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Translation and validation of the caffeine use disorder questionnaire in Arabic

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Abstract

Background Due to the elevated global prevalence of its consumption, and the detrimental health effects it can have, caffeine use disorder (CUD) should receive a great deal of attention from clinicians and the research community in Arab countries as an area of concern. To help advance the field, this study aimed to translate the Caffeine Use Disorder Questionnaire (CUDQ) into the Arabic language, and examine its psychometric properties in community adults.

Methods A descriptive, observational and cross-sectional study was carried out during the period from May to July 2024. Arabic-speaking adults from the general population of Lebanon ($N=1858$, 49.8% males, mean age of 30.05 ± 11.39 years), reporting caffeine consumption at least once during the last 12 months, were included.

Results The study's results provided support to the theoretical assumptions of unidimensionality of the original version of the CUDQ, with excellent composite reliability (Cronbach's $\alpha=0.90$). Furthermore, the structure of the Arabic CUDQ was equivalent across sex, suggesting that the latent CUD construct has the same meaning in male and female adults. The highest CUDQ scores were reported by participants drinking 7 to 9 cups and 10 cups or more of coffee/per day relative to those consuming lower amounts of coffee. Finally, our findings revealed good concurrent validity based on positive correlations of CUDQ scores with nicotine dependence, depression and anxiety scores.

Conclusion Overall, findings suggest that the CUDQ is appropriate and suitable for use to measure CUD among Arabic-speaking adults from the general population. Making the CUDQ available in the Arabic language can fill a gap in the assessment of problematic caffeine consumption in Arab contexts. Future studies are required to further confirm the psychometric soundness of the Arabic CUDQ in more representative samples, specific populations and other Arab countries.

Keywords Caffeine addiction disorder, Caffeine addiction, Validation, Psychometric properties, Arabic

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Text box 1. Contributions to the literature

- No population-based study has previously been carried-out to explore the prevalence and severity of caffeine use disorder in the Arabic-speaking adult general population to the best of our knowledge.
- This study aimed to build on the initial validation of the Caffeine Use Disorder Questionnaire (CUDQ) by providing further validation in a new language and context.
- Findings showed that the Arabic version of the CUDQ has enough empirical evidence of validity and reliability to support its use in Arab contexts.
- Making the CUDQ available in the Arabic language can fill a gap in the assessment of problematic caffeine consumption in Arab contexts.

Introduction

Caffeine is one of the most commonly used psychoactive and stimulant substances worldwide [1]. It consists of a complex chemical mixture of biologically active constituents including minerals, vitamins, lipids, alkaloids, carbohydrates, phenolic and nitrogenous compounds [2]. The most popular dietary sources of caffeine are coffee, tea, chocolates, energy drinks, sodas and other carbonated soft drinks [3]. Caffeine has both positive and negative impacts on health depending on its dosage [4]. Previous body of evidence provided by umbrella reviews of meta-analyses suggested that coffee consumption at 3–4 cups/day, which is equivalent to 300–400 mg/day of caffeine, provides safe and favorable health effects for most people [5, 6]. At such moderate dosage levels, beneficial effects include neuroprotective properties against the onset of neurodegenerative diseases [7], clinical utility for enhancement of analgesia [8], as well as a decreased risk of several cancers, metabolic, neurological, liver and conditions [5]. However, caffeine consumption at higher doses can be responsible for a wide range of adverse health outcomes, such as tachycardia, an increased risk for major cardiovascular events, irritability, anxiety [9], psychosis and even a life-threatening multisystemic "caffeinism" [10]. Consumption of caffeine at higher than recommended dietary doses can lead to caffeine intoxication, including irregular heartbeat, gastrointestinal distress, headache, restlessness, nervousness and insomnia [11]. Excessive caffeine consumption has also been linked to addictive use tendencies.

Addiction to caffeine

Some people seek treatment for their caffeine consumption because they report an inability to reduce or cut down use despite negative consequences and withdrawal symptoms when attempting to stop [12]. Controlled laboratory and clinical studies consistently demonstrated that caffeine produces physiological and behavioral effects similar to other potentially addictive substances, and that caffeine addiction is a clinically meaningful disorder that impacts a substantial proportion of caffeine consumers [12]. Both the 11th Revision of the International Classification of Diseases (ICD-11) [13] and the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5) [14] recognize caffeine withdrawal, caffeine intoxication, caffeine-induced insomnia, and caffeine-induced anxiety disorder as potential diagnoses when symptoms lead to clinically significant impairment or distress. While the ICD-10 has previously included substance dependence due to caffeine as a diagnosis, caffeine use disorder (CUD) is not recognized as a separate diagnosis by the ICD-11. Instead, problematic caffeine use can be distinguished under "Disorders due to use of caffeine" in terms of "Other specified disorders due to use of caffeine" or a "harmful pattern of use of caffeine" [13]. As for the DSM-5, CUD was involved as a condition for further study in section III, which is mainly due to a lack of data regarding its prevalence and clinical implications in the general population [14]. In the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition, Text-Revision (DSM-5-TR) [15], CUD remains included in section III as needing further investigation with the same diagnostic criteria as in the DSM-5. Both the DSM-5 and the DSM-5-TR propose three essential and sufficient diagnostic criteria for CUD: (1) unsuccessful efforts or a persistent desire to control or cut down caffeine use; (2) continued caffeine use despite knowledge of having a recurrent or persistent psychological or physical problems that are likely to have been exacerbated by, or have resulted from caffeine; and (3) caffeine-related withdrawal syndrome [14, 15]. Beyond these three key diagnostic criteria, six other criteria are included as markers for more severe CUD, which are tolerance, craving, and taking caffeine over a longer period of time or in larger amounts than intended [14]. The DSM-5 further specifies that a central objective in proposing the CUD for inclusion in the DSM-5 is to encourage research aimed at determining the validity, reliability, prevalence and clinical meaningfulness of the condition, with a specific focus on its impact on functional outcomes as a part of validity testing.

