A Study on The Toxicological/ Clinical Effects of Drugs/Substance Abuse Among Nigerian Youths: A Review Study.

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Abstract- ***Drug abuse by Nigerian students and youths is an emerging health problem. This systematic review summarized the evidence of the toxicological effects of drug abuse among the young population in Nigeria, majorly on commonly used drugs, their patterns of use, and their reported toxicological effects. The literature search (2010-2024) was performed with the help of major databases and PRISMA guidelines. Eight articles passed inclusion criteria, which were six cross-sectional and two case-control/case-report studies in undergraduates or youth groups. The reported substances contained alcohol and opioid analgesics (tramadol, codeine). Measured outcomes included liver enzymes, renal markers of function, blood counts, and clinical outcomes. Results showed that there was biochemical organ damage: alcohol users had an increased liver enzyme (AST, GGT) and hematologic abnormalities (anemia, thrombocytopenia), whereas, opioid users had renal failure (reduced eGFR). Polydrug abuse (alcohol/opioids) was related to metabolic acidosis and oxidative stress (elevated LDH, MDA; reduced antioxidants). These findings are consistent with world trends in substance toxicity and reflect the well-known association between excessive alcohol/opioid consumption and organ injury. The review gives an insight on the mitigation measures, focusing on the coordinated prevention as a strategy to reduce substance abuse among young people to safeguard health. This will involve age-specific community and school-based education, peer-based interventions, and frequent health screening so that substance-related damage can be identified and dealt with.***

Index Terms- ***Substance abuse; Toxicological effects; Nigerian youth; Alcohol; Opioids.***

I. INTRODUCTION

The use of psychoactive substances is even older than civilization. The consumption of those substances is growing across the globe (Robinson and Adinoff, 2016). When diseases are treated or controlled with a plant part or a synthetic agent, this is called rational use. However, when it is taken in excess and in a constant manner without observing the medically or culturally accepted patterns, it is termed drug abuse (Federal Ministry of Health (2017). Substance abuse in Nigeria and particularly among adolescents has become an epidemic. The common victims were males, adults, and urban residents, but the victims have widened to include females, adolescents, and rural residents (Catherine et al., 2019).

The prevalence of substance abuse disorder in the world is estimated at 2.2%, and alcohol alone contributes to 1.5%; nevertheless, there are significant regional differences (Castaldelli-Maia Bhugra, 2022). . As per the 2022 National Survey on Drug Use and Health, United States, 48.7 million, or 17.3%, individuals above 12 years of age had a substance abuse disorder (SUD) in the past year, which includes 29.5 million with alcohol use disorder (AUD), 27.2 million with a drug use disorder (DUD), and 8.0 million with combined AUD and DUD (SAMSHA, 2022). These substances are also likely to be related to immediate injury or health risks to one or more of the organ systems. Moreover, SUDs are commonly connected to mental health problems as a precondition and risk factor. Equally, cases and rates of sexually transmitted diseases (STDs),

including human immunodeficiency virus (HIV) infection, have been reported to be high in individuals with SUDs (Zacharia & Jacob, 2025).

This systematic review sought to synthesize evidence on the toxicological effects of substance abuse in student populations. The research determined the most abused drugs, how they abuse them, their frequency and the toxicological consequences of the abuse as it has been reported in literature. By critically analyzing information presented in studies related to the topic, this review provided insight into the approaches that can be used to mitigate the health risks of drug misuse in student communities.

II. METHODOLOGY

A. Study Design

In this study, the methodology of systematic literature review was used, which is a clear, reliable, and replicable method to help eliminate bias and obtain a more reliable finding to evaluate and interpret previous studies related to a specific area (Sniazhko and Muralidharan, 2019). The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow approach was followed (Page et al., 2021), based on the recommendations provided by Amirkhani et al. (2021). The objectives of RISMA include the compilation of significant ideas, integration of conclusions, and evaluation of the state of scholarly knowledge on a specific study topic or issue (Amirkhani et al., 2021).

B. Search Strategy

The literature search was comprehensive and was done through electronic databases of PubMed, Google Scholar, Science Direct, Scopus and PsycINFO. The keywords developed on each topic were coupled with Boolean operators (AND, OR) as per the protocol stipulated in the Cochrane Handbook for Systematic Reviews of Interventions version 6.3 (Lefebvre et al., 2022). Search words were combinations of the following keywords using Boolean operators (AND, OR): Substance abuse OR drug abuse OR drug misuse AND toxicological effects OR toxicity OR toxicology OR health effects OR organ damage. Only articles published in the period of 2010-2024, written in English, and involving human subjects were searched.

