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Original article

Evaluation of grit and its associated factors among undergraduate pharmacy students from 14 Asian and Middle Eastern countries amid the COVID-19 pandemic

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ABSTRACT

Introduction: Grit is proposed as an essential trait for academic achievement. Thus, evaluating its current status and the associated factors could aid academic support planning.
Objective: The present study aimed to assess grit level and its related factors among undergraduate pharmacy students from 14 countries amid the COVID-19 pandemic.
Methods: A cross-sectional survey-based study was conducted among pharmacy students from 14 countries in Asia and the Middle East. A 31-item questionnaire was developed, validated, and pilot-tested, including the validated short scale for grit assessment. The data was collected between 1 February and 15 April 2022. Descriptive and inferential statistics were employed as appropriate.
Results: A total of 2665 responses were received, mainly from females (68.7 %), living in urban areas (69.2 %) and studying at private universities (59.1 %). The average grit score on a scale of 5 was 3.15 ± 0.54. The responses revealed higher favourable responses to items on the perseverance of efforts (34.9 % to 54 %) compared to items on the consistency of interests (26.5 % to 31.1 %). Students who did not

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exercise (AOR: 0.47, 95 %CI: 0.33–0.67) or exercised irregularly (AOR: 0.64, 95 %CI: 0.45–0.90) were less likely to have higher grit scores than those who exercised regularly. Additionally, students who did not receive COVID-19 vaccination (AOR: 0.50, 95 %CI: 0.36–0.71) or received only one dose (AOR: 0.67, 95 % CI: 0.46–0.99) were less likely to have higher grit scores than those who received their booster vaccination. Interestingly, students who chose the pharmacy program as their only available or reasonable choice (AOR: 0.33, 95 %CI: 0.17–0.62) and students from public universities (AOR: 0.82, 95 %CI: 0.68–0.98) were less likely to have higher grit scores. On the other hand, students who did not face educational challenges with online learning (AOR: 1.19, 95 %CI: 1.003–1.416) and students with excellent (AOR: 2.28, 95 %CI: 1.57–3.31) and very good (AOR: 2.16, 95 %CI: 1.53–3.04) academic performance were more likely to have higher grit scores.

Conclusion: The findings revealed moderate grit levels. Higher grit levels were thought to be associated with several personal, lifestyle and academic factors. Further interventions to support students' grit attributes are required, particularly concerning the consistency of interests.

1. Introduction

Nowadays, educators in health care professions continually try to understand what leads to students' success (Francesca Ursua et al., 2021). In particular, pharmacy education has typically focused on predicting success using numerical grading systems to assess academic performance (Francesca Ursua et al., 2021; Noonan et al., 2005). This includes the students' progression and attrition rate throughout the pharmacy program (Francesca Ursua et al., 2021; Noonan et al., 2005). These assessments were reported and emphasized by standard educational accreditation programs such as the Accreditation Council for Pharmacy Education (ACPE) Standards (Noonan et al., 2005). ACPE Standards affirm that pharmacy graduates should not only focus on academic performance but also exhibit other skills, such as metacognitive skills and demonstrate self-awareness of their strengths and weaknesses (Noonan et al., 2005; Pate et al., 2017). Therefore, identifying the best approach to measure both academic factors and noncognitive skills upon admission and throughout the pharmacy program is needed and required by pharmacy schools (Pate et al., 2017).

Connections between the variety of noncognitive skills and academic performance have been explained and substantially developed over the decades (Kalsbeek et al., 2013; Noonan et al., 2005; Sedlacek, 2011; Stacey and Kurunathan, 2015). One such noncognitive factor is grit, defined as "perseverance and passion for long-term goals" (Duckworth et al., 2007). Grit is a construct that includes two noncognitive skills: perseverance of effort and consistency of interest (Kalsbeek et al., 2013; Wilson et al., 2014). These two abilities have recently gained much attention in general education and health schools (Pate et al., 2017). People with high levels of grit (also known as "gritty") maintain effort and eagerness to achieve their goals even when faced with significant obstacles (Duckworth et al., 2009). In this context, a validated, self-administered/reported survey has been developed to assess grit through a predefined scale known as the "Short Grit Scale, Grit-S". This scale indicates the positive outcomes independent of the intelligence predictors among different individuals (Duckworth et al., 2009).

