid profiles and cardiovascular health.

Methods

Study Area, Study population and Selection Criteria

This cross-sectional survey of undergraduate students aged 16–40 years was conducted at Wellspring University, Benin City, between November 2024 and February 2025. The study focused on determining the prevalence and associated factors of dyslipidemia among undergraduate students. Participants within the ages 16–40 years, fasted overnight for at least 10 hours and signed informed consents were included in the study. Participants that did not meet the above criteria and/or did complete the study were excluded.

Sample size Determination, Sampling Technique and Data collection

The minimum sample size for this study was estimated using the formula.[14]

$$n = \frac{Z^2 P(1-P)}{e^2}$$

The prevalence of dyslipidemia 13.17% reported in Chinese young adults,[15] margin of error of 7%, 95% confidence interval and 10% non-response rate was considered to arrive at a minimum sample size of 100.

Participants were recruited from the Colleges of Health Sciences, Science and Computing, and Management Sciences of Wellspring University through purposive sampling technique. 36 students that met the inclusion criteria were recruited from each of the three colleges. However, one participant did not complete the study, hence, was excluded. A total of 107 consenting undergraduate students voluntarily participated in the study. Data were collected using a pre-tested, structured questionnaire administered via face-to-face interviews. The questionnaire covered socio-demographic details, clinical information, and lifestyle habits such as diet, sleep, and physical activity. Anthropometric measurements were taken by trained Public Health Officers. Height was measured using a stadiometer to the nearest 0.1 cm, with participants barefoot and standing upright. Weight was recorded to the nearest 0.1 kg using a digital scale while participants wore light clothing. Body Mass Index (BMI) was calculated as weight (kg) divided by height (m^2).[13,16] and categorized as follows: underweight (<18.5 kg/m^2), normal (18.5–24.9 kg/m^2), overweight (25–29.9 kg/m^2), and obese (≥30 kg/m^2)[14,17].

Sample Collection and Laboratory Analysis

After a minimum 10-hour overnight fast, 5 mL of venous blood was drawn into lithium-heparinized tubes [7]. Samples were centrifuged, and non-hemolyzed serum was stored at –20°C and analyzed within seven days. All analyses were performed at the Wellspring University Clinical Chemistry Laboratory using Randox reagents and protocols [18,19]. A Spectrumlab MF-21D spectrophotometer (1 cm cuvette, ~500 nm wavelength) was used for all spectrophotometric determinations.

Total Cholesterol Assay

For each test, 10 µL of serum sample, and 10 µL of standard (200 mg/dL) was mixed with 1.0 mL of Randox total cholesterol reagent and incubated at 37°C for 5 minutes. Absorbance was read at 500 nm against the reagent blank (1 mL of distill H2O + 1 mL of reagent), and the concentration calculated using:

$$\text{Concentration of Test} = \left(\frac{\text{Absorbance of Test}}{\text{Absorbance of standard}}\right) \times 200 \text{ mg/dL}$$

Triglycerides assay

In preparation of triglyceride reagent, 15 ml of reagent was added to buffer and left on bench for 10 minutes before use. Randox triglyceride reagent (GPO-PAP method) was used. After reagent preparation, 10 µL of sample and 10 µL of standard (200 mg/dL) was added respectively to 1.0 mL of reagent, incubated for 5 minutes at 37°C, and absorbance read at 500 nm against the reagent blank (1 mL of distill H2O + 1 mL of reagent), and the concentration calculated using:

$$\text{Concentration of Test} = \left(\frac{\text{Absorbance of Test}}{\text{Absorbance of standard}}\right) \times 200 \text{ mg/dL}$$

HDL-Cholesterol Assay

To prepare the supernatant, 0.5 mL of serum was mixed with 1.0 mL of HDL reagent and incubated for 10 minutes at room temperature, followed by centrifugation at 4000 rpm for 10 minutes. Then, 100 µL of the supernatant and 100 µL of HDL standard (50 mg/dL) was mixed respectively with 1.0 mL cholesterol reagent and incubated at 37°C for 5 minutes. Absorbance was read at 500 nm against reagent blank, and concentration determined as:

$$\text{Concentration of Test} = \left[\left(\frac{\text{Absorbance of Test}}{\text{Absorbance of standard}}\right) \times 50 \text{ mg/dL}\right] \times 2$$

