

Association between ABO Blood Group Phenotype and Reaction to Academic stress and coping strategies among college students

Abstract:

Introduction: Proper stress response and use of ideal coping strategy can reduce stress-related death. However, whether individual's stress response/coping method is related to the blood type has not been empirically examined.

Objectives: Given this, this study examined the relationship between ABO blood type and reaction to academic stress and coping strategies among college students in Southern Nigeria.

Methods: A cross-sectional study was conducted on 319 (142 male and 77 female) students. They were examined using Perceived stress scale-10 (PSS-10) which measures stress level. Reaction to stress and coping strategy questionnaires (CSQ) were used to measure four types of stress reactions and coping methods.

Results: Prevalence of perceived stress was 79.6%. Most of the stressed participants (46.5%) were of blood group O. Most prevalent reactions to stress versus (vs) coping methods according to blood type were emotional (99.3%) vs religious (95.0%), emotional (88.4%) vs active distracting (90.9%), behavioral (82.5%) vs active practical (95.0%), and physiological (91.5%) vs active distracting (98.3%), for blood groups A, B, AB and O respectively. Compared to those with blood group A, participants with blood groups B and AB had higher odds of emotional reaction to stress (Odds Ratios (ORs); 2.13, (95% Confidence intervals (CI):1.459-2.799) and 1.47(95% CI: 0.555-3.871) respectively. ORs and CIs for cognitive reaction were 5.68(1.866-36.486) and 1.71(0.429-6.773) for blood groups B and AB respectively. For behavioral reaction, ORs and CIs were 1.25(0.494-3.174), 2.08(1.684-6.309) and 1.54(0.575-4.09) for blood groups B, AB and O respectively, while ORs and CIs for physiological reaction was 2.75(1.302-10.877) for blood group

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29 O. Active practical, active distracting, religious and active practical coping methods
30 were mostly used by individuals with blood groups A, AB, B and O respectively.

31 **Conclusion:** There is a relationship between individuals' ABO blood type and the
32 risk of being stressed, type of stress response and coping methods employed to
33 combat stress. Interventions to reduce stress and associated disorders should
34 among other factors consider individuals' blood group.

35

36 **Introduction:**

37 Stress is universal and inevitable part of life created by excessive environmental
38 and internal demands. It needs to be adequately responded to and coped with to
39 avoid the associated adverse health effects which are enormous and debilitating.
40 Although every one experiences stress as a result of normal daily activities, prior
41 studies have shown a unique stress response among individual to combat the
42 perceived stress-imposed threat. Each person has a different reaction and coping
43 strategy to his or her stress. Stress response is part of the homeostatic balance and
44 is necessary for evolution and survival. Dysfunction of stress response system leads
45 to poor physical, metabolic and physiological endpoints and consequently, to several
46 diseases including diabetes mellitus [1], peptic ulcer [2], obesity [3], sleep disorders,
47 hypertension [4], ischaemic heart disease [5], osteoporosis [6], reduced mental
48 alertness, increased anxiety, risk of depression, poor academic performance and
49 several cancers. Interestingly, people and groups differ in sensitivity and
50 vulnerability to these stress-induced disorders probably due to differences in their
51 interpretation, reaction and coping strategies adopted to combat stressors [7].

52 The central nervous system may response to stressful situation by altering the
53 endocrine, neural and/or immune activities. However, the pattern of biological
54 response depends on the situation. Even so, there are individual differences in
55 stress response to similar situation [8]. This inherent stress adaptive ability has
56 been shown to have some genetic predisposition [9] and thus, largely depends on
57 our body's natural biochemical response which is determined by our

58 deoxyribonucleic acid (DNA). The composition of our ABO blood type is determined
59 by the inheritance of gene on chromosome 9(9q34) [10]. Interestingly, the same
60 DNA locus (9q34) that determines our blood type also controls our response to
61 stress. Previous studies had attempted to establish a link between individuals'
62 blood type and personality trait with no scientific consensus, however recent
63 evidence implicates the role of a catecholamine metabolizing enzyme (dopamine
64 beta hydroxylase (DBH)) which is known to be involved in the metabolism of
65 dopamine into norepinephrine. It is now known that ABO/DBH linkage exists that
66 determine the dopamine: norepinephrine ratio that influences individual's behavior
67 [11, 9].