Several studies have reported the success of the grit scale in measuring predictors that affect students' outcomes (Duckworth et al., 2007; Eskreis-Winkler et al., 2014; Maddi et al., 2012). These studies' results were consistent, including grittier individuals attaining higher levels of education, academic performance, retention, and making fewer career changes (Duckworth et al., 2007). However, grit appears to be affected by many factors among individuals, and it may not be a fixed trait (Duckworth et al., 2007). These factors include but are not limited to gender, age group, marital status, first family member to attend university, and family relationships (Terry and Peck, 2020).

With grit being proposed as a necessary trait for academic success, evaluating a student's capacity to persist despite setbacks is critical. Therefore, grit can be a crucial driver for students' achievement and success, even when controlling for factors like a student's ordinary intelligence. Unfortunately, there is a lack of comprehensive data on which to base an evaluation of grit in the pharmacy student population. Therefore, this study aimed to assess the level of grit among undergraduate pharmacy students in 14 different countries during the COVID-19 pandemic.

2. Methods

2.1. Study design

This descriptive anonymous online cross-sectional study was conducted among pharmacy students in 14 countries in Asia and the Middle East: Bahrain, Bangladesh, Egypt, India, Indonesia, Iraq, Jordan, Libya, Malaysia, Oman, Pakistan, Saudi Arabia, Sudan, and the United Arab Emirates. The study used a validated, self-administered survey prepared in English and Arabic on *Google Forms* and was disseminated through study co-investigators in each country via social media platforms and other educational platforms such as Microsoft Teams. Participants were asked to answer only one of the versions to avoid duplicate responses. The data was collected between 1 February and 15 April 2022.

2.2. Inclusion and exclusion criteria

Undergraduate pharmacy students who have studied for at least one entire semester in an undergraduate pharmacy program in one of the participating countries. Eligible participants were actively registered and received their didactic learning content through face-to-face, virtual, or hybrid modes. Internship students in PharmD programs were excluded because they were not fully under the didactic learning component in the pharmacy schools, so some survey questions would not fully apply to them.

2.3. Sample size

This study was not directed to cross-country comparisons as there were considerable variations among countries regarding the number of pharmacy schools, target student population, and accessible sampling frames. Using the Raosoft sample size calculator, assuming an estimated proportion of 50 % and a 95 % confidence interval and confirming that at least one principal pharmacy school will be participating in each country, the minimum required sample size was estimated at 70 students at least in every setting. This was met successfully in all countries except for two due to the small student population or inconsistent overall

access to students during data collection. However, the data collection was continued over ten weeks to maximize participation, and we included all received responses in the final data analysis.

2.4. Instrument structure and translation

A 31-item questionnaire was developed, validated, and pilot-tested, including the validated short grit scale for grit assessment. In addition, we used the approved translated forms of the validated scale. We performed forward–backward translation for the introductory section on participants' information and experience with learning during the pandemic. These three versions, including the original version, were then compared to ensure consistency before proceeding to the pilot study. The questionnaire was prepared in English and Arabic on Google Forms, and the link was distributed on social media (*Facebook and WhatsApp*) to participants facilitated by key persons in the participating colleges and schools. Those key persons controlled the recruitment of participants by distributing survey links to particularly targeted students via their social media groups.

The questionnaire comprised three main parts:

- Part 1 (Eleven items to cover the general sociodemographic details of the participants).
- Part 2 (Twelve statements to gather information on COVID-19 and learning experiences in the pandemic era).
- Part 3 (eight statements to assess their grit levels).

2.5. Validity and pilot testing

We used the validated short grit scale. To ascertain the content validity of the remaining items by estimating the content validity index for each item (I-CVI), we involved a panel of five experts in pharmacy practice in evaluating the questionnaire's relevance and clarity. Items that had relevance (I-CVI < 0.78) were discarded from the final questionnaire, while items that had clarity (I-CVI < 0.78) were improved based on the experts' suggestions. Upon validation, a pilot study was conducted on 65 participants who fulfilled the inclusion criteria. The responses obtained from the participants in the pilot study were excluded from the final data analysis. The questionnaire was then finalized and disseminated for mass data collection.

