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Socioeconomic Impact of Synthetic Cannabinoid ("Kush") Use and Its Effects on Basic Metabolic Panel Parameters Among Users in Three Districts of Sierra Leone: A Mixed-Methods Cross-Sectional Study

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ABSTRACT

Background: The synthetic cannabinoid "Kush" has emerged as a significant public health threat in Sierra Leone, with a 4,000% surge in hospital admissions between 2020 and 2023 prompting a national emergency declaration in April 2024. This study assessed the socioeconomic impact of Kush use and its effects on basic metabolic panel (BMP) parameters among users in three districts of Sierra Leone.

Methods: A mixed-methods cross-sectional study was conducted in Western Area (Urban/Rural), Bo District, and Bombali District from May 15–31, 2025. Using snowball sampling, 286 Kush users (≥6 months use) completed structured questionnaires assessing socioeconomic impacts, reasons for use, and beliefs about the drug. Venous blood samples were analyzed using a CYAN SMART semi-automated biochemistry analyzer for liver function (SGPT, SGOT, ALP, bilirubin, total protein, albumin) and kidney function (creatinine, urea, uric acid) parameters. Quantitative data were analyzed descriptively using SPSS version 16.0; qualitative data were analyzed thematically.

Results: Participants were predominantly male (75.9%), aged 18–25 years (48.3%), and unemployed (36.4%). Most (53.8%) had used Kush for 1–2 years. Significant social impacts included homelessness (34.3%), community discrimination (69.2%), and stigmatization as thieves or mentally ill (47.6%). Economically, 48.6% spent NLE 1,200 monthly on Kush—exceeding the national average cost of living (NLE 915.45). Kidney function parameters were markedly Elevated: mean creatinine 2.34 mg/dL (reference: 0.6–1.4), mean uric acid 9.41 mg/dL (reference: 2.5–7.7), and mean urea 43.81 mg/dL (reference: 15–45). Liver function showed mild elevations in SGOT (43.8 U/L; reference: 3.12–38.0) and total bilirubin (1.28 mg/dL; reference: 0.2–1.0), with low total protein (6.45 g/dL; reference: 6.6–8.3) and albumin (3.43 g/dL; reference: 3.5–5.0).

Conclusions: Kush use in Sierra Leone is associated with severe socioeconomic consequences and significant renal dysfunction. The elevated creatinine and uric acid levels suggest nephrotoxic effects requiring urgent public health intervention. Community-based rehabilitation programs, health education, and regulatory policies targeting precursor chemicals are urgently needed.

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Introduction

Drug addiction represents a global public health crisis, with an estimated 35 million people worldwide suffering from drug use disorders in 2019 [1]. Synthetic cannabinoids have emerged as particularly dangerous substances due to their unpredictable composition and severe health consequences [2]. In West Africa, the proliferation of synthetic drugs has strained already fragile health systems, with significant social and economic repercussions [3].

In Sierra Leone, a synthetic cannabinoid locally known as "Kush" has rapidly become the most pressing substance use concern. Comprising ketamine, formaldehyde, synthetic cannabinoids (MDMB-4en-PINACA, AB-CHMINACA), acetone, and tramadol, Kush has been associated with multiple organ dysfunction and resistance to conventional sedatives [4]. Between 2020 and 2023, the Sierra Leone Psychiatric Hospital reported a 4,000% increase in Kush-related admissions, prompting the President to declare a national public health emergency in April 2024 [5]. Despite this crisis, empirical research on Kush's health effects remains virtually nonexistent.

The socioeconomic consequences of synthetic cannabinoid use are well-documented globally. Users frequently experience

family rejection, homelessness, employment loss, and community stigmatization [6,7]. Economically, substance use diverts resources from essential needs, with users often spending disproportionate income on drugs [8,9]. In resource-limited settings like Sierra Leone, these impacts are amplified by weak social safety nets and limited rehabilitation infrastructure [10].

Biochemically, synthetic cannabinoids have been linked to hepatotoxicity and nephrotoxicity in clinical studies [11,12]. However, no studies have quantified these effects among Kush users in Sierra Leone or West Africa. The Basic Metabolic Panel (BMP)—encompassing liver enzymes (SGPT, SGOT, ALP, bilirubin, protein, albumin) and kidney markers (creatinine, urea, uric acid)—provides a standardized framework for assessing these organ-specific toxicities [13].

This study aimed to: (1) assess the social and economic impact of Kush use among consumers; (2) determine reasons for and levels of Kush use; (3) investigate users' beliefs about Kush; and (4) analyze BMP parameters among users in three districts of Sierra Leone.

Materials and Methods

Study Design and Setting

A mixed-methods cross-sectional study was conducted from May 15–31, 2025, in three districts representing Sierra Leone's major regions: Western Area (Urban/Rural, including the capital Freetown), Bo District (Southern Province), and Bombali District (Northern Province). These districts were selected based on population density and reported Kush use prevalence.