Population-based evidence showed that 8% of non-clinical U.S. adults met the three DSM-proposed key criteria for CUD [16], whereas much higher prevalence rates (72–84%) were observed among help-seekers for problematic caffeine consumption [17–19]. The rates of endorsement of the DSM-5 diagnostic criteria for CUD in other specific populations (such as individuals diagnosed with other substance use disorder, eating disorders or other psychiatric disorders) was also found to be significantly higher relative to that reported in the general population (for review, see [12]). Research found that fulfilling CUD criteria is linked to caffeine-related functional impairment, greater psychological distress (depression, anxiety, stress), some substance use, poorer

sleep [16], hence the importance of assessing and understanding CUD. At the same time, due to the ubiquity of caffeine use and the high potential for overdiagnosis, it is necessary to provide accurate screening and diagnostic tools for facilitating the correct recognition of DSM-defined criteria for CUD.

Measurement of addiction to caffeine in current research

Previous clinical studies on caffeine addiction have mainly adopted retrospective survey-based approaches in which respondents were asked to indicate how many caffeinated beverages they consumed per day [20, 21]. However, this method cannot be considered as accurate, since caffeine concentration substantially differs within and across beverages and foods (e.g., a 6-ounce cup of brewed coffee contains from 54 mg to 210 mg [22]). Therefore, researchers have recommended that future studies should develop and evaluate methods to evaluate caffeine consumption accurately and frequently [12]. In 2018, and based on the proposed CUD criteria of the DSM-5, Ágoston et al. [23] designed and validated a new self-report tool using an item-response theory, which they called the Caffeine Use Disorder Questionnaire (CUDQ). The CUDQ was originally validated in a sample of 2259 Hungarian adults aged 34 years in average (70.5% male) who consumed caffeine in the last year at least one time. It contains ten items (e.g., "Did you feel a strong desire or had unsuccessful attempts to reduce or control your caffeine consumption?"). The CUDQ has been successfully translated, adapted and validation in the Turkish language, showing good psychometric characteristics in terms of structural validity, internal consistency, and construct validity [24]. In addition, the CUDQ was applied to 152 Persian-speaking community members, where it revealed good internal consistency (a Cronbach's alpha of 0.770), and excellent test–retest reliability [25]. No other linguistic validation studies are available to date as far as we are aware of.

Rationale and aim of the study

Coffee consumption in per capita has seen a significant worldwide increase of 37% over the last two decades, with the Middle East and North Africa (MENA) being the main affected region (84.2%) [1]. Although caffeine has increasingly attracted the interest of clinicians and researchers [26], no population-based study has previously been carried-out to explore the prevalence and severity of CUD in the Arabic-speaking adult general population to the best of our knowledge. The scant research conducted in Arab countries so far to characterize caffeine dependence in this population relied on collecting data on sources and doses of the caffeine consumed (e.g [27–29]). , , and/or random plasma caffeine levels [30]. Arab countries have a long history of cultivation and production of coffee [31]. Coffee is of great significance to Arab people; it is a widely popular traditional drink that symbolizes generosity, nobility, hospitality, and represents one of the symbols of the deep-rooted culture and the "national mentality of the Arabs" [31]. Coffee is found in almost every household and is served in almost every occasion of Arabs' life such as weddings, get-togethers, official meetings, funerals and religious feast [32]. For example, it has been estimated that Saudi people spend over 266 million dollars per year for coffee and caffeine consumption [32]. Due to the elevated global prevalence of its consumption, and the detrimental health effects it can have, CUD should receive a great deal of attention from clinicians and the research community in Arab countries as an area of concern. To help advance the field, this study aimed to translate and validate the CUDQ into the Arabic language. It is hypothesized that the Arabic version of the CUDQ will demonstrate a single-factor structure with good model fit indices, as well as good reliability and adequate concurrent validity against measures of anxiety, depression and nicotine dependence.