LDL-Cholesterol Calculation

LDL-C was derived using the Friedewald equation [20]:

$$\text{LDL-C} = \text{TC} - \text{HDL} - \left(\frac{\text{TG}}{5}\right)$$

Definition of Dyslipidemia: Dyslipidemia was defined based on the National Cholesterol Education Program (NCEP) ATP III guidelines [4] as a raised TG level of ≥ 200 mg/dL (2.26 mmol/L), raised TC level of ≥ 240 mg/dL (6.22 mmol/L), reduced HDL-C of < 40 mg/dL (1.04 mmol/L) and/or raised LDL-C of ≥ 160 mg/dL (4.14 mmol/L)

Data Analysis

Data were entered in Microsoft Excel and analyzed using IBM SPSS version 23.0. Descriptive statistics and frequency distributions were presented in tables and charts to show the prevalence of dyslipidemia and its associated factors. Associations between lipid parameters and socio-demographic or lifestyle variables were tested using Chi-square (Fisher's test for cells < 5 values). A p-value < 0.05 was considered statistically significant.

Results

Participants ranged from 16 to 40 years (mean age 20.33 ± 4.14 SD). Most respondents (94.4%) were aged ≤ 25 years, and females comprised 74.8%. Over half (51.4%) were from the South-South region, followed by 22.4% from the South-West. Based on BMI, 44.9% had normal weight (18.5–24.9 kg/m^2), while 29.0% were overweight and 24.3% obese. Regarding physical activity, 31.8% reported no weekly exercise, and 29.9% exercised 1–3 hours weekly. Over half (51.4%) consumed fruits and vegetables 2–3 times weekly, whereas 36.4% rarely or never did. Daily and 2–3 times weekly consumption of carbonated drinks were reported by 37.4% and 44.9%, respectively. Similarly, 43.0% ate junk food daily and 42.1% 2–3 times weekly. Most (62.6%) ate 1–2 meals daily, and 71.0% skipped meals regularly. Additionally, 29.0% reported stress-related eating, and 32.7% slept less than 5 hours per night. While 60.7%

were from middle-income families, 65.4% lacked access to safe exercise spaces, though 66.4% had access to affordable healthy foods (**Table 1**).

The mean total cholesterol (TC) was 150.37 ± 62.84 mg/dL. While 82.2% had desirable/normal (< 200 mg/dL) TC, 8.4% had borderline high (200–239 mg/dL), and 9.3% high (≥ 240 mg/dL) levels. Mean triglycerides (TG) were 74.69 ± 36.60 mg/dL, with 97.2% normal (< 150 mg/dL) and 2.8% borderline high (150–199 mg/dL). Mean HDL-C was 65.83 ± 55.64 mg/dL. Findings showed that 52.3% had low (< 40 mg/dL in men, < 50 mg/dL in women), 7.5% had normal (40–60 mg/dL), and 40.2% high (> 60 mg/dL) values. Mean LDL-C was 92.38 ± 63.07 mg/dL. While 57.0% were normal/optimal (< 100 mg/dL), 9.3% had borderline high (130–159 mg/dL), and 14.9% had high (≥ 160 mg/dL). Overall, while 40.2% had normal lipid profiles, 59.8% had dyslipidemia (**Figure 1**).

From Tables 2, a significant association existed between age and TC ($\chi^2 = 22.042$, $p = 0.027$). Fruit and vegetable intake were shown to be associated significantly with HDL-C ($\chi^2 = 10.515$, $p = 0.005$). Furthermore, physical activity was significantly associated with LDL-C ($\chi^2 = 20.111$, $p = 0.031$). Although, sleep duration in the overall was not significantly associated with LDL-C ($\chi^2 = 15.128$, $p = 0.053$), its influence on lipid profile maybe be of concern. Findings from this study showed that access to affordable healthy food was significantly associated with HDL-C ($\chi^2 = 7.094$, $p = 0.013$).