Participants

Inclusion criteria were: (1) confirmed Kush user; (2) minimum six months of use; (3) age 18 years or older; (4) resident of selected districts; and (5) capacity to provide informed consent. Exclusion criteria were age below 18 years or inability to comprehend the consent process.

Sampling and Sample Size

Given the hidden nature of the population, non-probability exponential non-discriminative snowball sampling was employed [14]. The minimum sample size was calculated using Cochran's formula for unknown populations ($n_0 = Z^2pq/e^2$), yielding 385 participants. Adjusted for finite population ($N \approx 350$ per district), the target was 125 per district (total n = 375). Of 306 questionnaires returned, 286 complete responses with blood samples were analyzed (response rate: 76.3%).

Data Collection

A structured questionnaire captured: (a) sociodemographics; (b) drug use patterns; (c) social impacts (residential status, discrimination, employment); (d) economic impacts (expenditure, income, work hours); (e) reasons for use and beliefs; and (f) health awareness. Trained research assistants administered questionnaires in local languages where necessary. Open-ended questions captured qualitative data on user experiences and beliefs.

Venous blood samples (3–5 mL) were collected by trained phlebotomists and transported to Premium Laboratory for analysis. Liver function tests (SGPT/ALT, SGOT/AST, ALP, total bilirubin, direct bilirubin, total protein, albumin) and kidney function tests (creatinine, urea, uric acid) were performed using a CYAN SMART semi-automated biochemistry analyzer.

Ethical Considerations

Ethical approval was obtained from the University of Makeni Ethical Review Board. Community stakeholders were notified, and written informed consent was obtained from all participants. Confidentiality was maintained through anonymized coding. Participants could withdraw at any time without penalty.

Data Analysis

Quantitative data were entered into SPSS version 16.0 and analyzed descriptively (frequencies, percentages, means, standard deviations). Qualitative data from open-ended responses were analyzed thematically. District-specific and cumulative biochemical parameters were compared against established reference ranges.

Results

Sociodemographic Characteristics

Of 286 participants, 217 (75.9%) were male and 69 (24.1%) females. Age distribution was: 18–25 years (48.3%), 26–33 years (17.1%), 34–41 years (12.6%), 42–49 years (10.1%), and ≥50 years (11.9%); mean age 37.8 years. By district: Western Area (40.2%), Bo (30.1%), Bombali (29.7%). Religious affiliation: Christianity (59.1%), Islam (37.1%), other (3.9%). Marital status: single (61.9%), married (27.3%), engaged (10.8%). Employment: unemployed (36.4%), employed (33.6%), self-employed (30.1%) (Table 1).

Table 1: Sociodemographic Characteristics of Kush Users (n=286)

Characteristic	n (%)	Mean (SD)
Sex		
Male	217 (75.9)	
Female	69 (24.1)	
Age (years)		37.8
18–25	138 (48.3)	
26–33	49 (17.1)	
34–41	36 (12.6)	
42–49	29 (10.1)	
≥50	34 (11.9)	
District		
Western Area	115 (40.2)	
Bo	86 (30.1)	

Bombali	85 (29.7)	
Religion		
Christianity	169 (59.1)	
Islam	106 (37.1)	
Other	11 (3.9)	
Marital status		
Single	177 (61.9)	
Married	78 (27.3)	
Engaged	24 (10.8)	
Employment		
Employed	96 (33.6)	
Self-employed	86 (30.1)	
Unemployed	104 (36.4)	

Drug Use Patterns and Awareness

Only 34.3% had heard of "drug abuse" as a concept. Primary information sources were healthcare personnel (65.8% of informed participants) and friends (9.4%). The vast majority (85.0%) had never attended drug education events. Duration of use: 6 months–1 year (29.7%), 1–2 years (53.8%), >2 years (16.4%). Age of initiation: 18–30 years (47.9%), <18 years (27.3%), ≥30 years (24.8%) (Table 2).

Table 2. Drug Use Patterns and Awareness (n=286)

Variable	n (%)
Heard of drug abuse	
Yes	98 (34.3)
No	188 (65.7)
Attended drug education	
Yes	43 (15.0)
No	243 (85.0)
Duration of use	
6 months–1 year	85 (29.7)
1–2 years	154 (53.8)
>2 years	47 (16.4)
Age at initiation	
<18 years	78 (27.3)
18–30 years	137 (47.9)
≥30 years	71 (24.8)

Social Impact

Homelessness affected 34.3% of participants, primarily due to financial constraints (45.9%) and family rejection (42.9%). Discrimination was reported by 69.2%, with 39.5% describing community treatment as "very bad." Nearly half (47.6%) had been labeled as thieves or mentally ill due to their addiction. Community reactions to interaction were poor (48.6%), fair (28.3%), or good (23.1%). Among the 36.4% unemployed, 51.9% attributed this to employer rejection based on personality changes, and 39.4% to inability to retain employment (Table 3).