Methods

A descriptive, observational and cross-sectional study was carried out during the period from May to July 2024. Eligibility criteria were the following: (1) being an adult aged 18 or older, from the general population of Lebanon, (2) being native Arabic-speaking, (3) reporting caffeine consumption at least once during the last 12 months. Data were gathered using the snowball sampling technique and an online questionnaire. The questionnaire link was circulated via different social media platforms (e.g., Facebook, WhatsApp, Instagram, Twitter). It was ensured that each participant could fill out the survey questionnaire only once. An introductory paragraph was included at the beginning of the link, containing detailed information about the study. An electronical informed consent was obtained before beginning the survey. Participants were not included in the study if they did not give informed consent. All participants were asked to complete the survey voluntarily without compensation and were assured about anonymity and confidentiality of their responses. Ethics approval for this study was obtained from the ethics committee of the School of Pharmacy at the Lebanese International University. The study questionnaire involved the following information and measures:

Sociodemographic information

The questionnaire collected sociodemographic data consisting of age, sex, marital status, educational attainment, and cigarette smoking. Participants were also asked to indicate how many times per day (on average) during the

past year they have consumed caffeine beverages such as coffee, tea, soft drinks, energy drinks, and dark chocolate. Answer options were the following: 0, 1 to 2, 3 to 4, 5 to 6, 7 to 9, and 10 or more.

The Caffeine use disorder questionnaire

The CUDQ was initially developed based on the nine criteria proposed for CUD in DSM-5, combined with a tenth item on suffering caused by the caffeine-related symptoms and their severity during the last 12 months. Respondents are asked to rate how often they experienced the symptoms during the last 12 months on a 4-point Likert scale from 1 (Never) to 4 (Very often). Before its application in our sample, the CUDQ was translated and culturally adapted. To achieve this, the scale was first translated into Arabic following international standards and guidelines to ensure semantic equivalency between the Arabic and original versions [33]. This process involved a forward and backward translation procedure. Initially, a Lebanese translator, independent of the study, translated the scale from English to Arabic. Then, a Lebanese psychologist fluent in English translated the Arabic text back into English. The translators ensured that all translations, whether specific or literal, were appropriate. A committee of experts, including two psychiatrists and one psychologist, reviewed both the original and translated English versions alongside the study team and translators to identify and resolve any inconsistencies, ensuring the translation's accuracy. To verify that the Arabic and original versions were conceptually equivalent, a measure tailored to our specific needs was conducted, focusing on detecting any potential misinterpretations of the language and readability of the items [34]. Thereafter, a pilot study involving thirty community adults was conducted to confirm that each question was understood; no further adjustments were necessary following the pilot study.

External variables

The fagerström test for nicotine dependence (FTND)

The FTND contains 6 items, three are multiple-choice rated between 0 and 3 and three are binary (yes/no) rater 1 or 0. Greater total scores reflect higher levels of dependence on nicotine [35]. The Arabic validated version of the FTND was adopted [36], and showed a Cronbach's alpha of 0.69 in the present study.

The patient health questionnaire-9 (PHQ-9)

The PHQ-9 was used to assess the severity of depression symptoms depression over the last two weeks through 9 items (e.g., "Feeling down, depressed, or hopeless") [37]. Items are rated on 4 points from 0 (not at all) to 3 (nearly every day). Total scores range between 0 and 27. Greater scores indicate higher depression. The PHQ-9 was used in its Arabic validated version [38, 39], with a Cronbach's alpha of 0.92.

The generalized anxiety disorder 7-item (GAD-7)

This is a self-administered tool composed of seven items (e.g., "Worrying too much about different things") used to measure the severity of generalized anxiety symptoms over the last two weeks according to the DSM-5 [40]. Items can be rated between 0 (Not at all) and 3 (Nearly every day), with total scores varying between 0 and 21. The Arabic validated version was used in this study [38, 41], and yielded a Cronbach's alpha of 0.92.

Analytic strategy

There were no missing responses in the dataset. To assess the psychometric properties of the CUDQ, a confirmatory factor analysis (CFA) was conducted via SPSS AMOS v.29 software. The minimum sample size for the CFA was esteemed at 72–480 participants based on 3 to 20 times the number of the scale's variables [42]. We intended to test the unidimensional factor structure described in the literature. Parameter estimates were obtained using the maximum likelihood method. The model adequacy was verified via several fit indices: the root mean square error of approximation (RMSEA) (≤ 0.08), standardized root mean square residual (SRMR) (≤ 0.05), the Tucker-Lewis Index (TLI) and the comparative fit index (CFI) (both ≥ 0.90) [43]. Multivariate normality was not verified (Bollen-Stine bootstrap $p=0.002$); therefore, we performed non-parametric bootstrapping procedure. The ten items of the CUDQ were transformed into dichotomous variables by comprising the last three options into one 'yes' answer (Fig. 1).