68 It is posited that our blood type is important with regards to the type and
69 concentration of these stress hormones, their resting levels, the way we respond to
70 stress, how quickly these level revert back after stress. In the university
71 environment, students are continuously exposed to high level of stress which may
72 be academic or self imposed kind of stressors or both. These may include
73 psychosocial, physical or individual stressors, and they must respond to it on a daily
74 basis [7], though differently [12].

75 Whether the response pattern has any relationship with individual's blood group
76 phenotype has not been investigated. Understanding the ABO group phenotypic
77 correlate of stress, stress response and coping strategy may suggest genetic related
78 risk factors that increase individual's susceptibility to stress and predicts ideal
79 stress response and coping methods to reduce the risk of stress-related diseases.
80 Therefore, the aim of this study was to assess the relationship between ABO blood
81 group phenotype and reaction to academic stress and coping strategies among
82 undergraduates in a Nigerian University.

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87 **Subjects and Methods**

88 This cross-sectional study was conducted between the month of March and October,
89 2018 in a Nigerian University. Students were invited to participate in the survey
90 through several media including announcement during lecture and practical
91 classes. Participation was free and voluntary. Of the initial 528 students who
92 responded to the invitation, 319 (142 male and 77 female) undergraduates from
93 different faculties in the university met the inclusion criteria and were assessed.
94 This number represented 60.42% of the initial number invited to participate. Others
95 (39.58%) were excluded for not meeting the inclusion criteria.
96 The exclusion criteria were inappropriate age (<18years), missing data, decline
97 participation, inadequate completion of questionnaire, and poor mental status.
98 All participants signed written informed consent and the study protocol was
99 approved by the Institutional Research Ethics Committee.

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101 **Instruments of survey/Assessment measures**

102 Two survey instruments were used in this study, including a 4-section semi
103 structured questionnaire which assessed the demographic characteristics of
104 participants, stress level, reaction to stress and coping strategies employed by the
105 participants and determination of ABO blood group phenotype. The questionnaire
106 was adapted from previous studies with similar hypothesis [13, 14].

107 Part A of the questionnaire recorded the socio-demographic characteristics of
108 participants including age (years), gender, marital status, year of study and faculty
109 of study.

110 Part B of the questionnaire consisted of items adapted from Perceived Stress Scale-
111 10 (PSS-10) and Student-life Stress Inventory (SLSI), and measures perceived
112 stress, reaction to stress and coping methods used by respondents as described
113 elsewhere [13, 14]. Briefly, participants were asked to respond to each question on a
114 five point scale ranging from 0 (never), to 4(very often). Scores ranged from 0-40

115 with higher scores indicative of higher stress. A score of ≥ 20 was suggestive of high
116 stress level.

117 Reaction sub-scale consisted of 28 items and measures four categories of reactions
118 to stressors (physiological, 14 items, emotional, 4 items, behavioral, 8 items and
119 cognitive, 2 items). The reaction sub-scale was assessed on a 4-point scale (i.e.,
120 1=never, 2=occasionally, 3=often, 4=most of the times) and dichotomized (1 and 2 vs
121 3 and 4). It was summed to produce total scores ranging from 1-14 for physiological
122 reaction, 1-4, 1-8 and 1-2 for emotional, behavioral, and cognitive reactions
123 respectively. Low versus (vs) high reactions were 1-7 vs 8-14, 1-5 vs 6-8, 1 vs 2 for
124 physiological, behavioral, and cognitive reactions respectively.

125 The coping strategy sub-section consisted of 63 items and measures 4-types of
126 coping including active practical, active distracting, avoidance and religious coping
127 methods. This section was assessed on a 5-point scale (i.e., 1=never, 2=seldom,
128 3=occasionally, 4=often, and 5=most of the time). None, low and high usages of a
129 specific coping method were represented by scores of 1, 2-3 and ≥ 4 respectively.