2.6. Data collection

The final survey was distributed through online media, mainly social media platforms (e.g., Facebook and WhatsApp), using the convenience sampling method. The online medium was used to disseminate the survey form to avoid the additional risk of face-to-face interaction during the current COVID-19 restrictions. In addition, a weekly reminder was sent throughout the ten weeks dedicated to data collection. Finally, the total grit scores were calculated for each participant. Considering the reverse coding in four items while the other four items were normally coded, and as per the developer's suggestion to divide the total scores per number of items, the final grit scores ranged from 1 to 5, where 5 represents extremely gritty.

2.7. Statistical analysis

The Statistical Package for the Social Sciences (SPSS-10 Inc., Chicago, IL., USA) version 28.0 was used to analyze the data. The responses were analyzed using descriptive statistics in the form of frequencies and percentages. First, the total grit scores were calculated. Next, the significance of the differences between patients' demographics, their COVID-19 and learning experiences as categorical variables, and the total grit scores was examined using Mann-Whitney and Kruskal Wallis tests, considering they did not meet the assumption of normal distribution. A Mann-Whitney *U* test was run to determine whether grit scores differed between all binomial variables, and the Kruskal-Wallis test was conducted to investigate differences in grit scores between all categorical variables of more than two groups. Subsequently, pairwise comparisons were performed using Dunn's (1964) procedure with a Bonferroni correction for multiple comparisons. The p-values are presented for these pairwise comparisons. Finally, binary logistic regression was performed to determine the significant factors associated with higher grit scores and the adjusted odds ratios (AORs) were computed and presented with their 95 % confidence intervals. A p-value of ≤ 0.05 was set as the significance level for all comparisons.

Ethical approval

Ethical approval for this study was obtained from the institutional research and ethics committee (IREC 2022–081). The online survey form included the participation information sheet and informed consent. Participants were briefed on the strict confidentiality of their information and the anonymous use of their data for scientific research purposes only. By approving the consent form, participants were deemed to have consented to participate in this research. They were also free to withdraw their consent during the study.

3. Results

3.1. Sociodemographic, general health status, and COVID-19-related information

A total of 2665 responses were received. Participants aged on average 21.38 ± 1.65, mainly females (68.7 %), single (92.5 %), and living in urban areas (69.2 %). A detailed description of the participants' sociodemographic data is provided in Table 1. Among the participants, 93.9 % reported the absence of any chronic disease. About 18.8 % of participants were overweight, 4.2 % were obese, but only 8.9 % had a regular exercise routine. Regarding COVID-19-related infection, 36.5 % had been infected, and approximately 58 % and 24 % had close contacts infected and died because of COVID-19 infection, respectively. About 65.1 % were fully vaccinated, 19.9 % received their booster dose, and 8.2 % were non-vaccinated. Table 1 shows the participants' general health information, COVID-19 infection history, and vaccination status.

3.2. Academic-related information, challenges, and learning mode

The respondents were mainly from private universities (59.1 %). About 31 % were enrolled in Doctor of Pharmacy programs. Students enrolled in the Pharmacy program based on their interest and passion were 56.1 %, while 29.9 % enrolled based on their family recommendation. Regarding their academic performance, 18.2 % and 35.4 % had excellent and very good grades, respectively. In comparison, 12.6 % and 6.6 % got moderate and fair grades, respectively. More than half (58.2 %) reported challenges with online learning during the pandemic. Approximately 48 % of the responses indicated that their faculties adopted the hybrid learning mode.

3.3. Assessment of grit scores and responses to individual items

The overall grit score (mean ± SD) on a scale of 5 was 3.15 ± 0.54. The short grit scale assesses two primary domains of

Table 1
Participants' demographic data, general health, and vaccination status (n = 2665).

Items	N	%
Country of Residence		
Bahrain	39	1.5 %
Bangladesh	130	4.9 %
Egypt	586	22.0 %
India	255	9.6 %
Indonesia	209	7.8 %
Iraq	178	6.7 %
Jordan	224	8.4 %
Libya	32	1.2 %
Malaysia	197	7.4 %
Oman	70	2.6 %
Pakistan	278	10.4 %
Saudi Arabia	190	7.1 %
Sudan	170	6.4 %
United Arab Emirates	107	4.0 %
Gender		
Male	835	31.3 %
Female	1830	68.7 %
Area of residence		
Urban (lives in a city)	1843	69.2 %
Rural (lives in a town or village)	571	21.4 %
Urban (lives in a city for education but belongs to rural)	251	9.4 %
Presence of chronic disease or disability		
No	2503	93.9 %
Yes	162	6.1 %
Exercise status		
No	973	36.5 %
Yes, irregular exercise.	1454	54.6 %
Yes, regular (5 days/week).	238	8.9 %
Body mass index		
Normal (18.5-<25)	1784	66.9 %
Underweight (<18.5)	267	10.0 %
Overweight (25-<30)	501	18.8 %
Obese (>30)	113	4.2 %
Have you received the COVID-19 vaccine?		
Not vaccinated	219	8.2 %
One dose only	180	6.8 %
Two doses (full)	1736	65.1 %
Three doses (booster)	530	19.9 %