To examine sex invariance of CUDQ scores, we conducted multi-group CFA [44] using the total sample. Measurement invariance was assessed at the configural, metric, and scalar levels [45]. We accepted $\Delta CFI \leq 0.010$ and $\Delta RMSEA \leq 0.015$ or $\Delta SRMR \leq 0.010$ as evidence of invariance [46]. The remaining analysis was done via SPSS software v.26. Composite reliability was assessed using McDonald's ω and Cronbach's α, with values greater than 0.70 reflecting adequate reliability. Normality of the 10-item CUDQ total scores was verified since the skewness and kurtosis values varied between −1 and +1 [47]. Consequently, the Pearson test was used to correlate two continuous variables and the independent sample t test to compare the CUDQ total scores between sexes. The ANOVA test was used to check for a difference between age categories in terms of CUD. The following six age categories were considered: 18–24 (young adults), 25–34 (early adulthood), 35–44 (mid-adulthood), 45–54 (midlife), 55–64 (late middle age) and 65+ (older adults) [48]. $P<0.05$ was deemed statistically significant.

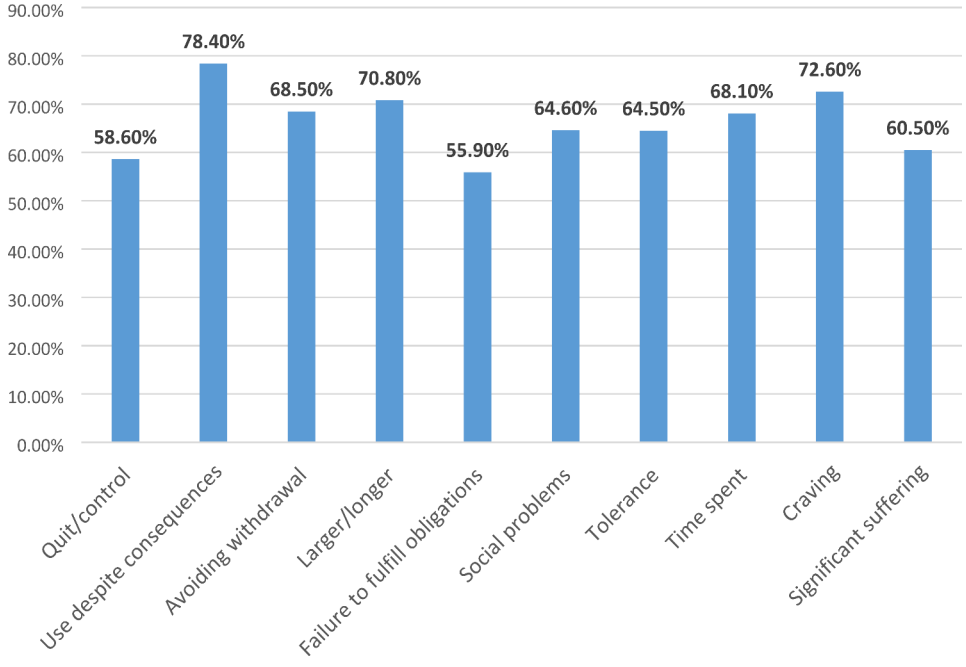

Fig. 1 Percentage of participants showing each symptom of the Caffeine Use Disorder Questionnaire

Table 1 Characteristics of the study sample ($n=1858$)

Variable	*N* (%)
Sex	
Male	935 (49.8%)
Female	943 (50.2%)
Educational attainment	
Secondary or less	446 (23.7%)
University	1432 (76.3%)
Tobacco use	
Yes	1112 (59.2%)
No	766 (40.8%)
Average daily frequency of caffeine consumption during the past year	
0	106 (5.6%)
1 to 2	653 (34.8%)
3 to 4	548 (29.2%)
5 to 6	288 (15.3%)
7 to 9	78 (4.2%)
10 or more	205 (10.9%)
Variable	**Mean ± SD**
Age in years	30.05 ± 11.39
Household Crowding Index (person/room)	1.11 ± 2.02

Results

Characteristics of the sample

The total sample included 1858 participants, with 49.8% males, 66.9% single and 76.3% with a university level of education. The mean CUDQ score was 9.68±6.43, with a median of 10, a minimum of 0 and a maximum of 30. Other participants information is illustrated in Table 1.

Confirmatory factor analysis

CFA results showed that the unidimensional structure of the scale was very good: RMSEA=0.092 (90% CI 0.086, 0.099), SRMR=0.043, CFI=0.930 and TLI=0.910. We noticed a high modification index between residuals of items 5 and 10; after adding a correlation between them, the fit indices improved: RMSEA=0.077 (90% CI 0.071, 0.084), SRMR=0.037, CFI=0.953 and TLI=0.937. The standardized loading factors from the CFA are

Table 2 Standardized loading factors of the Caffeine Use Disorder Questionnaire deriving from the deriving from the confirmatory factor analysis

