



Brain fog and burnout: a comparison of two exhaustion syndromes among adolescents in Nigeria

Abstract

Background: Brain fog and burnout are exhaustion syndromes first described in different cultural contexts, and both occur among students. They share some similarities but have not been compared in research. **Objective:** This study sought to determine the relationship between brain fog and burnout among adolescent students in Calabar, Nigeria. **Method:** In this cross-sectional study, 810 students were recruited from ten secondary schools in Calabar. The Brain Fog Syndrome Scale and the Maslach Burnout Inventory-Student Survey were administered. **Results:** The mean sample age was 15.93 (± 1.35) years, and the gender distribution was approximately equal. The emotional exhaustion and cynicism dimensions of burnout were significantly associated with brain fog syndrome ($p < 0.05$). Respondents with high emotional exhaustion (Odds ratio [OR]=3.3, confidence interval [CI]=2.06-5.36) and cynicism (OR=2.7, CI=1.66-4.39) were more likely to meet the threshold for brain fog syndrome. Principal components analysis of items from both instruments yielded a four-factor structure, and one had substantial loadings from both scales. **Conclusions:** Both syndromes are related, probably due to an overlap in core exhaustion symptoms. More research is needed to elucidate their relationship further.

Keywords: Psychological stress. Culture. Somatoform Disorders.

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INTRODUCTION

Brain fog and burnout as exhaustion syndromes were first described in different socio-cultural contexts. Whereas brain fog occurred among Nigerian students grappling with Western-style education, burnout was observed in American health workers who did emotionally demanding work with people.[1,2] Exhaustion/fatigue is the core feature in both conditions, manifesting as physical, emotional, or cognitive symptoms.

Arising in relation to studying, the components of the brain fog syndrome (BFS) as initially described include intellectual impairment, sensory impairment (chiefly visual), and somatic complaints, most commonly of pain or burning in the head and neck.[3] It is a common condition among Nigerian students, with a prevalence as high as 40.2%, and causes significant interference with the academic success of sufferers.[3] It was later found to occur even in persons not undertaking academic pursuits.[4]

The term “burnout” was first used by the American psychiatrist H. Freudenberger to describe a state of physical

and mental exhaustion caused by one's professional career.[2] It was considered a reaction to job-related interpersonal stressors, confined to professions that provide human services such as healthcare, social work, psychotherapy, and teaching. Burnout was subsequently described among students, expanding beyond its original conceptualisation.[5,6]

Exhaustion features eminently in both constructs, with some differences in their manifestation. Brain fog is characterised by mental fatigue expressed as cognitive difficulties, whereas in burnout, exhaustion is primarily emotional.[3,7] However, an expanded definition of burnout that appears to be the current consensus includes cognitive and physical exhaustion.[7,8] Apart from exhaustion, other similarities between both conditions exist.

Somatisation symptoms are essential in brain fog, without which the diagnosis cannot be made. These symptoms are mainly sensations arising in the head and neck, including pain, “internal heat”, pressure, tightness, crawling, dizziness, and blurred vision.[3,4] Somatising is not central to the burnout construct, but some studies report that they are commonly

present.[9,10] It is worth noting that somatisation in brain fog is dramatically different from those seen in burnout. “Internal heat”, for example, which is not typical in burnout, is an idiom of distress with psychopathological salience in cultures of sub-Saharan Africa.[11]

Regarding personality, both syndromes are commoner in persons with neurotic traits,[12,13] who are high achievers,[1,14] and have an external locus of control.[2,15] Furthermore, a transition along the individualism-collectivism continuum plays a role in their aetiologies. Some researchers believe BFS results from exposing a person from a collectivistic cultural background to an educational system based on individualism.[3] Interestingly, burnout appeared in American society when communal support began to erode, and individualism was on the rise.[7] These changes started after the Second World War, climaxed in the 1970s, and were characterised by the gradual disintegration of traditional social communities like the church, neighbourhood, and family.[7]

Both syndromes have been associated with depression and anxiety but are not distinct nosological entities.[3] Instead, they are listed in the “Glossary of cultural concepts of distress” of the American Psychiatric Association’s fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) as related to the “neurasthenia spectrum of syndromes”.[16]

Due to their similarities, both conditions may be the same, only differing in their expression due to cultural pathoplastic effects. The similarity between both syndromes has not been described or examined. Also, the presence or extent of their overlap is unknown. This preliminary study investigates the relationship between BFS and burnout syndrome among secondary school students in Nigeria.