grit: consistency of interest and perseverance of efforts. Four items are aimed at evaluating each domain, where the items on the consistency of interest are reverse-coded. The overall responses revealed relatively higher favorable responses to items related to perseverance of efforts (34.9 % to 54 %) compared to the items associated with the consistency of interest (26.5 % to 31.1 %). For example, in the domain of the perseverance of efforts, the highest positive response (54 %) was for item number 8, "I am diligent," while the lowest (34.9 %) was for item number 2, "Setbacks do not discourage me." Meanwhile, in the domain of the consistency of interest, the highest positive response (31.1 %) was for item number 5, "I often set a goal and later choose to pursue a different one," while the lowest (26.5 %) was for item number 6 "I have difficulty maintaining my focus on projects that take more than a few months to complete." Table 2 shows the individual responses received on the 5-point scale for all eight items of the short grit scale.

3.4. Factors associated with higher grit scores:

This section presents variables that showed statistically significant association with the total grit score. Higher grit levels were reported among students living in urban compared to rural areas ($p = 0.020$), those in private universities compared to those in public universities ($p = 0.025$), and among those who did not face challenges with online learning during the pandemic compared to those who faced challenges ($p = 0.003$).

Furthermore, students who were engaged in irregular and regular exercise had higher grit levels than those who did no exercise ($p < 0.001$). Also, regular exercisers had higher grit levels than irregular exercisers ($p = 0.021$). Additionally, fully vaccinated ($p = 0.007$) and booster-vaccinated ($p = 0.002$) students had higher grit levels than unvaccinated students. Furthermore, students who chose the pharmacy program based on their interest and passion had higher grit levels than those who chose it based on family recommendations ($p < 0.001$). Also, those who chose the pharmacy program based on their interest and passion ($p < 0.001$) and as inspired by pharmacists they knew ($p = 0.011$) had higher grit scores compared to those who entered the pharmacy program as their only available/reasonable choice. Finally, students with higher academic performance as excellent and very good grades achievers showed higher grit levels compared to lower grades achievers ($p < 0.001$). Table 3 presents all associated factors that correlate with higher grit scores.

Furthermore, the findings of the binary logistic regression revealed that students who did not engage in any exercise (AOR: 0.47, 95 %CI: 0.33–0.67) or exercised irregularly (AOR: 0.64, 95 % CI: 0.45–0.90) were less likely to have higher grit scores than those who maintained a regular exercise routine. Additionally, students who did not receive COVID-19 vaccination (AOR: 0.50, 95 %CI: 0.36–0.71) or received only one dose (AOR: 0.67, 95 %CI: 0.46–0.99) were less likely to have higher grit scores than those who received their booster vaccination. Interestingly, students who chose the pharmacy program as their only available or reasonable choice (AOR: 0.33, 95 %CI: 0.17–0.62) and students from public universities (AOR: 0.82, 95 %CI: 0.68–0.98) were less likely to have higher grit scores. On the other hand, students who did not face educational challenges with online learning (AOR: 1.19, 95 %CI:

Table 2
Responses to individual grit items (n = 2665).