C. Inclusion Criteria

Studies were included if they:

i. Reported on drug/substance abuse or misuse
ii. Provided clinical, biochemical, or toxicological outcomes (e.g., liver enzymes, renal function, neurological impact)
iii. Were observational studies, cross-sectional surveys, case reports, or clinical trials
iv. Were peer-reviewed and published in English between 2010 and 2025

D. Exclusion Criteria

Studies were excluded if they:

i. Focused solely on psychological or behavioral outcomes without biological/toxicological data
ii. Were animal studies
iii. Were review articles, editorials, or opinion pieces
iv. Were not published in English

E. Data Extraction

The act of obtaining information out of the source of data in order to be further processed is called extraction. As indicated by Chavez Jr and Murcia (2023), the process enabled more in-depth analysis of the information by means of categorizing the studies. Standardized data collection forms are used to collate data provided by primary studies (Montori et al., 2003).They connect the systematic reviews to primary research and form the basis of appraising, analysing, summarizing and interpreting a body of evidence (Buchter et al., 2020). A data extraction form was designed to extract the following information in each of the included studies:

i. Author(s) and year
ii. Country or region
iii. Study population and sample size
iv. Type(s) of substances reported
v. Reported toxicological or clinical effects
vi. Method of measurement (e.g., blood tests, imaging, clinical signs)
vii. Study design and main findings

F. Quality Assessment

The quality of the included studies was evaluated with the help of CASP checklist (Critical Appraisal Skills Program) of observational and cross-sectional studies. The most important areas evaluated were: Clarity of study aim, Methodological rigor,

Appropriateness of statistical analysis, Validity and reliability of measurements.

G. Ethical Considerations

In order to foster the reproducibility, the systematic review processes and results were documented carefully. Personally identifiable information were anonymized, although the data were secondary in nature. Also, much concern was put in place to make sure that the journal papers that were used as sources of data were reliable and ethically published.