Table 3: Social Impact of Kush Use (n=286)

Variable	n (%)
Residential status	
Homeless	98 (34.3)
Family residence	91 (31.8)
Rented apartment	74 (25.9)
With spouse	23 (8.0)
Experienced discrimination	
Yes	198 (69.2)
No	88 (30.8)
Community treatment	
Very bad	113 (39.5)
Bad	85 (29.7)
Good	61 (21.3)
Fair	27 (9.4)
Labeled thief/mentally ill	
Yes	136 (47.6)
No	150 (52.4)
Unemployment reasons (n=104)	
Employer rejection (personality)	54 (51.9)
Inability to keep job	41 (39.4)
Other	9 (8.7)

Economic Impact

Most participants (45.1%) used Kush twice daily, spending NLE 40 daily (48.6% of respondents). Monthly expenditure on Kush averaged NLE 1,200 for 48.6% of users—exceeding the national average cost of living (NLE 915.45). Work hours were severely reduced: 41.6% worked only 4 hours daily. Job loss due to drug use was reported by 39.9%. The majority (59.1%) earned below NLE 800 monthly (Table 4).

Table 4. Economic Impact of Kush Use (n=286)

Variable	n (%)
Daily frequency	
Once	63 (22.0)
Twice	129 (45.1)
>2 times	94 (32.9)
Daily expenditure (NLE)	
20	53 (18.5)
40	139 (48.6)
60	17 (5.9)
80	77 (26.9)
Work hours/day	
4	119 (41.6)
6	43 (15.0)
8	75 (26.2)
>8	49 (17.1)
Ever sacked due to drug use	
Yes	114 (39.9)
No	172 (60.1)
Monthly income (NLE)	
<800	169 (59.1)
800	51 (17.8)
>800	66 (23.1)

Reasons for Use and Beliefs

Stress relief was the predominant reason for use (64.0%), followed by pleasure (27.6%), habit (7.3%), and other reasons (1.1%). Despite 77.3% being aware of health risks, 66.8% had never considered quitting. Of the 33.2% who had considered cessation, 76.8% indicated they would require assistance, predominantly through rehabilitation services and skills training. Qualitative responses revealed a paradoxical perception: users acknowledged Kush's harmful effects while describing temporary relief from life's hardships. One participant stated: "This thing makes me forget that I don't have work; it makes me nod off and rest my heart."

Biochemical Parameters

Kidney Function: Mean creatinine was markedly elevated across all districts: Western Area 2.16 mg/dL, Bo 2.36 mg/dL, Bombali 2.50 mg/dL (cumulative: 2.34 mg/dL; reference: 0.6–1.4). Urea was at the upper limit of normal (cumulative: 43.81 mg/dL; reference: 15–45). Uric acid was substantially elevated (cumulative: 9.41 mg/dL; reference: 2.5–7.7) (Table 5).

Table 5: Kidney Function Parameters by District

Parameter	Western Area	Bo	Bombali	Cumulative	Reference Range
Creatinine (mg/dL)	2.16	2.36	2.50	2.34	0.6–1.4
Urea (mg/dL)	45.11	42.50	43.83	43.81	15–45
Uric acid (mg/dL)	9.60	9.33	9.31	9.41	2.5–7.7

Liver Function: SGPT/ALT was near the upper reference limit (cumulative: 39.6 U/L; reference: 3.0–40.0). SGOT/AST exceeded the reference range (cumulative: 43.8 U/L; reference: 3.12–38.0). ALP was within normal limits (85.3 U/L). Total bilirubin was elevated (1.28 mg/dL; reference: 0.2–1.0), though direct bilirubin remained normal (0.23 mg/dL; reference: 0.06–0.25). Total protein (6.45 g/dL; reference: 6.6–8.3) and albumin (3.43 g/dL; reference: 3.5–5.0) were below normal (Table 6).

Table 6: Liver Function Parameters by District

Parameter	Western Area	Bo	Bombali	Cumulative	Reference Range
SGPT/ALT (U/L)	39.3	40.9	38.7	39.6	3.0–40.0
SGOT/AST (U/L)	41.7	49.7	40.0	43.8	3.12–38.0
ALP (U/L)	69.8	87.6	98.3	85.3	26–117
Total bilirubin (mg/dL)	1.35	1.26	1.22	1.28	0.2–1.0
Direct bilirubin (mg/dL)	0.32	0.22	0.16	0.23	0.06–0.25

Total protein (g/dL)	6.49	6.78	6.09	6.45	6.6–8.3
Albumin (g/dL)	3.28	3.59	3.43	3.43	3.5–5.0

District-specific variations showed Bombali had the highest creatinine (2.50 mg/dL) and Bo the highest SGOT (49.7 U/L), though patterns were generally consistent across regions.