130 Blood samples were obtained from all participants through a finger prick with a
131 sterile disposable lancet. Anti-A, anti-B and anti-D monoclonal blood group reagents
132 were used to determine participants' ABO blood group phenotype by slide
133 agglutination method.

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135 **Results:**

136 The socio-demographic variables of 319 undergraduates who participated in this
137 survey revealed that 254 (79.6%) participants were stressed, while 65 (20.4%) were
138 not stressed. In addition, 177 (55.5%) were female while 142 (44.5%) were males.
139 Other demographic variables (age, level of study and faculty of study) showed no
140 significant difference between the stressed and not stressed participants with the
141 exception of marital status which significantly ($P<0.05$) differed between the two
142 groups (Table 1).

143 Table 2 shows the distribution of stress by blood group as follows; 29.1%, 8.7%,
144 15.7% and 46.5% for blood groups A, B, AB and O respectively. The highest
145 prevalence of stress was found among individuals with blood group O, followed by
146 A, AB and B

147 Table 3 shows that most participants with blood group A showed emotional reaction
148 (97.37%), followed by behavioral (68.9%) and physiological (51.4%) reactions to
149 academic stressors. Majority of those with blood group B (86.4%) displayed
150 emotional reaction followed by behavioral (59.1%) and physiological (54.5%)
151 reactions to stress. A greater number of participants with blood group AB showed
152 behavioral (82.5%) reaction followed by cognitive (75%) and physiological reactions
153 to stress. Blood group O individuals mostly reacted physiologically (91.5%) followed
154 by behavioral (64.4%) and cognitive reaction (47.5%).

155 Furthermore, majority (93.2%) of participants in group A blood adopted religious
156 mode of coping with stress, blood group B (90.9%) made use of distracting coping
157 strategy while blood group AB (95.0%) employed practical coping strategy.
158 Similarly, most (98.3%) participants with blood group O blood group adopted
159 distracting coping method. Interestingly, it was further observed that although
160 there was a slight variation in the use of practical, distracting, religious coping
161 methods within each of the blood group phenotype, there were no significant
162 differences in the number of respondents who employed these coping strategies to
163 cope with academic stressors.

164 Table 5 shows that the odds of being stressed when faced with stressful situation
165 were higher among individuals with blood group B. Individuals with blood group B
166 have the highest likelihood of reacting cognitively (OR:5.86, CI:1.866-36.486,
167 P=0.006), followed by emotional reaction (OR:2.13, CI: 1.459-2.799, P=0.007) and
168 behavioral reaction (OR:1.25, CI:0.494-3.174, P=0.635) and less likelihood of
169 reacting physiological (OR:0.88, CI:0.338-2.286, P=0.792).

170 Individuals in blood group AB had higher likelihood of exhibiting behavioral
171 reaction (OR:2.08, CI:0.266-2.141, P=0.754), cognitive (OR:1.71, CI:0.429-6.773,

172 P=0.448) and emotional (OR:1.47, CI:0.555-3.873, P=0.439) and less likelihood of
 173 reacting physiologically (OR:0.754, CI:0.266-2.141, P=0.754). Blood group O
 174 individuals have increased likelihood of exhibiting physiological reaction (OR:2.75,
 175 CI:1.302-10.877, P=0.042) followed by behavioral reaction (OR:1.54, CI:0.575-4.09,
 176 P=392) and less likelihood of exhibiting emotional and cognitive reactions (Table 6).