Item label	CFA
CUDQ 1 - Did you feel a strong desire or had unsuccessful attempts to reduce or control your caffeine consumption?	0.54
CUDQ 2 - Did you consume caffeine despite you knew that it can cause permanent or recurrent physical or psychological consequences?	0.65
CUDQ 3 - Did you consume caffeine in order to avoid one or more caffeine withdrawal symptoms (e.g. headache, nausea, fatigue)?	0.68
CUDQ 4 - Did you consume more caffeine or did you consume caffeine longer than you intended?	0.75
CUDQ 5 - Because of caffeine use, did you fail to fulfill any major work, school or home responsibilities (e.g. repeated absences from work or school due to caffeine consumption or withdrawal symptoms)?	0.59
CUDQ 6 - Did you consume caffeine despite you knew that it can cause permanent or recurrent social problems or exacerbate them (e.g. debate with spouse because of the consequences, medical problems and costs due to caffeine use)?	0.68
CUDQ 7 - Did you have to consume more caffeine than earlier in order to reach the same effect or did you experience that the same amount of caffeine did not have the desired effect anymore?	0.73
CUDQ 8 - Did you spend a significant amount of time with consuming or obtaining caffeine?	0.73
CUDQ 9 - Did you feel a strong desire or urge to consume caffeine?	0.73
CUDQ 10 - Did the before mentioned phenomena, which you experienced, cause you significant inconvenience or suffering in your everyday life?	0.66

Table 3 Measurement invariance of the Caffeine Use Disorder Questionnaire Scale across sex in the total sample

Model	CFI	RMSEA	SRMR	Model Comparison	ΔCFI	ΔRMSEA	ΔSRMR
Configural	0.951	0.056	0.040				
Metric	0.952	0.052	0.041	Configural vs. metric	0.001	0.004	0.001
Scalar	0.951	0.049	0.041	Metric vs. scalar	0.001	0.003	< 0.001

Note. CFI = Comparative fit index; RMSEA = root mean square error of approximation; SRMR = Standardized root mean square residual

summarized in Table 2. The composite reliability was excellent (ω = 0.90 / α = 0.90). The percentage of participants showing each symptom of the caffeine use disorder questionnaire is shown in Fig. 1. The most endorsed items by our sample were use despite consequences (78.4%), craving (72.6%) and larger/longer (70.8%).

Sex invariance

We were able to show the invariance across sex at the configural, metric, and scalar levels (Table 3). No significant difference was found between males and females in terms of CUDQ scores (9.60 ± 6.47 vs. 9.76 ± 6.40; t(1876) = −0.54; $p = 0.592$).

Concurrent validity

Higher depression (r(1878) = 0.37; $p < 0.001$), higher anxiety (r(1878) = 0.39; $p < 0.001$) and higher nicotine dependence (r(1878) = 0.14; $p < 0.001$) were significantly associated with higher CUDQ scores. Furthermore, the highest mean CUDQ was found in participants drinking 7 to 9 cups of coffee/per day (11.86 ± 6.10) and 10 cups or more (11.46 ± 7.11), followed by those drinking 5–6 cups/day (10.85 ± 6.31), 3–4 cups/day (10.67 ± 5.87) and 1–2 cups/day (8.36 ± 6.00) ($p < 0.001$). It is noteworthy that there was no significant difference between age categories in terms of caffeine dependence: 18–24 (9.46 ± 6.30; $n = 800$), 25–34 (9.94 ± 6.30; $n = 601$), 35–44 (10.03 ± 6.88; $n = 205$), 45–54 (9.31 ± 6.63; $n = 168$), 55–64 (9.97 ± 6.95; $n = 87$) and 65+ (9.06 ± 7.43; $n = 17$), F(5, 1872) = 0.69, $p = 0.634$).

Discussion

Despite not being yet recognized by the DSM-5 as a clinical diagnosis, providing clinicians with a valid and reliable measurement instrument that evaluates CUD can still benefit help-seeking caffeine consumers in the detection of patterns of caffeine addiction, their monitoring and treatment. To this end, this study proposed to offer an Arabic validated version of the CUDQ for use among Arabic-speaking adults. The study's results provided support to the theoretical assumptions of unidimensionality of the original version of the CUDQ, with excellent composite reliability and invariance across sex groups. Validity was supported through adequate patterns of correlations with anxiety, depression and nicotine dependence. Overall, findings suggest that the CUDQ is appropriate and suitable for use to measure CUD among Arabic-speaking adults from the general population. Making the CUDQ available in the Arabic language can fill a gap in the assessment of problematic caffeine consumption in Arab contexts.

The most endorsed items by our sample were use despite consequences, craving and larger/longer. Ágoston et al. [23] found that Hungarians endorsed caffeine causing interpersonal problems or interfering with fulfilling obligations as the most severe CUD symptoms, and recommended to further investigate their possible manifestations in future clinical research. Besides, suffering from CUD symptoms was the third most severe criterion, suggesting that it can be important for assessing caffeine addiction. In contrast, craving and longer/larger caffeine

consumption appeared at mild levels of the CUD continuum, likely signifying that these symptoms do not reflect problematic caffeine consumption [23].