Table 1: Socio-demographic and Health Behaviour Characteristics of Respondents

Variables	Options	Frequency (n)	Percentage (%)
Age group (years)	< 20	55	51.4
	20-25	46	43.0
	26-30	1	.9
	31-35	2	1.9
	36-40	3	2.8
Gender	Male	27	25.2
	Female	80	74.8
Geographical region	South-south	55	51.4
	South-west	24	22.4
	South-east	12	11.2
	North-central	9	8.4
	North-east	4	3.7
	North-west	3	2.8
Nutritional status	Thin	2	1.9
	Normal	48	44.9
	Overweight	31	29.0
	Obese	26	24.3
Hours of weekly physical exercise	None	34	31.8
	Less than 1 hour	22	20.6
	1-3 hours	32	29.9
	Above 3 hours	19	17.8
Fruit and vegetable consumption	Daily	13	12.1
	2-3 times weekly	55	51.4
	Rarely/never	39	36.4
Carbonated drinks	Daily	40	37.4
	2-3 times weekly	48	44.9
	Rarely/never	19	17.8
Junk foods	Daily	46	43.0
	2-3 times weekly	45	42.1
	Rarely/never	16	15.0
Frequency of meal per day	1-2 times	67	62.6
	3 times	18	16.8
	More than 3 times	22	20.6
Skip meals regularly	Yes	76	71.0
	No	31	29.0
Eating in response to stress or emotion	Frequently	31	29.0
	Occasionally	54	50.5
	Never	22	20.6
Hours of sleep per night (hours)	< 5	35	32.7
	5-7	55	51.4
	> 7	17	15.9
Income level of family	Low	26	24.3
	Middle	65	60.7
	High	16	15.0
Access to safe space for exercise	Yes	37	34.6
	No	70	65.4

Access to affordable healthy food options in area	Yes	71	66.4
	No	36	33.6

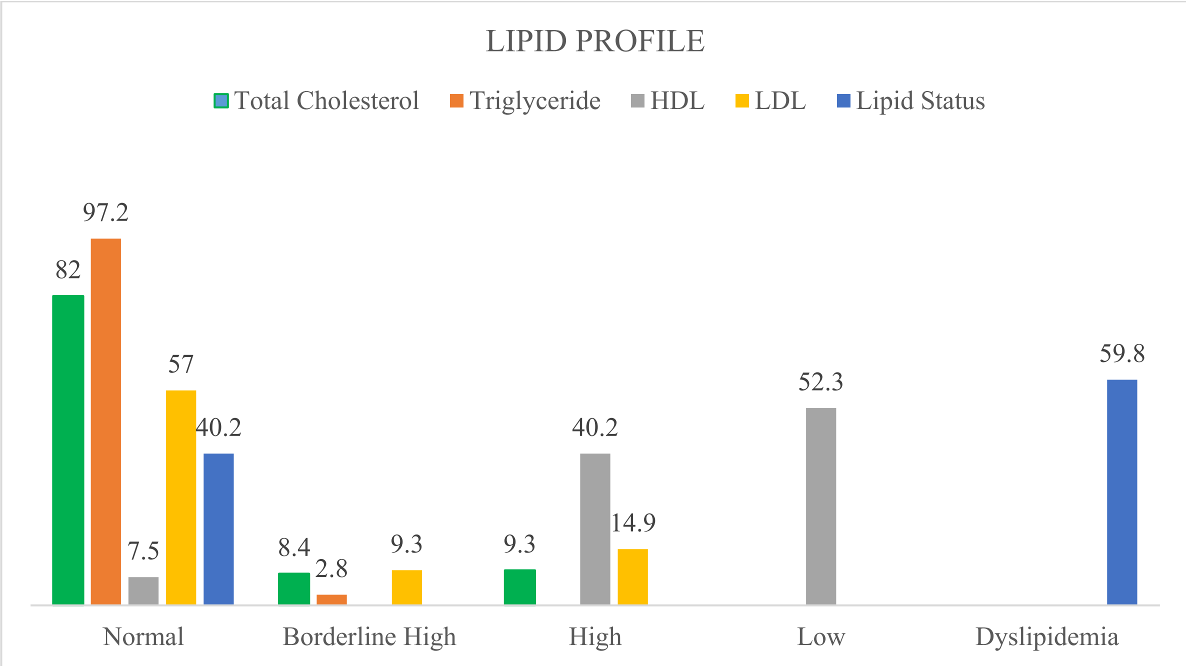

Figure 1: Lipid Profile Value of Respondents

Table 2: Socio-demographic and Behavioral Factors Associated with Dyslipidemia among Respondents