III. RESULTS

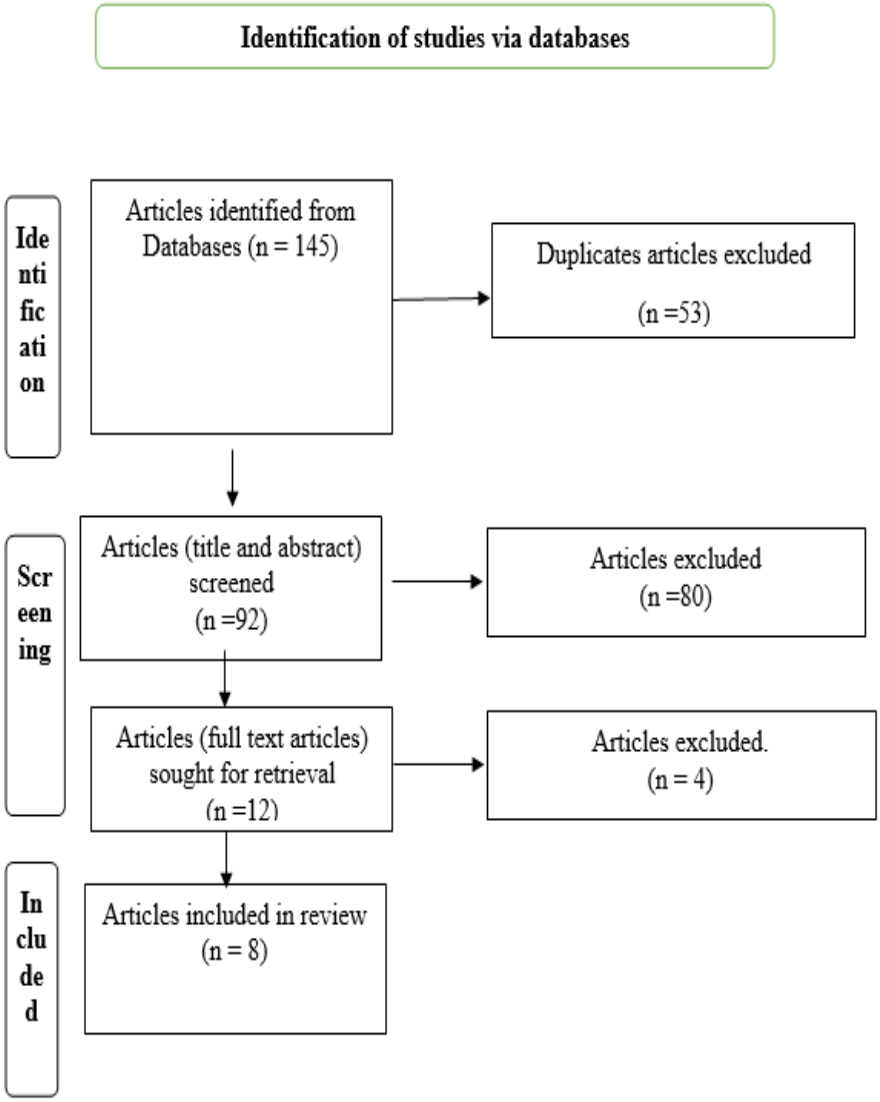

Figure 1: The PRISMA Flow diagram showing the process of identification of eligible studies (Page et al. 2021).

Eight studies were identified that met the inclusion criteria, conducted at various Nigerian sites (Table 1). These included six cross sectional studies and two case control /report studies among students/young adults. A PRISMA-style screening (Figure 1 above) yielded the eight final articles, excluding works that lacked measured biochemical or toxicological outcomes and review studies. Among included studies, sample sizes ranged from a single case to >140 individuals; populations were higher institution undergraduates or youths in community or clinical settings. Common substances were alcohol (in

virtually all) and opioids (tramadol). Outcomes measured included liver enzymes, renal function, blood counts, and clinical symptoms. Table 1 and 2 summarizes each study's design, population, substances and toxicological/clinical effects and main findings.

Table 1: included studies population and substance abuse and the toxicological/clinical effects

S/n	Author (year)	Region (Country)	Population (n)	Substance(s)	Toxicological/Clinical Effects
1	Dic-Ijiewere & Osadolor (2023)	Edo State (South)	Male undergraduates (n=142; 82 users, 60 controls)	Tramadol + Alcohol (±MDMA)	AST, ALP, GGT, LDH ($p<0.01$); ↓bicarbonate; oxidative stress markers (↑MDA, ↓SOD/GSH)
2	Etura *et al.* (2024)	Cross River (South)	Univ. drinkers (n=50) vs nondrinkers (n=50)	Alcohol	MCV, MCH, Platelets; RDW, PDW, Thrombin time (all $p<0.05$)
3	Adias *et al.* (2013)	Rivers State (South)	Chronic alcoholics (n=120) vs controls (n=80)	Alcohol	AST ($p=0.002$), GGT ($p=0.02$); ALT (n.s.); PT & aPTT ($p<0.05$)
4	Maduka & Onuoha (2024)	Bayelsa State (South)	Adults (n=200; mixed alcohol-use groups)	Alcohol	Progressive AST, ALT with drinking level ($p<0.001$)
5	Ohaju-Obodo *et al.* (2020)	Delta State (South)	25-yr-old male student (case report)	Tramadol	Severe withdrawal syndrome; "serotonin-norepinephrine toxicity"
6	Abdulrasheed *et al.,* 2023	Kaduna (North)	Borstal rehabilitation inmates (n=315)	Opioid analgesics (codeine, tramadol)	eGFR (renal impairment), ALT (hepatic injury)
7	Analike *et al.*, 2018	Anambra (south)	Male college students, n=60 (40 smokers, 20 controls)	Cannabis smoking	Renal biomarkers (creatinine, urea, uric acid, Ca, electrolytes)
8	Dangana *et al.*, 2016	Northern Nigeria	Substance abusers vs non-users, n=250 (200 abusers, 50 controls)	Multiple (cannabis, alcohol, opioids, etc.)	Hematology (PCV, eosinophils, WBC)

Table two: Study design with measurement and main findings from the result

	Authors	Measurement	Study design	Main Findings
1	Dic-Ijiewere & Osadolor (2023)	Serum biochemistry (ALT, AST, GGT, ALP, LDH, electrolytes); ELISA for CYP enzymes	Case-control cross-sectional.	Tramadol/alcohol users vs non-users: significant liver enzyme elevations and metabolic derangements in users.