METHOD

Calabar is a metropolitan city with an estimated population of 600,000, comprised of two local government areas (LGA): Calabar south and Calabar municipality.[17] It has two federal tertiary institutions, and several primary and secondary schools. The sampling frame in this cross-sectional study was the private and public secondary schools in Calabar registered under the Cross River State Ministry of Education.

Using Cochran’s formula for calculating sample size[18] for a known prevalence rate,[19] a sample size of 810 was estimated. Only adolescents of the senior secondary three (SS3) class were eligible for participation. Students with a history of mental illness were excluded.

Stratified random sampling was used for recruitment. Information from the State Ministry of Education showed that there were 22 government-owned schools in Calabar metropolis, with 15 in Calabar municipality and seven in Calabar south. All the government-owned schools were co-educational except one, a female-only school in Calabar municipality. There were 58 private schools in the Calabar metropolis. Thirty-one were in Calabar municipality, while 27 were in Calabar south. Only six of the 58 schools were single-gender schools. For uniformity in the sampling frame, single-gender schools were excluded.

In the first sampling strata, schools in each LGA were grouped based on ownership, yielding two groups per LGA and a total of four groups of schools. Using simple random sampling, we selected four schools from group one (which had 28 private schools) and three schools from group two (which had 24 privately owned schools). From group three, which had 14 government-owned schools, two schools were selected, and from group four with seven government-owned schools, one group was selected. The number of schools contributed by each group was determined by the proportion they contributed to the total number of schools.

Sampling yielded ten schools comprising seven privately owned and three government-owned schools. Simple random sampling was used to select study participants within each arm of selected schools’ SS3 class.

Study measures

Brain Fog Syndrome Scale (BFSS)

This is a seven-item scale developed by Prince and Morakinyo to identify brain fog.[20,21] The possible responses to each item on the questionnaire are three (often, sometimes, and never) with scores of two, one, and zero, respectively. The scores on this scale range from zero to 14. A BFS case must have a minimum score of six, which must include a minimum score of one on each item numbered four and five because these items are the core of the construct. Items four and five inquire about symptoms in the head (such as crawling sensation or heat) and their interference with studying. The questionnaire has been validated and used in several local studies on BFS.[12,22,23]

Maslach Burnout Inventory-Student Survey (MBI-SS)

This study examines the burnout syndrome codified in the Maslach Burnout Inventory (MBI), considered the gold standard for measuring burnout worldwide.[24] MBI-Student Survey (MBI-SS) is a 15-item questionnaire consisting of three subscales: emotional exhaustion (EE), with five items; cynicism (CYN), with four items; and academic inefficacy (AI), with six items. Respondents rate how frequently they experience each symptom in a six-point scale as follows: “never” (zero), “few times a year” (one), “once a month or less” (two), “a few times a month” (three), “once a week” (four), “five times a week” (five), “every day (six). AI items (three, six, eight, nine, 12, and 15) are reversed-scored, and all items in each dimension are summed. Cut-off points are used to grade burnout into low, moderate, or high.[25] It has been used among students in previous Nigerian studies.[26,27]

Sociodemographic questionnaire

A sociodemographic questionnaire was used to elicit such variables as age, marital status, religion, etc.

Study procedure

Questionnaires were administered during the break period of selected schools. We discussed the study objectives with students and informed them that participation was voluntary. Sampling was done to determine the required number of students per class with the support of two trained research

assistants. Parental information forms/consent forms were distributed to students below 18 years. Students 18 years and above could sign the consent forms by themselves. The following week, a day was fixed to return consent forms and fill out the questionnaire. The filling of questionnaires took about 15 minutes. This procedure was repeated for each SS3 class of the schools until the sample size was attained.

Ethical considerations

Written approval to conduct the study was obtained from the Cross River State Ministry of Education. The Research Ethics Committee of the State Ministry of Health approved the study (CRS/MH/CGS/E-H/018/VOL II/082), and permission was also obtained from the principals of the selected schools. Consent and assent were required for participation.