Variables	Options	Total Cholesterol Category					Triglyceride Category				HDL Category				LDL Category					
		N	BH	H	χ2	P-Value	N	BH	χ2	P-Value	L	N	χ2	P-Value	N	BH	H	VH	χ2	P-Value
Age Group (Years)	< 20	47	3	5	22.042	.027	53	2	.380	1.000	27	28	2.000	.827	31	6	3	4	17.170	.387
	20-25	39	5	2			45	1			19	27			29	4	3	3		
	26-30	1	0	0			1	0			0	1			0	0	0	0		
	31-35	1	0	1			2	0			1	1			1	0	0	1		
	36-40	0	2	1			3	0			2	1			1	0	1	1		
Gender	Male	21	3	3	.521	.754	27	0	1.042	.570	12	15	.027	1.000	15	3	0	4	4.291	.387
	Female	67	7	6			77	3			37	43			47	7	7	5		
Geographical Region	South-south	44	6	5	7.224	.692	54	1	2.168	.820	22	33	2.404	.809	32	8	4	3	22.730	.137
	South-west	20	2	2			23	1			13	11			12	2	1	3		
	South-east	12	0	0			11	1			7	5			11	0	0	0		
	North-central	6	1	2			9	0			4	5			3	0	0	3		
	North-east	3	1	0			4	0			2	2			2	0	2	0		
	North-west	3	0	0			3	0			1	2			2	0	0	0		
Nutritional Status	Thin	2	0	0	1.801	.914	2	0	1.383	.629	2	0	2.500	.552	0	0	0	0	18.194	.112
	Normal	41	4	3			46	2			22	26			27	6	1	4		
	Overweight	24	3	4			31	0			14	17			19	3	2	4		
	Obese	21	3	2			25	1			11	15			16	1	4	1		
Hours of Weekly Physical Activity	None	29	0	5	11.726	.062	34	0	5.517	.166	13	21	1.369	.712	20	3	1	3	20.111	.031
	< 1 hour	20	2	0			20	2			10	12			14	3	2	0		
	1-3 hours	23	5	4			32	0			16	16			19	0	4	6		
	> 3 hours	16	3	0			18	1			10	9			9	4	0	0		
Fruit and Vegetable Consumption	Daily	11	1	1	2.945	.580	13	0	.523	1.000	9	4	10.515	.005	7	1	1	1	11.888	.152
	2-3x weekly	45	7	3			53	2			17	38			39	2	4	3		
	Rarely/never	32	2	5			38	1			23	16			16	7	2	5		
Carbonated Drinks	Daily	31	4	5	1.562	.822	40	0	1.903	.400	21	19	1.419	.507	20	4	2	5	6.327	.630
	2-3x weekly	41	4	3			46	2			21	27			31	4	2	3		
	Rarely/never	16	2	1			18	1			7	12			11	2	3	1		
Junk Foods	Daily	39	4	3	.926	.915	44	2	.920	.833	22	24	.534	.807	27	6	3	2	5.756	.694
	2-3x weekly	36	5	4			44	1			21	24			25	4	2	6		
	Rarely/never	13	1	2			16	0			6	10			10	0	2	1		
Frequency Of Meal Per Day	1-2 times	56	5	6	2.932	.600	66	1	1.168	.554	30	37	.157	.961	37	6	7	4	9.134	.332
	3 times	16	1	1			17	1			9	9			13	1	0	1		
	> 3 times	16	4	2			21	1			10	12			12	3	0	4		
Skip Meals Regularly	Yes	62	6	8	2.000	.396	74	2	.029	1.000	37	39	.883	.397	44	6	6	7	1.587	.818
	No	26	4	1			30	1			12	19			18	4	1	2		
Eating In Response To Stress/ Emotion	Frequently	26	2	3	1.222	.878	30	1	.815	.814	18	13	5.007	.084	19	2	1	3	6.443	.617
	Occasionally	44	5	5			52	2			19	35			33	6	5	4		

	Never	18	3	1			22	0			12	10			10	2	1	2		
Hours of Sleep Per Night	< 5 hours	31	3	1	4.679	.322	34	1	.631	1.000	18	17	1.541	.471	20	2	1	2	15.128	.053
	5-7 hours	42	7	6			53	2			22	33			31	8	6	6		
	> 7 hours	15	0	2			17	0			9	8			11	0	0	1		
Income Level of Family	Low	23	2	1	3.447	.511	25	1	.583	1.000	13	13	.249	.890	17	1	2	1	4.190	.860
	Middle	54	6	5			63	2			29	36			37	7	3	6		
	High	11	2	3			16	0			7	9			8	2	2	2		
Access to Safe Exercise Space	Yes	28	6	3	3.159	.238	35	2	1.405	.550	18	19	.186	.688	20	3	2	5	2.146	.737
	No	60	4	6			69	1			31	39			42	7	5	4		
Access to Affordable Healthy Food	Yes	59	5	7	1.743	.446	68	3	1.565	.324	39	32	7.094	.013	38	6	4	8	4.556	.351
	No	29	5	2			36	0			10	26			24	4	3	1		