2	Etura *et al.* (2024)	Automated hematology analyzer (CBC parameters)	Case-control.	Chronic alcohol users (University of Calabar) had significant reductions in red blood cell indices and platelets, and elevated red-cell distribution and coagulation times
3	Adias *et al.* (2013)	Serum liver enzymes; coagulation tests (PT, aPTT)	Cross-sectional	In Port Harcourt drinkers, AST and GGT were significantly higher than in nondrinkers. Coagulation times were also prolonged in drinkers. ALT showed no significant change.
4	Maduka & Onuoha (2024)	Serum AST, ALT	Cross-sectional.	Compared non-drinkers to heavy drinkers, finding dose-dependent liver enzyme elevations: AST and ALT were significantly
5	Ohaju-Obodo *et al.* (2020)	Clinical observation	Case report.	A medical student with 4-year heavy tramadol use developed prolonged abstinence symptoms (tremor, agitation). Managed with detox protocol
6	Abdulrasheed et al., 2023	Blood tests (serum creatinine→eGFR, ALT), viral (HBV/HCV/HIV) screening	Cross-sectional;	Substance use was inversely correlated with eGFR ($p=0.002$) and positively with ALT ($p=0.063$), indicating potential kidney and liver disease.
7	Analike *et al.*, 2018	Serum biochemistry panel	Cross-sectional	No significant differences in creatinine, urea or electrolytes. Cannabis smokers had higher uric acid (2.42 vs 1.92 mmol/L) and Ca (1.60 vs 1.24 mmol/L) than controls. Authors concluded *no evidence of renal damage* from cannabis.
8	Dangana *et al.*, 2016	CBC and urine drug screen	Cross-sectional.	Poly-drug abusers had higher packed cell volume and eosinophil counts than non-users ($p=0.02$ and $p=0.0008$, respectively). Suggests illicit drug abuse can cause polycythemia and eosinophilia.

IV. THEMATIC ANALYSIS AND DISCUSSION OF RESULTS

A. Hepatic toxicity

Majority of the reviewed Nigerian studies reported the presence of liver injury in youths who use substances. Studies that are included in the current study (Adias et al., 2013; Maduka & Onuoha, 2024) found that chronic alcohol users in Port Harcourt and Bayelsa respectively had a significantly higher level of aspartate aminotransferase (AST) and gamma-glutamyl transferase (GGT) than non-drinkers. In a similar study, Dic-Ijiewere and Osadolor (2023) found that, compared to controls, young men who co-used tramadol and alcohol had significantly higher

GGT (and LDH) levels. Our findings are in conformity with an animal models study by Abdullahi et al. (2023) which reported that high doses of tramadol led to dramatic increases in ALT, AST, ALP and bilirubin in rats. The liver indices across majority of the studies tended to increase on heavy consumption of alcohol or opioids, which is well-known pathophysiology of the liver injury in alcohol and opioids. This observation agrees with other publications (Caldwell et al., 2006; Spoerke et al., 2010; Tripodi & Mannucci, 2011) that alcoholic hepatitis and liver cirrhosis-related increase in liver enzymes are linked to alcohol-induced reduction in the synthesis of blood clotting factors and alteration in coagulation parameters. The fact that some comparisons did not show significant changes in ALT (e.g. Adias et al. (2023) found ALT non-significantly higher) indicates that early or moderate misuse does not cause clinically significant changes in enzymes at first. In general, the results are consistent with international data that alcohol abuse and long-term opioid use are the leading causes of liver enzyme elevation and possible liver impairment.

B. Renal toxicity

The renal effects were not as significant but still detectable, one of the included study (Abdulrasheed et al., 2023) identified a correlation between the abuse of opioids (codeine, tramadol), and a decline in eGFR- the only toxicant that was significantly linked to impaired kidney function in multivariate analysis of the Nigerian inmate population. In comparison with another included study (Analike et al., 2018), healthy students smoking cannabis did not demonstrate any significant increase in creatinine or urea, which is why the study also did not show significant nephrotoxicity. Subsequently, another of the reviewed study (Dic-Ijiewere & Osadolor, 2023), showed that subjects who abused alcohol and tramadol had serious acidosis (low bicarbonate), which means that the kidney is under metabolic stress. It was also observed in the animal study by Abdullahi et al. (2023) that urea and creatinine increased dose-dependently with tramadol. Wider literature study by (Owoade et al., 2019; Elkhateeb et al., 2015) also support our findings as they observed the hepatotoxic effect of Tramadol and Alcohol when given together in experimental animals. Therefore, our results indicate that opioids (particularly when combined with alcohol) can overburden the kidneys in young people, but that isolated use of cannabis does not have a significant impact on GFR. These findings are consistent with those of the rest of the world that chronic alcohol and opioid abuse have the ability to damage renal functions with time, but short-term cannabis abuse does not affect the kidneys. Our data support the notion that Nigerian youth with an abused drug problem can develop subtle renal dysfunction (e.g. reduced eGFR or acidbase disorder) prior to overt renal disease.

