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Happiness Measured by a Single Item: Psychometric Evaluation of the Arabic Version of Fordyce Global Happiness Scale Among University Students and Mothers of Children With Intellectual Disabilities

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ABSTRACT

Objectives: Aiming to validate the Fordyce Global Happiness Scale in Arabic, this cross-sectional study recruited two convenience Saudi samples of 422 university students and 85 mothers of children with intellectual disabilities.

Methods: Among students, a latent variable model was used to examine scale convergent/divergent validity relative to life satisfaction and depressive symptomatology. Scale cutoffs were assessed in the two samples through cluster analyses and ROC analysis. Differences in happiness were evaluated between mothers and students and across student groups of gender, academic degree, and type of study (practical vs. theoretical).

Results: The latent variable model expressed good fit, showing satisfaction with life and positive affect as significant positive predictors of happiness, which was inversely associated with somatic complaints and negative affect. Two-step cluster analysis resulted in a two-cluster solution, which revealed three cutoffs (among students: < 5, 5–8, > 8 and among mothers: < 4, 4–8, > 8), which significantly classified the samples according to the levels of happiness into low/mild, moderate, and high. ROC analysis revealed an optimal cutoff of 4.5 with high sensitivity (100%) and acceptable specificity (74% and 62%) among students and mothers, respectively. The highest and lowest levels of all depressive symptoms were noticed in participants with happiness scores (< 4.5 or < 5) and > 8, respectively. Known-group validity was signaled by lower overall happiness scores in the mother sample relative to university students.

Conclusions: Fordyce Global Happiness Scale captures happiness as a distinct construct, which relates to the cognitive and emotional components of well-being and physical symptoms of psychopathology.

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1 | Introduction

Happiness comprises a sense of satisfaction, with the presence of positive feelings and absence of negative feelings (Krys et al. 2024). It reflects how people feel and think about their lives through a process that portrays differences in how they evaluate objective circumstances depending on their own nervous system reactions, goals, values, and culture (Nima et al. 2024). It is one component of the broader concept of subjective well-being (Boyadjieva and Ilieva-Trichkova 2022; Nima et al. 2024; Şimşek 2009). Despite extensive research, happiness remains an ambiguous and complex concept that pertains to a positive emotion, which influences individuals' state of wellbeing and behaviors (Grigoriadou et al. 2024). For example, happiness promotes prosocial behaviors, which are directed toward the benefit of other people and the environment (Nguyen et al. 2024). The phenomenon of happiness is also related to better coping, mental and physical health, less suffering as well as longevity (Lukoševičiūtė et al. 2022; Timóteo et al. 2024). On the other hand, individuals in societies that strive for happiness optimization may delve into problematic conduct for example, the abuse of illicit substances (aiming at promoting positive feelings or dumping negative emotions) and pathologically elevated, mood-enhancing behaviors, which induce heightened levels of mania (Krys et al. 2024). Accordingly, studying happiness expands our understanding of human wellbeing and the effect of events, interventions, and public-policy decisions on quality of life (Nima et al. 2024).

The academic performance, health behaviors (diet, sleep, physical activity, among others), and mental wellbeing of university students may be jeopardized by an array of exhaustive challenges in the university environment (Ali et al. 2021a). Resilience refers to individuals' capacity to resume or regain homeostasis/wellbeing in the face of adversities (Ali et al. 2024a; Seppälä et al. 2020). Interestingly, happiness among students is a resilience factor, which protects against academic burnout while important factors in the school environment such as the quality of educational services fail to buffer academic burnout (Rahdar et al. 2019). Research shows that happiness among university students is more clearly separable for males than for females, and it is uniquely associated with communal, interpersonally oriented traits and high positive affect. Meanwhile, related measures of positive mental health (e.g., self-esteem) are primarily associated with a lack of negative affect as well as agentic, independence-oriented and achievement-oriented traits (Furr 2005). Current perspectives of positive psychology view happiness not as a matter of fate, but rather as a condition that can be actively developed and maintained (Bergsma et al. 2020; Seppälä et al. 2020). Efforts directed toward the promotion of preventive psychological health among university students involve the application of measures that foster positive traits such as happiness (Colombo et al. 2006). Indeed, interventions involving happiness training increase satisfaction with life and induce positive changes, especially among students (Bergsma et al. 2020). In this respect, a study adopting a preventative and proactive approach to mental health through the implementation of SKY Campus Happiness reported significant reductions in anxiety, stress, depression, and distress, along with improvement in social and emotional skills whereas minimal or no improvement was noted in students receiving Foundations

in Emotional Intelligence and Koru Mindfulness-based interventions (Seppälä et al. 2020). Happiness training is also associated with improvement in physical problems such as high blood pressure and migraine (Khodabakhsh 2021). Therefore, happiness interventions are highly recommended among students and young working individuals since happier people are more productive, leading to increased welfare of the whole society (Bergsma et al. 2020; Seppälä et al. 2020).