Discussion

The prevalence of high total cholesterol (TC) in this study (9.3%) was notably lower than reports from Pakistan (39.3%),[21] Saudi Arabia (54%),[22] Uyo, Nigeria (43.4%),[7] Ethiopia (38.9%),[23] India (23.3%),[24] Malaysia (51%)[25] and Egypt (60.6%),[26] but slightly higher than 6.35% among Chinese young adults [15]. Variations may be linked to differences in genetics, dietary patterns, and levels of physical activity across populations. The proportion with borderline high triglycerides (2.8%) was lower than findings from Pakistan (48.9%),[21] Uyo (20.8%),[7] China (13.85%),[15] and Ethiopia (44.6%),[23] indicating a comparatively lower burden of hypertriglyceridemia among participants. Low HDL-C (52.3%) in this study was similar to Ethiopia (53.5%)[23] and Qatar (56.8%),[27] but higher than the levels reported in Uyo (12.9%)[7] and Cameroon (44.3%) [28]. Conversely, it was lower than that in Pakistan (83.9%),[21] China (73.8%),[15] and Egypt (66%) [26]. These disparities may reflect differences in dietary habits, lifestyle, and levels of urbanization. The prevalence of high LDL-C (14.9%) in our study was also lower than those reported in Pakistan (39.7%),[21] Uyo (30.3%),[7] and Ethiopia (29.4%),[23] but higher than among Chinese young adults (5.95%)[15] and American Indian youth (2.8%) [29].

Overall dyslipidemia prevalence was 59.8%, higher than 13.17% reported in Chinese young adults,[15] but lower than findings from Ethiopia (76.6%),[23] Iran (78.9%),[30] Poland (77.2%),[31] Palestine (66.4%),[32] South Africa (67.3%),[33] and Uganda (63.3%) [34]. A significant association existed between age and TC. This agrees with findings from China, where dyslipidemia was more prevalent in individuals above 24 years [15,35]. Age-related lipid alterations may stem from increased insulin resistance, postprandial dyslipidemia, and hormonal decline [23]. Physical activity was also associated with LDL-C levels. Participants engaging in > 3 hours of weekly exercise had lower high LDL values. This aligns with studies confirming that physical exercise improves lipid metabolism and cardiovascular health, with HDL-C being the most responsive parameter [36,37].

Higher fruit and vegetable intake was linked to raise normal HDL-C levels. This finding agrees with evidence based reports that diets rich in fruits and vegetables, due to their antioxidant and anti-inflammatory properties, protect against lipid disorders [23]. Rapid dietary transitions toward processed and high-fat foods in low- and middle-income countries may exacerbate dyslipidemia prevalence [38,39]. Although, sleep duration was not broadly associated with dyslipidemia, sleeping less than five hours daily may increase LDL-C levels. Similar findings by Tsiptsios et al. (2022)[40] and Smiley et al. (2019)[41] revealed that short sleep (<6 hours) doubles dyslipidemia risk and is linked to high TG and low HDL-C. However, other studies suggest long sleep duration may also increase dyslipidemia risk [42,43].

Conclusion

This study revealed a high prevalence of dyslipidemia (59.8%) among undergraduates maybe primarily due to low HDL-C levels. Factors such as age, sleep duration, physical activity, and fruit and vegetable intake are significant factors that may influenced lipid profiles, emphasizing the need for lifestyle modification to reduce dyslipidemia risk in young adults. Nevertheless, the small sample size and single university surveyed limit broad representation of this study. Hence, the result of this study cannot be generalized among undergraduate students in Benin City.

Declarations

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Conflicts of Interest

The authors have no conflicts of interest to declare

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Authors declare that this study has not received any financial support.

Ethical Clearance

The study was approved by the Ethical Committee, College of Health Sciences, Wellspring University (Approval No. COHS/PH/2111/2024). Each participant provided informed written consent prior to inclusion.

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