C. Hematological effects.

The reviewed studies indicated that substance abuse was related to alterations in blood cells. According to Dangana et al. (2016) one of the included study, illicit drug users in Nigeria were found to have significantly higher packed cell volume (PCV) and eosinophil counts as compared to non-users indicating relative polycythemia and eosinophilia. In alcoholic drinkers, Etura et al. (2024) observed that alcohol drinkers had a significantly reduced mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH), platelet count and plateletcrit but elevated red-cell distribution width (RDW), platelet distribution width (PDW) and prolonged thrombin time compared to the control. The changes show anemia, thrombocytopenia, and reactive platelet abnormalities in drinkers. Only minor changes in hematology were observed during the cannabis study (Analike et al., 2018). . In contrast, the one detailed case report of a student abusing tramadol described primarily neurological/withdrawal effects (agitation, tremors) rather than laboratory values (Ohaju-Obodo et al., 2020), highlighting the diversity of clinical manifestations. Collectively, these results reflect the known effects of substance abuse: macrocytosis or microcytosis, anemia, and thrombocytopenia can be caused by heavy alcohol use, and eosinophilia can be a drug-hypersensitivity reaction (Analike et al., 2018; Etura et al., 2024). In summary, our review indicates that drug abusers in Nigeria have non-obvious hematologic abnormalities- elevated PCV/eosinophils with polydrug abuse, and low red-cell and platelet indices with alcohol abuse- similar to a worldwide trend of drug-induced blood toxicity.

D. Metabolic and oxidative stress markers.

A number of studies provided the evidence of metabolic imbalances and oxidative stress in youths who use substances. The combined tramadol-alcohol group had a significantly higher level of DH and significantly lower level of serum bicarbonate compared to the control group, which indicates tissue injury and metabolic acidosis (Dic-Ijiewere & Osadolor, 2023). In the cannabis experiment, smokers had significantly higher uric acid levels in serum (Analike et al., 2018) which could be an adaptive antioxidant reaction. In animal studies, tramadol and alcohol cause oxidative stress: high-dose tramadol in rats reduced antioxidant enzymes (catalase and SOD) Abdullahi et al. (2023), and Dic-Ijiewere et al. (2024) reported increased MDA and a loss of GSH/SOD in users. These findings suggest that Nigerian substance abusing youths experience more oxidative damage (represented by elevated LDH, MDA) and metabolic disturbance (↓bicarbonate) compared with non-users. A case report study by Ohaju-Obodo et al. (2020) on a medical student with 4-year heavy tramadol use developed prolonged abstinence symptoms (tremor, agitation). Managed with detox protocol. This is consistent with international evidence that alcohol and opioid abuse are associated with free-radical production and disrupted metabolic homeostasis. Overall, the studies reviewed show that the Nigerian drug-using students have biochemical evidence of oxidative stress (↑LDH, MDA; ↓antioxidants) and acid base imbalance, which suggests a mechanism of organ injury.

Our results are congruent with the reviews of substance abuse in general. A scoping review of drug abuse in Nigeria identified cannabis, cocaine, amphetamines, heroin, benzodiazepines, codeine, cough syrup and tramadol as the most frequently used drugs by youths (Jatau et al., 2021) - the same substances that were involved in our studies. It is interesting to note that alcohol was the most reported substance in our review and others. This is consistent with WHO data in Europe that alcohol is the most commonly attempted drug (≈57 per cent of 15-year-olds have ever tried alcohol) (WHO, 2024). The hepatic and hematologic changes that we found (e.g. increased AST/GGT in drinkers (Adias et al., 2013) anemia and thrombocytopenia in alcohol users (Etura et al., 2024)) reflect the established global pattern of alcohol-induced organ damage. Similarly, our observation of slight renal deterioration with opioids and none with cannabis is consistent with available international evidence that opioids have the potential to damage kidneys whereas cannabinoids are relatively safe in the short-term. Overall, it can be seen that, Nigerian youth are experiencing toxic effects that are largely comparable to those reported globally, not only due to shared drug pathophysiology, but also due to local drug use patterns (high codeine/tramadol and alcohol use).