CFA showed that all items loaded on a single factor with excellent reliability (Cronbach's α=0.90). Therefore, the CUDQ may be regarded as a scale measuring a unidimensional construct with ten items, and implies that a total summated score can be applied to rate respondents' levels of CUD. The developers of the CUDQ observed a mild positive correlation between total caffeine intake per day and the extent of CUD, suggesting that it would be more valuable to use total CUDQ scores as a continuous rather than a dichotomous variable using certain cut-off values to get more elaborate findings regarding the link of caffeine usage and CUD [23]. Consistent with our findings, a study involving Turkish-speaking adults reported adequate fit indices for the one-factor model and good reliability coefficients (Cronbach's α=0.86) [24]. Furthermore, the structure of the Arabic CUDQ was equivalent across sex, suggesting that the latent CUD construct has the same meaning in male and female adults. This implies that the scale is suitable for comparisons of both means and correlations across sex groups. No significant sex differences were identified for CUDQ scores in our sample, which in line with previous findings [16].

The highest CUDQ scores were reported by participants drinking 7 to 9 cups and 10 cups or more of coffee/per day relative to those consuming lower amounts of coffee, which support the validity of the CUDQ in detecting those at-risk for CUD. In addition, our findings revealed good concurrent validity based on positive correlations of CUDQ scores with nicotine dependence scores. In line with our findings, the original validation study of the CUDQ showed that regular smokers experienced significantly a higher number of CUD symptoms than non-smokers, whereas those who were occasional smokers did not differ from non-smokers and smokers [23]. This is also consistent with previous binational population-based findings which showed that smoking initiation and smoking persistence were significantly linked to consuming more daily doses of caffeine [49]. Furthermore, higher CUDQ scores were correlated with more severe depression and anxiety, providing additional evidence to the clinical relevance of the CUD construct, and the negative effects of caffeine addiction on mental health [16]. Finally, no significant differences were found in CUD scores between the different age groups. Based on a large sample of 37,602 US caffeine consumers, a previous study showed that the 50- to 64-year-old age group had the highest intake [50]. Similar to these findings, data from the National Health and Nutrition Examination Survey (NHANES) 2007–2012 showed that individuals aged 50 to 54 years consumed significantly more caffeine (211±6 mg/d) than both older (153±4 mg/d) and younger (107±4 mg/d) individuals [51]. In another study, caffeine dependence was found to be significantly affected by age, with dependence effects being more pronounced in individuals of older age. This finding was explained by the fact that older adults' bodies process caffeine more slowly [27]. These observed age differences can be related to cultural variations. As most of the previous studies were performed in Western countries, future studies need to further explore this aspect in other cultural backgrounds.

Study limitations

This study has some limitations that should be acknowledged and addressed. First, the sample was gathered online using snowball sampling, which could limit diversity of the sample and contribute to potential biases due to its reliance on social networks. To address this limitation and improve generalizability of our findings, future research should consider the use of random or stratified sampling techniques. The sample may not be representative of the general Lebanese population, as younger, single and highly educated adults were overrepresented. Future studies need to consider including a more demographically proportional sample of adults. In addition, a self-report questionnaire was adopted, which could have led to recall and social desirability biases. This limitation can be overcome by employing a mixed-method approach, such as including biochemical measures (e.g., caffeine levels in saliva or blood), which could enhance data accuracy. Some psychometric properties were not tested in the context of this study, such as test-retest reliability and convergent validity, which may limit insights into the measure's stability over time. Future research should evaluate the Arabic CUDQ scores' stability over time by administering it at different time points. Furthermore, the future investigation of predictive validity is still required to validate the usefulness of the CUDQ in diagnosing CUD. Finally, the study's cross-sectional nature limits the ability to establish causal relationships. Future longitudinal studies should be considered to explore changes in caffeine consumption and CUD symptoms over time.

Practical and research implications

To date, there are diverging opinions among addiction professionals about the inclusion of CUD in the DSM [52], and there is currently a common agreement on the importance and necessity to foster research efforts on the topic. Given that caffeine consumption is largely variable depending on the population and the type of drink [53], there is a critical need for further epidemiological, clinical and genetic research to increase knowledge on the prevalence and clinical relevance of the CUD in populations from different countries and cultures around the

world. We believe that offering an Arabic validated version of the CUDQ will help foster research on CUD in Arabic-speaking populations worldwide, and enhance our knowledge about potential differences in symptoms and clinical correlates across cultural groups. More specifically, research still needs to investigate rates of endorsement of the CUD diagnosis in both clinical and non-clinical populations as well as some specific populations (e.g., pregnant women, adolescents), and determine the subgroups who are the most vulnerable to developing the condition. Additionally, the Arabic CUDQ can be used to obtain crucial information to help inform the development and implementation of treatment opportunities for consumers who are distressed or impaired by this health problem and who seek assistance or treatment to reduce or quit caffeine consumption. Finally, we hope that the Arabic CUDQ could help raise awareness among clinicians and the general public on the addictive potential and harms associated with caffeine, and draw the attention of public health policy-makers to the importance of recognizing the need for appropriate regulatory measures to prevent caffeine-related negative health effects in Arab settings.