Data management

Data were analysed with the Statistical Package for Social Sciences (SPSS) version 21. A chi-squared test was done to examine the association between both syndromes. Odds ratios (OR) adjusted for age and gender using binary logistic regression were computed for the relationship between BFS and the dimensions of burnout. Factor analysis was used to reduce the number of dimensions needed to describe the data from both instruments. The alpha level for all tests was five per cent.

RESULTS

Most respondents were about 16 years old, and the gender distribution was roughly equal. Students from public schools were slightly more than private school students, and Calabar municipality, the more urban part of the metropolis, had a slightly higher representation. Most respondents were from monogamous families and lived with their parents. Also, most had parents with at least tertiary education (Table 1).

The EE dimension of burnout was significantly associated with BFS ($p < 0.05$). About three-quarters (roughly 75%) with BFS had moderate to severe levels of EE. Furthermore, after adjusting for age and gender, those with high EE were over three times more likely to meet the threshold for BFS (Table 2).

Similarly, CYN and BFS were significantly related ($p < 0.05$). Again, roughly three-quarters of those with BFS had moderate to severe CYN. Respondents with high CYN were 2.7 times more likely to have BFS after controlling for age and gender (Table 2). However, the AI dimension did not have a significant association with brain fog ($p > 0.05$).

A principal components analysis was done to investigate further the relationship between both constructs as measured by their scales (Table 3). Bartlett's test of sphericity gave a chi-squared score of 3295.6 ($p < 0.001$), indicating that the correlation matrix obtained was suitable for factor analysis. The Kaiser-Meyer-Olkin measure of sampling adequacy gave a result of 0.77, showing that the sample size was adequate for factor analysis.

Table 1: Sociodemographic variables of all respondents

Variable	Frequency (n=810)	Percentage (100%)
Age (years)		
13-15	5	0.6
16-18	576	71.1
19-21	218	26.9
21 – 24	11	1.4
Mean (SD)	15.93 (± 1.35)	
Gender		
Male	400	49.6
Female	410	50.4
Male: Female=1: 1.02		
School type		
Public	436	53.8
Private	374	46.2
LGA		
Calabar South	355	43.8
Calabar municipality	455	56.2
Religion		
Christian	801	98.9
Muslim	8	1
Other	1	0.1
Marital status of parents		
Married (monogamous)	621	76.6
Married (polygamous)	92	11.4
Separated/divorced	73	9
Not yet married	24	3
Residence type		
Parents	696	85.9
Relative	111	13.8
Alone	2	0.1
Other	1	0.2
Paternal education		
Primary	64	7.9
Secondary	242	29.9
Tertiary	494	61
Not educated	10	1.2
Maternal education		
Primary	81	10
Secondary	288	35.6
Tertiary	432	53.3
Not educated	9	1.1

SD: Standard deviation, LGA: Local government area

Table 2: Bivariate comparison of brain fog and burnout syndromes

Burnout	BFS			
	Non-case	Case	Statistic	aOR (95% CI)
EE level			$\chi^2=32.64$	
Low	305 (44.2%)	29 (24.2%)	$p<0.001$	Ref
Moderate	190 (27.5%)	26 (21.7%)		1.47 (0.84-2.59)
High	195 (28.3%)	65 (54.2%)		3.33 (2.06-5.36)
CYN level			$\chi^2=17.21$	
Low	302 (43.8%)	32 (26.6%)	$p<0.001$	Ref
Moderate	205 (29.7)	36 (14.9%)		1.66 (0.99-2.76)
High	183 (26.5)	52 (43.3%)		2.70 (1.66-4.39)
AI level			$\chi^2=4.02$	
Low	117 (17.0%)	28 (23.3%)	$p=0.13$	Ref
Moderate	97 (14.1%)	20 (16.7%)		1.60 (0.98-2.6)
High	476 (69.0%)	72 (60.0%)		1.36 (0.79-2.36)

BFS: Brain fog syndrome, aOR: Adjusted odds ratio, CI: Confidence interval, EE: Emotional exhaustion, CYN: Cynicism, AI: Academic inefficacy; Ref: Reference

A four-factor structure emerged using a cut-off of eigenvalues of one and above. These four factors explained 42.4% of the total variance, and all loadings with values greater than 0.3 were retained.