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180 **Table 1:** Socio-demographic Characteristics of the Respondents

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Variables	With Stress (n=254)	Without Stress (n=65)	Total (n=319)	p-value
Sex				
Male	108(42.5)	34(52.3)	142(44.5)	0.202
Female	146(57.5)	31(47.7)	177(55.5)	
Age (Years)				
16-19	39(15.4)	12(18.5)	51(16.0)	0.385
20-25	170(66.9)	47(72.3)	217(68.0)	
26-30	33(13.0)	5(7.7)	38(11.9)	
31 and above	12(4.7)	1(1.5)	13(4.1)	
Marital Status				
Single	211(83.1)	64(98.5)	275(86.2)	0.016*
Married	35(13.8)	1(1.5)	36(11.3)	
Divorced/Separated	4(1.6)	0(0.0)	4(1.3)	
Widowed	4(1.6)	0(0.0)	4(1.3)	
Level of Study				
100L	41(16.1)	9(13.8)	50(15.7)	0.165
200L	53(20.9)	17(26.2)	70(21.9)	
300L	50(19.7)	19(29.2)	69(21.6)	
400L	71(28.0)	17(26.2)	88(27.6)	
500L	22(8.7)	1(1.5)	23(7.2)	

600L	17(6.7)	2(3.1)	19(6.0)	
Faculty				
Arts	50(19.7)	18(27.7)	68(21.3)	0.255
Engineering	36(14.2)	11(16.9)	47(14.7)	
Environmental	15(5.9)	7(10.8)	22(6.9)	
Law	3(1.2)	3(4.6)	6(1.9)	
Pharmacy	19(7.5)	0(0.0)	19(6.0)	
Science	32(12.6)	7(10.8)	39(12.2)	
Social Science	14(5.5)	3(4.6)	17(5.3)	
Basic Medical	19(7.5)	3(4.6)	22(6.9)	
Education	12(4.7)	3(4.6)	15(4.7)	
Clinical Science	20(7.9)	3(4.6)	23(7.2)	
Business	18(7.1)	4(6.2)	22(6.9)	
Administration	16(6.3)	3(4.6)	19(6.0)	
Agriculture				

*significant at 5%(p<0.05).

Table 2: Distribution of academic stress by blood group phenotype of the respondents

Blood Phenotype	Stress (n=254)	Not Stress (n=65)	Total (n=254)	Chi-square statistic	p-value
A	74(29.1)	20(30.8)	94(29.5)	0.467	0.926 ^{NS}
B	22(8.7)	5(7.7)	27(8.5)		
AB	40(15.7)	12(18.5)	52(16.3)		
O	118(46.5)	28(43.1)	146(45.8)		

NS= not significant at 5 % (p>0.05).

Table 3: Distribution of Reaction to Stress by Blood Phenotype

Reaction to Stress	A (n=74)	B (n=22)	AB (n=40)	O (n=118)
Emotional	72(97.3)	19(86.4)	17(42.5)	40(33.9)
Cognitive	28(37.8)	8(36.4)	30(75.0)	56(47.5)
Behavioural	51(68.9)	13(59.1)	33(82.5)	76(64.4)
Physiological	38(51.4)	12(54.5)	19(47.5)	108(91.5)
χ^2 value	22.92	4.77	7.63	36.80
p-value	<0.0001	0.189	0.054	<0.0001

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200 **Table 4:** Distribution of Coping Strategies by Blood Phenotype.

Coping Strategies	A (n=74)	B (n=22)	AB (n=40)	O (n=118)
Practical	69(93.2)	19(86.4)	38(95.0)	116(98.3)
Distracting	64(86.5)	20(90.9)	34(85.0)	95(80.5)
Religious	62(83.8)	18(81.8)	37(95.5)	114(96.6)
χ^2 value	0.400	0.286	0.018	2.480
p-value	0.8129	0.867	0.991	0.289

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204 **Table 5:** Logistic Regression showing Association between Stress and Blood Phenotype

Variable	B	S.E	Wald	OR(95% C.I)	p-value
Blood Phenotype			1.491		
A	-	-		1.00(reference)	0.684
B	-0.155	0.577	0.07	1.17[0.377 - 3.623]	0.788
AB	-0.189	0.584	0.11	0.83[0.264 – 2.598]	0.746
O	-0.262	0.631	0.172	0.77[0.223 – 2.652]	0.679