Conclusion

Caffeine consumption has become part of adults' everyday lives worldwide, with daily per capita amounts of caffeine having steadily risen in many parts of the world over the last years and more heavy users having expressed a desire to quit or reduce caffeine consumption. This study aimed to build on the initial validation of the CUDQ by providing further validation in a new language and context. Findings showed that the Arabic version of the CUDQ has enough empirical evidence of validity and reliability to support its use in Arab contexts. Although additional work is required to further confirm the psychometric soundness of the Arabic CUDQ in more representative samples, specific populations and other Arab countries, it can be assumed that the scale is ready for use among Arabic-speaking adults from the general population.

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Author contributions
SO, FFR and SH designed the study; FFR drafted the manuscript; SH carried out the analysis and interpreted the results; FS and MD collected the data; DM and RH reviewed the paper for intellectual content. All authors reviewed the final manuscript and gave their consent.

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None.

Data availability
All data generated or analyzed during this study are not publicly available due to restrictions from the ethics committee, but are available upon a reasonable request from the corresponding author (SH).

Declarations

Ethics approval and consent to participate
Ethics approval for this study was obtained from the ethics committee of the School of Pharmacy at the Lebanese International University. Written informed consent was obtained from all subjects; the online submission of the soft copy was considered equivalent to receiving a written informed consent.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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References

1. Quadra GR et al. Caffeine Consumption over Time, in Handbook of Substance Misuse and Addictions: From Biology to Public Health, V.B. Patel and V.R. Preedy, Editors. 2022, Springer International Publishing: Cham. pp. 1535–1552.
2. Spiller MA.The chemical components of coffee.Caffeine, 2019:97–161.
3. Verster JC, Koenig J. Caffeine intake and its sources: a review of national representative studies. Crit Rev Food Sci Nutr. 2018;58(8):1250–9.
4. Butt MS, Sultan MT. Coffee and its consumption: benefits and risks. Crit Rev Food Sci Nutr. 2011;51(4):363–73.
5. Poole R, et al. Coffee consumption and health: umbrella review of meta-analyses of multiple health outcomes. BMJ. 2017;359:j5024.
6. Grosso G, et al. Coffee, Caffeine, and Health outcomes: an Umbrella Review. Annu Rev Nutr. 2017;37:131–56.
7. Reddy VS, et al. Pharmacology of caffeine and its effects on the human body. Eur J Med Chem Rep. 2024;10:100138.
8. Derry CJ, Derry S, Moore RA. Caffeine as an analgesic adjuvant for acute pain in adults. Cochrane Database Syst Reviews, 2014(12).
9. Ding M, et al. Long-term coffee consumption and risk of cardiovascular disease: a systematic review and a dose-response meta-analysis of prospective cohort studies. Circulation. 2014;129(6):643–59.
10. Adeleye QA, et al. Psychosis following caffeine consumption in a young adolescent: review of case and literature. Ann Afr Med. 2023;22(3):392–4.
11. Pohler H. Caffeine intoxication and addiction. J Nurse Practitioners. 2010;6(1):49–52.
12. Meredith SE, et al. Caffeine use disorder: a comprehensive review and research agenda. J Caffeine Res. 2013;3(3):114–30.
13. World Health Organization. ICD-11, the 11th Revision of the International Classification of Diseases; 2022.
14. American Psychiatric Association. Diagnostic and statistical manual of mental disorders: DSM-5. Volume 5. American psychiatric association Washington, DC; 2013.
15. American Psychiatric Association. Diagnostic and statistical manual of mental disorders (5th ed., text rev.); 2022.
16. Sweeney MM, et al. Prevalence and correlates of caffeine use disorder symptoms among a United States sample. J Caffeine Adenosine Res. 2020;10(1):4–11.
17. Juliano LM, et al. Characterization of individuals seeking treatment for caffeine dependence. Psychol Addict Behav. 2012;26(4):948.
18. Sweeney MM, et al. A randomized controlled trial of a manual-only treatment for reduction and cessation of problematic caffeine use. Drug Alcohol Depend. 2019;195:45–51.
19. Evatt DP, Juliano LM, Griffiths RR. A brief manualized treatment for problematic caffeine use: a randomized control trial. J Consult Clin Psychol. 2016;84(2):113.
20. Jones HA, Lejuez C. Personality correlates of caffeine dependence: the role of sensation seeking, impulsivity, and risk taking. Exp Clin Psychopharmacol. 2005;13(3):259.
21. Svikis DS, et al. Caffeine dependence in combination with a family history of alcoholism as a predictor of continued use of caffeine during pregnancy. Am J Psychiatry. 2005;162(12):2344–51.
22. LM J, Anderson BL.Griffiths RR. Caffeine.Strain. E., editor. Lowinson & Ruiz's substance abuse: a Comprehensive Textbook. Fifth. Philadelphia: Lippincott Williams & Wilkins; 2011. pp. 335–53.