Grit items	N (%)				
	Very much like me	**Mostly like me**	**Somewhat like me**	**Not much like me**	**Not like me at all**
1. New ideas and projects sometimes distract me from previous ones (Consistency of interest) *	301 (11.3)	517 (19.4)	1131 (42.4)	588 (22.1)	128 (4.8)
2. Setbacks do not discourage me (Perseverance of effort)	320 (12.0)	610 (22.9)	1014 (38.0)	561 (21.1)	160 (6.0)
3. I have been obsessed with a certain idea or project for a short time but later lost interest (Consistency of interest) *	436 (16.4)	631 (23.7)	874 (32.8)	512 (19.2)	212 (8.0)
4. I am a hard worker (Perseverance of effort)	608 (22.8)	796 (29.9)	890 (33.4)	290 (10.9)	81 (3.0)
5. I often set a goal and later choose to pursue a different one (Consistency of interest) *	376 (14.1)	583 (21.9)	879 (33.0)	559 (21.0)	268 (10.1)
6. I have difficulty maintaining my focus on projects that take more than a few months to complete (Consistency of interest) *	445 (16.7)	628 (23.6)	886 (33.2)	501 (18.8)	205 (7.7)
7. I finish whatever I begin (Perseverance of effort)	637 (23.9)	741 (27.8)	780 (29.3)	384 (14.4)	123 (4.6)
8. I am diligent (Perseverance of effort)	639 (24.0)	799 (30.0)	844 (31.7)	280 (10.5)	103 (3.9)

*Reverse-coded items.

Table 3
Factor associated with higher grit scores in pairwise comparisons.

Variable	Category with higher grit scores (mean rank)	Category with Lower grit scores (mean rank)	P value
University type*	Students in private universities (1360.75)	Students in public universities (1292.96)	p = 0.025
Facing challenges with online learning*	Those who did not face challenges (1385.79)	Those who did face challenges (1295.14)	p = 0.003
Residence #	A significant difference in grit scores across residential areas.		p = 0.016
	Urban (lives in a city) (1361.24)	Rural (lives in a town or village) (1261.63)	p = 0.020
Vaccination status #	A significant difference in grit scores according to students' vaccination status.		p = 0.001
	Three doses (booster) (1392.06)	Not vaccinated (1168.84)	p = 0.002
	Two doses (full) (1346.36)	Not vaccinated (1168.84)	p = 0.007
Exercise #	A significant difference in grit scores between different levels of the physical activity group.		p < 0.001
	Regular exercise (1519.54)	Irregular exercise (1375.01)	p = 0.021
	Regular exercise (1519.54)	No exercise (1224.60)	p < 0.001
	Irregular exercise (1375.01)	No exercise (1224.60)	p < 0.001
Year of study #	A significant difference in grit scores between different study years.		p = 0.009
	Year 5 (1,403.77)	Year 4 (1265.02)	p = 0.018
	Year 1 (1401.04)	Year 4 (1265.02)	p = 0.043
Reason for choosing the pharmacy programme #	A significant difference in grit scores between reasons for choosing the pharmacy programme.		p < 0.001
	Interest/passion (1438.71)	Family/friends recommendation (1192.55)	p < 0.001
	Interest/passion (1438.71)	Only available/reasonable choice (974.14)	p < 0.001
	Inspired by a pharmacist I know (1,297.77)	Only available/reasonable choice (974.14)	p = 0.011
Academic performance #	A significant difference in grit scores between academic performance grades.		p < 0.001
	Excellent (1467.35)	Good (1306.45)	p = 0.003
	Excellent (1467.35)	Moderate (1195.19)	p < 0.001
	Excellent (1467.35)	Fair (1002.05)	p < 0.001
	Very good (1394.91)	Moderate (1195.19)	p < 0.001
	Very good (1394.91)	Fair (1002.05)	p < 0.001
	Good (1306.45)	Fair (1002.05)	p < 0.001

*Mann-Whitney test.
Kruskal-Wallis test. Adjusted p-values are presented for pairwise comparisons.

Table 4
Findings of binary logistic regression of higher grit scores.