Factor one, which had an eigenvalue of one, explained 16.2% of the variance and was named the “EE/CYN factor” based on the heavily loading items. All the items loading on this factor were components of the EE and CYN subscales of MBI.

Factor two, which had an eigenvalue of one and explained 12.4% of the variance, was named the “AI” dimension because it loaded all items of the AI dimension.

Factor three had an eigenvalue of one and explained eight per cent of the total variance. It loaded items two, four, five, and seven of BFSS maximally and was named the “somatisation factor” because all items of BFSS which inquire about the presence and consequence of somatisation (i.e., factors four, five, and seven) loaded on it.

Factor four had an eigenvalue of one and explained 5.7% of the total variance with items one, three, and six of BFSS and item four of MBI loading maximally. Factors seven and ten of MBI, which loaded maximally on factor one, also loaded on this factor with values above 0.3. As seen in Table 3, their loading was similar in magnitude to their loading on factor one. Item one of BFSS is about fatigue, and questions four, seven, and ten of MBI are components of the EE subscale of MBI. This factor was named the “common exhaustion factor” because it substantially loaded items concerning exhaustion from both constructs.

DISCUSSION

We found that respondents with BFS had significantly higher EE and CYN than respondents without brain fog. Furthermore, those with BFS were roughly three times more

likely to have mild to moderate EE and CYN. Principal components analysis of both scores yielded a four-factor structure. Unsurprisingly, a “common exhaustion factor” that had significant loadings of items on fatigue or EE from both scales emerged.

The level of burnout in the AI dimension was not significantly different between those with BFS and those without the syndrome, which was unexpected. According to Morakinyo, persons with BFS were above average in their intellectual potential and had an unusually high drive for academic success, making them overstudy.[14] These traits might compensate for deficits due to the brain fog, paradoxically improving their academic efficacy. Alternatively, the AI dimension of MBI could have psychometric limitations, and this much has been acknowledged in a review paper by Schaufeli—one of the instrument’s authors.[28] This dimension correlates poorly with the other two dimensions of burnout in the scale, making some authors question its validity.[24] The subscale possibly failed to capture academic inefficacy adequately.

Consequently, we acknowledge that evaluating the relationship of both syndromes is constrained and dependent on the validity of their measures. Anyhow, this study demonstrates a significant relationship between both syndromes.

Hranov, in a review, discussed the phenomenon of overlapping psychopathological syndromes and proffered some possible explanations for the relationship between anxiety and depression.[29] We thought some of his explanations might apply to the current comparison.

According to him, significant syndromic overlap could be viewed as “comorbidity”. Secondly, “interaction” could be a plausible reason, wherein the existence of one disorder indicates the likelihood of the other because the specific diathesis for the first makes the subject vulnerable to the coexistent disorder. In his third and fourth propositions, he opined that both could be aspects of a single, more complex disorder or a single, gradually evolving illness with a common neurobiological basis. Lastly, he suggested that the similarities could be due to non-aetiological processes. For example, their congruence could be explained by similarities in personality or commonalities in syndrome definition and rating instruments.

The term ‘comorbidity’ was introduced in medicine to describe cases where a ‘distinct additional clinical entity’ occurred during the clinical course of an index disease.[30] According to Mario Maj, using the term to connote the concomitance of two or more psychiatric diagnoses appears incorrect because, in most cases, it is unclear whether the diagnoses reflect the presence of distinct clinical entities or refer to multiple manifestations of a single clinical entity.[31] The distinctness of both syndromes in this study is far from settled. Also, the similarities between both syndromes in aetiology and clinical manifestation, added to their overlap in this study, weaken the case for distinctness.

The case for interaction between BFS and burnout depends on their distinctness, and we believe this is unlikely.