E. Public health and education implications

The data indicate the necessity of special prevention programs. Adias et al. (2013) are right in saying that stricter control of substances and mass campaigns among the population should be instituted to safeguard the youth. Realistically, schools and communities ought to provide age-appropriate education on the risks of substances (e.g. that even recreational use can elevate liver enzymes). Peer outreach and curriculum-based modules can also be used to bring to the fore the documented harms (AST/ALT elevations, anemia, etc.) and counter myths. Media and social campaigns, perhaps even those carried out by recovered youths, would also increase awareness. Notably, it is suggested that the youths and students should be a priority target of the interventions, based on the identified sources and reasons of drug use in Nigeria. Parent and teacher training to help identify early signs, may also be included in the programs. In summary, health education, community, and regulation (e.g. policing age restrictions, regulating OTC sale of codeine) must be combined in an effort to reverse the tide of youth substance abuse and the associated toxic consequences thereof.

F. Clinical implications

Clinicians who practice with students and adolescents need to actively screen substance use even when physical complaints are not specific. Routine questions regarding alcohol and drug use should be included with any abnormal laboratory result in the young patient. An example is when liver enzymes or anemia are unexpectedly elevated, there is a possibility of an undetected substance use. With confirmed abuse, early intervention is required: brief

counseling, referral to substance abuse experts, and organ function monitoring (liver and renal panels, full blood count) can prevent the development. Our review indicates that regular laboratory screening (LFTs, urea/creatinine, LDH) of high-risk youths may determine early toxicity. Moreover, medical treatment plans ought to combine both medical care (e.g. treatment with naltrexone in alcohol use disorders, proper withdrawal management) and mental health care. There is evidence that early detection and treatment of substance use disorders among the adolescents leads to better results. In practice, pediatricians and youth counselors should be aware of these toxicological findings and manage accordingly, screening symptomatic and asymptomatic youths to enable prompt detoxification and therapy.

G. Policy and regulatory implications

Lastly, there should be policy interventions to support education and clinical initiatives. Nigerian government and schools ought to implement the laws that are already in place against underage drinking and illegal drug sales. As an example, restriction of access to high-dose codeine and tramadol has been shown to decrease abuse. The NDLEA and NAFDAC may increase surveillance and community based work in schools. As suggested by the experts, the national prevention strategies must be focused on the hotspots and suppliers that are known in Nigeria (Jatau et al., 2021). By means of fiscal policies (e.g. taxation of alcohol) and advertising limitations, youth exposure can be reduced. Notably, policies should also finance treatment and rehabilitation of young addicts. We have seen that a combination of local studies and WHO evidence indicates that multi-sectorial policies (education, health, law enforcement) are needed. According to the conclusion of Jatau et al., youth substance toxicity requires a concerted effort by the government, communities, and religious leaders that will help curb the issue on both the supply and demand side (Jatau et al., 2021).

CONCLUSION AND RECOMMENDATIONS

Our analysis shows that drug-abuse in Nigerian adolescents have toxicological effects that are similar to those related to organ damage all over the world. Of particular interest, heavy alcohol consumption was the most common and was related to increased liver enzymes and hematologic abnormalities (anemia, thrombocytopenia), whereas opioid abuse (codeine/tramadol) was associated with a slight renal impairment (decreased eGFR). There was also evidence of oxidative stress and metabolic imbalance (e.g., elevated LDH/MDA, acidosis) in substance-using students, which indicates tissue injury. The findings point to the necessity of immediate public health intervention. We suggest focused prevention initiatives, such as age-specific education at school and community awareness to help understand the dangers of drugs. Clinicians should screen regularly adolescents on substance use and screen liver and kidney, and intervene when there are abnormalities early. Policy interventions are also important: the existing age limits must be enforced, over-the-counter codeine/tramadol should be regulated, and fiscal (e.g., taxation of alcohol) measures should be introduced to decrease the exposure of young people. Finally, government, healthcare providers, educators, and communities must combine efforts to reduce the problem of substance abuse among the youth and limit its harmful consequences. It is proposed to monitor trends in substance use and health outcomes of the younger population to adjust the intervention. By transferring these experiences into cross-cutting policies, Nigeria will be in a better position to safeguard its young citizens against the adverse effects of drug abuse.

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