Discussion

This study provides the first empirical evidence of Kush's socioeconomic burden and biochemical toxicity among users in Sierra Leone. Our findings reveal a crisis affecting predominantly young males, with severe social marginalization, economic devastation, and significant renal dysfunction.

The demographic profile—75.9% male, 48.3% aged 18–25—aligns with global patterns of synthetic cannabinoid use among young men [15,16]. The low awareness of "drug abuse" as a concept (34.3%) and near-universal absence of drug education exposure (85.0%) highlight critical gaps in health literacy that likely perpetuate use. This finding underscores the need for targeted school-based and community prevention programs.

Social consequences were profound. The 34.3% homelessness rate—driven primarily by financial exhaustion and family rejection—exceeds estimates from similar studies in Bangladesh and Nigeria [6,17]. The 69.2% discrimination prevalence and 47.6% stigmatization rate suggest a vicious cycle where social exclusion exacerbates psychological distress, potentially reinforcing drug use as coping behavior [18]. Community rejection (48.6% poor reactions) may also deter help-seeking, as users fear further marginalization.

Economically, our finding that 48.6% of users spend NLE 1,200 monthly—131% of the national average cost of living—parallels report from Nigeria where drug expenditure exceeded living costs by 67% [8]. The reduction to 4-hour workdays for 41.6% of users and 39.9% job loss rate indicate substantial productivity losses. In a post-conflict, resource-constrained economy like Sierra Leone's, such individual-level productivity losses aggregate to significant macroeconomic impacts, consistent with Thavorncharoensap et al.'s estimate that substance use disorders cost 0.45–5.44% of GDP in affected countries [9].

The biochemical results constitute the study's most novel contribution. The markedly elevated creatinine (2.34 mg/dL, 67% above upper reference limit) and uric acid (9.41 mg/dL, 22% above upper limit) strongly suggest nephrotoxicity. These findings align with Alzu'bi et al.'s [11] demonstration that synthetic cannabinoids impair renal function through acute tubular injury and oxidative stress. The urea elevation to 43.81 mg/dL (upper reference limit: 45) further supports declining glomerular filtration. Given that creatinine is both sensitive and specific for renal function, these elevations are clinically significant and indicate potential progression to chronic kidney disease among chronic users [19].

Liver function showed milder abnormalities. While SGPT remained at the reference threshold, SGOT elevation (43.8 U/L) and low total protein/albumin suggest possible early hepatic synthetic dysfunction or malnutrition. However, the absence of marked bilirubin derangement (except total bilirubin) indicates that Kush's hepatotoxicity may be less severe than its nephrotoxicity, or that hepatic damage requires longer exposure duration. This contrasts with Tarantino et al.'s findings on alcohol-related liver disease but aligns with the variable hepatotoxicity reported for synthetic cannabinoids [11, 20].

The predominance of stress relief (64.0%) as the stated reason for use, combined with high unemployment (36.4%) and low income (59.1% earning <NLE 800), suggests that Kush serves as a maladaptive coping mechanism in contexts of economic precarity and limited mental health services. The 66.8% who had never considered quitting, despite 77.3% acknowledging health risks, indicates strong physical or psychological dependence—consistent with the compulsive use patterns described by Everitt and Robbins [21].

Limitations

This study has several limitations. The snowball sampling method, while necessary for a hidden population, may introduce selection bias toward more accessible users. The cross-sectional design precludes causal inference regarding biochemical changes. The absence of a non-user control group limits our ability to attribute biomarker abnormalities exclusively to Kush versus confounding factors (malnutrition, concurrent infections, alcohol use). Self-reported data on socioeconomic variables may be subject to recall and social desirability biases. Finally, the study's restriction to three districts limits generalizability to other regions of Sierra Leone.

Implications

These findings carry urgent policy implications. The renal toxicity data support immediate clinical screening of Kush users for kidney function and the establishment of nephrology referral pathways. The socioeconomic devastation documented argues for integrated interventions combining substance use treatment with housing support, vocational training, and anti-stigma campaigns. Regulatory measures targeting precursor chemicals (ketamine, formaldehyde, tramadol) and synthetic cannabinoid analogs are essential, alongside border control enhancements to prevent new compound introduction.

Conclusions

Kush use in Sierra Leone is associated with catastrophic socioeconomic consequences and significant renal dysfunction among users. The elevation of creatinine and uric acid levels indicates nephrotoxic effects that demand immediate public health response. Integrated interventions addressing substance use treatment, economic rehabilitation, and regulatory control of precursor chemicals are urgently required to mitigate this emerging crisis.

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