Study variable	P value	AOR	95 % CI	
			Lower	Upper
Residence area	0.70			
Residence area (Urban)	0.53	1.09	0.82	1.45
Residence area (Rural)	0.90	1.02	0.73	1.41
Ref: Residence area (live in a city but belong to rural)				
Exercise	<0.001			
Exercise (No)	<0.001	0.47	0.33	0.67
Exercise (Irregular)	0.010	0.64	0.45	0.90
Ref: Exercise (Regular)				
Vaccination status	<0.001			
Vaccination status (No)	<0.001	0.50	0.36	0.71
Vaccination status (One dose)	0.045	0.67	0.46	0.99
Vaccination status (Two doses "full")	0.292	0.88	0.70	1.11
Ref: Vaccination status (Three doses "booster")				
Year study	0.297			
Year study (1)	0.505	0.90	0.66	1.22
Year study (2)	0.108	0.78	0.57	1.05
Year study (3)	0.321	0.87	0.67	1.13
Year study (4)	0.045	0.77	0.59	0.99
Ref: Year study (5)				
Reason for choosing Pharmacy Programme	<0.001			
Choice Pharmacy (Interest/passion)	0.603	1.13	0.69	1.85
Choice Pharmacy (Family/friends recommendations)	0.502	0.84	0.51	1.38
Choice Pharmacy (Inspired by a pharmacist I know)	0.932	1.02	0.58	1.79
Choice Pharmacy (Only available/reasonable choice)	0.001	0.33	0.17	0.62
Ref: Choice Pharmacy (Others or no specific reason)				
Academic Performance	<0.001			
Academic Performance (Excellent)	<0.001	2.28	1.57	3.31
Academic Performance (Very good)	<0.001	2.16	1.53	3.04
Academic Performance (Good)	0.003	1.68	1.19	2.38
Academic Performance (Moderate)	0.010	1.65	1.12	2.42
Ref: Academic Performance (Fair)				
University type (Public)	0.038	0.82	0.68	0.98
Ref: University type (Private)				
Challenges with online TL (No)	0.046	1.19	1.003	1.416
Ref: Challenges with online TL (Yes)				

AOR: Adjusted Odds Ratio.

1.003–1.416) and students with excellent (AOR: 2.28, 95 %CI: 1.57–3.31), very good (AOR: 2.16, 95 %CI: 1.53–3.04), and good (AOR: 1.68, 95 %CI: 1.19–2.38) academic performance were more likely to have higher grit scores. Table 4 presents the binary logistic regression results performed on variables associated with significant differences in higher grit scores.

4. Discussion

We have estimated the grit level of undergraduate students in the pharmacy profession across 14 different countries. The investigation of 2665 samples demonstrated a moderate grit score. Moreover, there were relatively higher favourable responses to items related to perseverance of efforts compared to the items associated with consistency of efforts. Our findings underlined several factors contributing to the students' grit levels. Students' grit levels were significantly different based on residence area, exercise routine, vaccination status, university type, academic performance, year of study, the primary reason for studying pharmacy, and experiencing challenges with online learning.

Numerous noncognitive traits affect academic performance and mental strength, but Duckworth sees grit as the strongest predictor of academic excellence (Credé et al., 2017; Duckworth et al., 2007). Grit possesses extreme steadfastness and determination to sustain the same amount of pleasure and passion every day for an extended time (Stoffel and Cain, 2018). The higher the level of grit, the easier it is for an individual to see difficulties and stress in life as an ultimate part of their struggle to achieve long-term goals, and this motivation makes them less likely to be depressed (Liu et al., 2022). Grittier students outperform their peers in academics, do not give up after minor setbacks, maintain a healthy balance of curricular and extracurricular activities, and are better able to overcome mental health challenges during the COVID-19 pandemic (Loftus et al., 2020).

The concepts of growth mindset, grit, and resilience are crucial for pharmacy students who are held accountable for online learning and make their efforts to learn in online classes during the pandemic. Grit can also help develop a growth mindset. Gritty individuals are more likely to be involved in the practice, which leads to improvement in skill over time. A progressive growth mindset allows the mind to adapt to new challenges. They perceive failures and obstacles as an opportunity to grow and practice coping with adverse events through an adaptive rather than avoidant approach. On the contrary, a fixed mindset is regressive, views failure as an obstacle to growing and succeeding, dislikes challenges and learning new things, and believes and sticks to their predetermined set of beliefs (Credé et al., 2017; Park et al., 2020).

The student's propensity for physical activity may impact their intelligence and motivation. According to a study by Dunston et al., physical activity is a significant factor in developing grit (Dunston et al., 2022). We have identified our samples with regular exercise to have better grit scores than those with irregular exercise, and the least score was noticed in those with no exercise ($p < 0.01$). Concerning the COVID-19 vaccination, our findings showed that approximately 85 % of the student population received full and booster vaccination. This was linked to higher grit scores compared to their non-vaccinated counterparts. This might be explained by the role that vaccination plays in protecting individuals from infection and its dire consequences, and previous research has highlighted the significant role of perseverance as a protective factor against depressive symptoms among young adults who are at increased risk of COVID-19 infection (Hou et al., 2021). In addition, recent research conducted among students of different disciplines showed that students had positive attitudes and beliefs and were familiar with vaccination despite a few knowledge gaps that can be enhanced further by introducing specialized immunization courses at the undergraduate level (Elkalmi et al., 2021).