23. Ágoston C, et al. Caffeine use disorder: An item-response theory analysis of proposed DSM-5 criteria. Addict Behav. 2018;81:109–16.
24. Kaya S et al. Validation of the Turkish version of the caffeine use disorder questionnaire in an adult population. Int J Mental Health Addict, 2021;1–12.
25. Abdoli F, et al. Estimate the prevalence of daily caffeine consumption, caffeine use disorder, caffeine withdrawal and perceived harm in Iran: a cross-sectional study. Sci Rep. 2024;14(1):7644.
26. Nieber K. The impact of coffee on health. Planta Med. 2017;83(16):1256–63.
27. Amer SA, et al. Caffeine addiction and determinants of caffeine consumption among health care providers: a descriptive national study. Volume 27. European Review for Medical & Pharmacological Sciences; 2023;8.
28. Alaa Hammami MB, et al. Caffeine consumption levels and knowledge among adults in the United Arab Emirates: insights from a nationwide survey. J Caffeine Adenosine Res. 2018;8(2):71–9.
29. Makki NM, et al. Caffeine Consumption and Depression, Anxiety, and Stress Levels Among University Students in Medina: A Cross-Sectional Study. Cureus. 2023;15(10):e48018.
30. Samaha A, et al. Data on the relationship between caffeine addiction and stress among Lebanese medical students in Lebanon. Data Brief. 2020;28:104845.
31. Kukhareva E. A drink for the Soul: the Coffee tree and Coffee as a Symbol of the Arab National Mentality. Russian J Cult Stud Communication. 2024;2(1):14–28.
32. AL-Asmari KM, Zeid IMA, Al-Attar AM. Coffee arabica in Saudi Arabia: an overview. Int J Pharm Phytopharmacological Res (eIJPPR). 2020;10(4):71–8.
33. Van Widenfelt BM, et al. Translation and cross-cultural adaptation of assessment instruments used in psychological research with children and families. Clin Child Fam Psychol Rev. 2005;8:135–47.
34. Ambuehl B, Inauen J. Contextualized measurement scale adaptation: a 4-Step tutorial for health psychology research. Int J Environ Res Public Health. 2022;19(19):12775.
35. Heatherton TF, et al. The Fagerström Test for Nicotine Dependence: a revision of the Fagerström Tolerance Questionnaire. Br J Addict. 1991;86(9):1119–27.
36. Kassim S, Salam M, Croucher R. Validity and reliability of the Fagerstrom Test for Cigarette Dependence in a sample of Arabic speaking UK-resident Yemeni khat chewers. Asian Pac J Cancer Prev. 2012;13(4):1285–8.
37. Kroenke K, Spitzer RL, Williams JB. The PHQ-9: validity of a brief depression severity measure. J Gen Intern Med. 2001;16(9):606–13.
38. Sawaya H, et al. Adaptation and initial validation of the Patient Health Questionnaire – 9 (PHQ-9) and the Generalized Anxiety Disorder – 7 Questionnaire (GAD-7) in an Arabic speaking Lebanese psychiatric outpatient sample. Psychiatry Res. 2016;239:245–52.
39. Dagher D, et al. Depressive symptoms among a sample of Lebanese adolescents: Scale validation and correlates with disordered eating. Arch Pediatr. 2023;30(6):401–7.
40. Spitzer RL, et al. A brief measure for assessing generalized anxiety disorder: the GAD-7. Arch Intern Med. 2006;166(10):1092–7.
41. El Khoury-Malhame M et al.Psychometric validation of the Arabic version of the GAD-7 among Lebanese Adolescents.2024.
42. Mundfrom DJ, Shaw DG, Ke TL. Minimum sample size recommendations for conducting factor analyses. Int J Test. 2005;5(2):159–68.
43. Hu Lt, Bentler PM. Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. Struct equation modeling: multidisciplinary J. 1999;6(1):1–55.
44. Chen FF. Sensitivity of goodness of fit indexes to lack of measurement invariance. Struct equation modeling: multidisciplinary J. 2007;14(3):464–504.
45. Vadenberg R, Lance C. A review and synthesis of the measurement in variance literature: Suggestions, practices, and recommendations for organizational research. Organ Res Methods. 2000;3:4–70.
46. Swami V, et al. Psychometric properties of an Arabic translation of the Functionality Appreciation Scale (FAS) in Lebanese adults. Body Image. 2022;42:361–9.
47. Hair JF Jr, et al. Advanced issues in partial least squares structural equation modeling. saGe; 2017.
48. Association AP. Publication manual of the American psychological association (7th ed.). 2020: Washington DC, USA.
49. Treur JL, et al. Associations between smoking and caffeine consumption in two European cohorts. Addiction. 2016;111(6):1059–68.
50. Pray L, Yaktine AL, Pankevich D. Caffeine in food and dietary supplements: examining safety. Workshop summary; 2014.
51. Lieberman HR, Agarwal S, Fulgoni VL. Daily Patterns of Caffeine Intake and the Association of Intake with Multiple Sociodemographic and Lifestyle Factors in US Adults Based on the NHANES 2007–2012 Surveys. J Acad Nutr Dietetics. 2019;119(1):106–14.
52. Budney AJ, et al. Caffeine withdrawal and dependence: a convenience survey among addiction professionals. J caffeine Res. 2013;3(2):67–71.
53. Mitchell DC, et al. Beverage caffeine intakes in the US. Food Chem Toxicol. 2014;63:136–42.

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