205 Adjusted for socio-demographics of the respondents.

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210 **Table 6:** Logistic Regression showing association between reaction to academic
211 stress and blood phenotype

Reaction to Stress	Blood Group	OR unadjusted (95% C.1)	p-Value
Emotional reaction	A	1.00 (reference)	
	B	2.13[1.459 – 2.799]	0.007**
	AB	1.47[0.555 – 3.873]	0.439
	O	0.95[0.397 – 2.271]	0.786
Cognitive reaction			
	A	1.00 (reference)	

	B	5.68[1.866 – 36.486]	0.006**
	AB	1.71[0.429 – 6.773]	0.448
	O	0.74[0.172 – 3.223]	0.693
Behavioral reaction	A	1.00 (reference)	
	B	1.25[0.494 – 3.174]	0.635
	AB	2.08[1.684 – 6.309]	0.019*
	O	1.54[0.575 – 4.09]	392
Physiological reaction	A	1.00 (reference)	
	B	0.88[0.338 – 2.286]	0.792
	AB	0.754[0.266 – 2.141]	0.754
	O	2.75[1.302 – 10.877]	0.042*

Adjusted for Socio-demographics characteristics.

*Significant at 5% (p<0.05),

**Significant at 1% (p<0.01).

Table 7: Logistic Regression and 95% confidence Interval showing Relationship between Blood Phenotype and Coping Strategies

Coping Strategies	Blood Phenotype	OR (95% C.I)	p-value
Practical Coping	A	1.00 (reference)	
	B	1.25[0.321 – 4.113]	0.632
	AB	2.28[1.011 – 6.885]	0.032*
	O	1.41[0.933 – 10.892]	0.632
Distracting Coping	A	1.00 (reference)	
	B	3.22[1.282 – 10.882]	0.036*
	AB	2.12[0.952 – 6.683]	0.583
	O	1.20[0.833 – 4.021]	0.933
Religious Coping	A	1.00 (reference)	
	B	1.95[1.358 – 10.588]	0.044*
	AB	1.82[1.252 – 4.049]	0.049*
	O	0.95[0.178 – 2.393]	0.519

Adjusted for socio-demographics characteristics.

*Significant at 5%(p<0.05),

**Significant at 1%(p<0.01).

225 **Discussion:**

226 The results of this study showed that undertaking a university education is a
227 highly stressful venture, and how this stress is perceived, responded to, and coped
228 with could be influenced by individual's blood type. Evidence for this notion is
229 twofold; first, similar to the results of the present study, previous investigators have
230 consistently recorded high prevalence of stress among college students. Here we
231 found that 79.6% of students were stressed. In a similar study at the University of
232 Calabar, Oku et al [15] reported 94.2% prevalence of stress among undergraduate
233 students. In 2015, Melaku [16] reported 52.4% prevalence of stress among college
234 students in Ethiopia. Likewise studies in other populations [17-23] have
235 demonstrated similar high frequency of stress among college students, although
236 variations in frequency across population have been observed, likely due to the
237 notion of individual and ethnic diversity in stress perception.

238 Second, perceived stress was more prevalent (46.5%) among individuals with blood
239 group O compared with other blood groups. This is consistent with the findings of
240 Chaudhuri et al [24] in a similar study in eastern India. In this study, perceived
241 stress score was significantly higher in group O compared to group A individuals, as
242 observed in the present study. This observation is despite the fact that individuals
243 of blood group O have higher threshold limit for stress than individuals of blood
244 group A. They secrete less stress hormones (Cortisol and adrenaline) and hence less
245 likelihood of being stressed compared with blood group A individuals known to
246 secrete high levels of these stress hormones, and consequently have higher tendency
247 for stress.