Moreover, students should be able to self-decide on their future that can be influenced by experts' opinions, transforming their choice to be the best decision. In our study, most opted for pharmacy courses out of their interest and were not much influenced by their parents. The desire to work as a healthcare professional and serve patients in need contributed to choosing pharmacy as a study program. Hanna et al. emphasized that how well a student gets to know about the profession before or during pursual, the course would prepare them for it, and this positive attitude to work hard for the attainment of a fixed goal is required to be a competent candidate in the profession (Hanna et al., 2016). Our findings also presented a higher grit score in those who opted for pharmacy courses based on their interest and passion for the profession compared to those who opted for pharmacy to follow their family recommendations or those who viewed studying pharmacy as the only available option.

In response to the pandemic, many academic institutions have adopted online learning as a main or at least supporting learning mode for students, involving both learning delivery and assessments (Elnaem et al., 2021, 2020; Nazar et al., 2020; Rahman et al., 2020). Our findings highlight that those students who did not face challenges with online learning tend to have higher grit scores than those who faced challenges with the transformation to online learning. This could be attributed to the link between learning mode transformation and the student's academic performance. Karattuthodi et al. and colleagues, in their Indian study, reported that poor academic performance was observed owing to the immediate shift to the online learning program (Karattuthodi et al., 2022). However, a blended learning approach composed of online lectures and on-site practical sections was followed in many countries and appreciated through student feedback (Strawbridge et al., 2022). On the other hand, those candidates with poor access to advanced facilities and assistance should be identified and supported (Saleem et al., 2022).

In addition, the present study's findings showed significant variations in the grit scores among the participants based on differences in their academic performance, year of study, and university type. Pate et al. stated through their study that grittiness is strongly associated with students' academic performance (Pate et al., 2017). The inability to streamline their workload and limitations in handling time would lower their curiosity to learn and diminish their confidence in themselves (Jegede et al., 2020). The emotional wellness of the students in this generation is not enough to withstand the stress of work. Fischbein et al. convey through their study that pharmacy students felt they would require mental health treatment in the near future (Fischbein and Bonfine, 2019). Emotional intelligence, which is strongly associated with grit, refers to the ability to adapt to a situation, understand the problem, manage stress, and develop an effective communication system (Ain et al., 2021). Furthermore, in a study by Tangmunkongvorakul et al. among Thai school students, grit was associated with satisfactory relationships with their teachers, support from their parents, and interest in the school (Tangmunkongvorakul et al., 2022). Among university students, higher grit was associated with more resilience and an increased likelihood of a growth-oriented mindset, which are critical attributes for future healthcare practitioners (Kannangara et al., 2018).

Overall, this study provides insights into the current grit levels among undergraduate pharmacy students across 14 countries. Several differences were identified across the main domains of grit assessment, particularly the one related to the consistency of interest. Moreover, we provide perhaps the most comprehensive list of factors associated with grit levels. In addition to vaccination status and physical activity, numerous academic-related factors are

linked to the assessed grit levels. Careful consideration of this list of factors could help design further interventions to support students' grit attributes among undergraduate pharmacy students, particularly concerning their consistency of interests.

The main limitation of the present study is the inconsistent samples across different countries attributable to various factors, as discussed earlier. Because of these differences, we were unable to compare grit levels across countries and provide country-specific recommendations. Also, there are limitations attributed to the nature of the cross-sectional study, with no ability to assess causal relationships. In addition, the recruitment methods were conveniently sought mainly from the institutions to which researchers were affiliated, and finally, the potential bias came from the use of self-reported assessment tools.

The strength of the present study is that it was a multinational study of 14 countries, and its target was pharmacy students in particular, which makes it unique in that there is a scarcity of literature evaluating grit among a large sample of pharmacy students.

5. Conclusion

The findings revealed moderate grit levels among participants. Higher levels of grit were associated with living in an urban area, having a regular exercise routine, being fully vaccinated, attending a private university, having higher academic performance, initially having an interest in studying pharmacy, and not having experienced any difficulties with online learning. Further interventions to support students' grit attributes are required, particularly concerning the consistency of interests.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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