Table 3: Factor analysis BFSS and MBI

BFSS/MBI		Factor 1	Factor 2	Factor 3	Factor 4
		Emotional exhaustion/ cynicism	Academic inefficacy	Somatisation factor	Common exhaustion factor
BFSS1	I get periods of complete exhaustion and fatigue				0.63
BFSS2	When I read, I feel that the words don't make sense			0.38	
BFSS3	I find it difficult to concentrate when studying			0.41	0.42
BFSS4	Burning, crawling, heat or other unpleasant sensations in my head, while studying			0.86	
BFSS5	Unpleasant sensation makes it difficult for me to study or assimilate what I read			0.86	
BFSS6	I am satisfied with my general efficiency in studying and with retention of what I study				-0.42
BFSS7	I suffer unpleasant sensations in my body related to study			0.47	
MBI1	I feel emotionally drained by my studies	0.57			
MBI2	I have become less interested in my studies since my enrolment at the school	0.59			
MBI4	I feel used up at the end of a day at the school		-0.30		0.42
MBI5	I have become less enthusiastic about my studies	0.62			
MBI7	I feel burned out from my studies	0.53			0.41
MBI10	I feel tired when I get up in the morning and I have to face another day at school	0.44			0.37
MBI11	I've become more uncertain about the usefulness of my studies	0.62			
MBI13	Studying or attending a class is really a stress for me	0.61			
MBI14	I doubt the significance of my studies	0.59			
MBI3	I can efficiently solve the problems that arise in my studies		0.48		
MBI6	I believe that I make an effective contribution to the classes		0.60		
MBI8	In my opinion, I am a good student		0.78		
MBI9	I learned many interesting things during my studies		0.75		
MBI12	I feel stimulated when I reach goals, I set during my study		0.59		
MBI15	During class I feel confident that I am effective in getting things done		0.63		

BFSS: Brain Fog Syndrome Scale, MBI: Maslach Burnout Inventory

Based on Hranov's third and fourth reasons, BFS and (academic) burnout may be the same complex disorder with a core symptom of exhaustion and associated symptoms showing a pathoplastic effect. Both could be reactions to chronic academic stress leading to exhaustion as the secondary event. The symptomatology accompanying exhaustion then possibly unfolds in directions shaped by an individual's cultural orientation, resulting in either BFS, burnout syndrome, or both.

Neuroticism is associated with both syndromes. The co-occurrence of both conditions could be a phenotypic correlation underpinned by a commonality in personality type.

Finally, the overlap may be due to commonalities in syndrome definition and measuring instruments. If this is the case, revisiting the definition and measurement of both constructs might help minimise the blurring between them. This, of course, would only make sense if there is

strong evidence of their distinctness. However, similarities in syndrome constructs and measuring scales might be unavoidable if both conditions are indeed unitary.

Since both instruments screen for exhaustion syndromes related to academic studies, they may measure overlapping subsets of a single condition, i.e., an academic exhaustion syndrome. The “common exhaustion factor” which emerged from factor analysis might support this.

In our study, not everyone with BFS had high burnout and vice versa. If either scale is used alone to measure academic exhaustion in Nigeria, some cases might be missed. Using both scales together might give a fuller picture but would be unwieldy. The solution might be developing a new scale with items drawn from both instruments, which would better capture academic exhaustion in its entire dimensions as it occurs among Nigerian students.

Conclusions and limitations

Based on our findings, we conclude that brain fog and burnout syndromes are significantly related. Apart from other similarities, both conditions are exhaustion syndromes at their core. It might be helpful to define a single construct of exhaustion with stable core symptoms and additional features that vary depending on context and culture. This would improve the reliability and simplicity of exhaustion measurement.

Our study, however, has some important limitations. First, we used only self-report questionnaires, which could generate bias. Second, causality cannot be inferred since this was a cross-sectional study. Also, the other psychological disorders were not screened, which may confound results.

AUTHOR CONTRIBUTIONS

EAE: Concepts, design, definition of intellectual content, literature search, clinical studies, data acquisition, data analysis, statistical analysis, manuscript preparation, manuscript editing, manuscript review, guarantor; **BEE:** Concepts, design, definition of intellectual content, literature search, clinical studies, manuscript preparation, manuscript editing, manuscript review, guarantor; **CJO:** Concepts, design, definition of intellectual content, literature search, clinical studies, manuscript preparation, manuscript editing, manuscript review, guarantor; **HA:** Concepts, design, definition of intellectual content, literature search, clinical studies, manuscript preparation, manuscript editing, manuscript review, guarantor; **OU:** Concepts, design, definition of intellectual content, literature search, clinical studies, manuscript preparation, manuscript editing, manuscript review, guarantor.

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