248 A plausible explanation for this observation is partly due to the fact that blood
249 group O is the most prevalent blood group in the general population of Nigeria and
250 elsewhere. The preponderance of blood group O over other blood groups have been
251 reported in several studies conducted in different parts of Nigeria and elsewhere,
252 although with varying frequencies likely due to the underlying genetic and ethnic
253 diversity of human populations [10, 25]. For instance, in a recent review to establish

a reference data base on the distribution of ABO and Rh blood groups from studies conducted in different parts of Nigeria, Anifowoshe et al[10] reported a consistent pattern of blood group O preponderance (52.93%). In a retrospective study among blood donors in Sokoto, Nigeria, Musa et al [26] recorded a consistent pattern of blood group O predominance in 51.91% of the participants. Medugu et al [27] found that 47.7% of pregnant women in Yola, Adamawa state, Nigeria were of blood group O. Likewise Hassan et al [28] reported the prevalence of 49.2% for blood group O in a 5 year retrospective survey of ABO blood group distribution among blood donors in Ahmadu Bello University Teaching Hospital, Kaduna, Nigeria.

A similar multi-race/ethnic study in United State reported a consistent pattern of blood group O preponderance [25]. Therefore, individuals of blood group O constituting the largest proportion of stressed participants could partly be corollary of the higher prevalence of blood group O in the general population of Nigeria. Also, there is delayed release of stress hormones (cortisol and catecholamines) following stressful encounter in individuals of blood group O, however, when released, the metabolism of these hormones is delayed because the enzyme of monoamine oxidase (MAO) which is working among others to enhance the metabolism of catecholamines such as adrenaline and nor-adrenaline is less active in platelets of blood group O individuals. Therefore, stress episodes/effects tend to be more sustained in individuals with blood group O than those with blood group A. Group A individuals respond to stress by releasing a large amount of adrenaline, which is also eliminated quickly to reduce the effect of stress.

Physiological reaction to stress was more prevalent in blood group O than A, while emotional was more prevalent in blood group A than O. The most common physiological reactions among blood group O individuals were feeling of un-coordination, headache, lower back pain, sweating and chills, stomach upset and changes in appetite, probably due to the effect of the secreted catecholamines. The behavioral and emotional reactions also observed in some group O individuals may be due to the longer time of stress in these individuals which is associated with

283 exhaustion, and subsequently to anger and aggression. Most prevalent reports were
284 the feeling of fear, guilt, apathy and decreased efficiency and effectiveness. Common
285 coping strategies adopted by these individuals were religious, active practical and
286 active distracting. Some of them used reading of bible, meditation, praying for
287 guidance to cope with their stresses. Others watched movies, involved in physical
288 activities or embarked on a short visit to friends.

289 Blood group A individuals reacted mostly emotionally, behaviorally and
290 physiologically to stress, and least of cognitive reaction. Most participants in this
291 group agreed that they forget things easily. They have limited attention span and
292 difficulty in concentrating. Some of them reported having problem with sleep and
293 are easily annoyed. Few others suffered from headache and poor appetite. Group A
294 individuals employed mainly active practical, active distracting and religious coping
295 methods to lessen their stress levels. They naturally have a higher serum cortisol
296 level than other blood groups, and when stressed, serum level of adrenaline rises
297 more than in other blood groups. They are designated as the worst group in
298 reducing their stress levels. Blood group B displayed marked emotional and
299 moderate behavioral and physiological reactions to stress. They employed mostly
300 active distracting, active practical and religious methods to allay their stresses.
301 They naturally have large amount of cortisol and release more adrenaline during
302 stress although not as much as blood group A individuals. However, blood levels of
303 these stress hormones are reduced immediately, thereby enhancing faster recovery
304 from stressful encounter similar to blood group A.

305 Individuals with blood group AB showed marked behavioral and cognitive reaction
306 to stress and employed mainly practical, religious and distracting coping strategies
307 to manage their stresses and reduce stress hormone slowly almost similar to blood
308 group O. This study has few limitations especially those related to the cross-
309 sectional nature of the study design. Also, self reporting bias should be considered
310 in the interpretation of results.

311

312 **Conclusion:**

313 There is a correlation between individual's blood type and the odds of being
314 stressed, reaction to stress and coping strategy employed to cope with stress.

315

316 **Conflict of interest:** None declared

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318 **Reference**

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