In 64 out of 133 studies, single-item measures were used to assess happiness among students and adolescents. However, happiness was not the primary focus of validation, and in most cases, the response options comprised a continuum with four or five points, entailing unwanted measurement effects for example, of cultural preferences and cognitive load: persons facing an even number of responses (with no middle-point) might be forced to report feeling either happy or unhappy; they may choose a doubting or incongruent state or opinion (e.g., which does not present the pressure to be happy) when facing an odd number of responses (with a middle point) (Lukoševičiūtė et al. 2022). On the other hand, Fordyce Global Happiness Scale, also known as Fordyce Emotion Questionnaire, requires individuals to describe their global estimation and general (not the present state) feeling of being happy or unhappy on a scale ranging from 0 (extremely unhappy, depressed, down) to 10 (extremely happy, feeling ecstatic, joyous, fantastic). This flexible rating scale allows the respondents to circle a number that accurately describes their actual feelings (Fordyce 1988). Thus, it may limit cognitive and cultural measurement biases (Lukoševičiūtė et al. 2022).

Despite the universality of happiness, research reports cross-cultural variations regarding the validity of single-item measures of general wellbeing (Raudenská 2023). Most happiness studies originated from Western contexts, which are individualistic in orientation and set value for happiness maximization (Kitayama and Salvador 2024; Krys et al. 2024). Research denotes that eco-cultural complexes pertaining to ecology and geography interfere with human activities, cultural practices, and meanings (Joshi et al. 2014; Kitayama and Salvador 2024; Krys et al. 2024). In this respect, individuals' thriving to maximize their happiness experience may be especially characteristic of Western, educated, industrial, rich, and democratic societies with minimal concerns expressed by individuals from other cultural backgrounds (Krys et al. 2024). The Arab region has its own special and distinct geographical and cultural nature, with collectivism as the most prominent orientation (Ali et al. 2021b, 2022a; Sabah et al., 2024a, 2024b). Qualitative investigations among Arab Americans associate happiness to living in congruence with Arab cultural values (e.g., centrality of family, community, and spirituality/religion) and the satisfaction of basic needs and safety within one's identity (Atari-Khan and Gerstein 2024). Likewise, native and expat Arab students from the UAE defined happiness as "an emotion and approach to life"; they also described it as a collective state stemming from family and social relationships as well as religion rather than from the self (D'raven and Pasha-Zaidi 2015). Such variation in the way Arabs conceptualize happiness may justify why six out of seven Arab countries included in the World Happiness Report 2024 scored the lowest rankings: Iraq 92nd; Morocco 107th; Tunisia 115th; Jordan 125th;

Egypt 127th; and Lebanon 142nd (Makdissi 2024). So, would the problem really lie within Arab people's sense/experience of happiness or their cultural view of happiness? Although our study is not designed to answer this question, providing a validated brief Arabic measure would be a great help for future studies targeting this issue.

Fordyce Global Happiness Scale as a single item that is rated on a 10-response scale may be an ideal measure for use among Arabs. This is because ultra brief measures require less mental effort/patience from the respondents, which results in higher response rates. This is crucial within the Arab context, given the consistently reported low response rates among Arab respondents (Zeinoun et al. 2022). However, it is unclear whether Arab collectivistic culture may influence the psychometric qualities and usability of this simple scale. Therefore, the current study aimed to validate the properties of Fordyce Global Happiness Scale in an Arab context, taking into consideration the value presented by other elements of the global phenomenon of subjective wellbeing: a complex biopsychosocial adaptive system, which comprises a cognitive dimension of evaluations of the satisfaction individuals experience in their lives, an affective-emotional dimension that depicts the balance between positive and negative affect, and a behavioral dimension in which individuals seek harmony in life (Espejo et al. 2022; Nima et al. 2024).

Aiming to offer a practical measurement tool of happiness in Arabic, this study used structural equation modeling (SEM) in a sample of university students to estimate the criterion validity (both convergent and divergent validity subtypes) of Fordyce Global Happiness Scale. Based on research declaring happiness as a component of the multidimensional model of subjective wellbeing (Boyadjieva and Ilieva-Trichkova 2022; Nima et al. 2024; Şimşek 2009), testing was conducted in relevance to other components of wellbeing: satisfaction with life and low emotional negativity as indicated by the three domains of a common measure of depression (positive affect, negative affect, and somatic complaints). In this respect, life satisfaction and positive affect (joy and contentment) capture distinct but related components of wellbeing. Thus, happiness, as the emotional component of wellbeing, may display convergent validity if it strongly correlates with these two measures. On the other hand, tests of divergent validity employ variables that are conceptually different from happiness (like negative affect or somatic complaints) to ensure that the happiness measure does not strongly correlate with unrelated/opposing constructs (Alvarenga et al. 2024). Hence, we can ensure that Fordyce Global Happiness Scale accurately assesses both cognitive and emotional components of wellbeing and does not overlap with unrelated constructs. Research describes the interactions among happiness, life satisfaction, and (positive/negative) emotions as complex and involving reciprocity (Badri et al. 2022; Cohn et al. 2009; Kwak 2024; Ng 2022; Zhu et al. 2024). Meanwhile, happiness is widely conceptualized as a reflection of how people feel and think about their lives (Nima et al. 2024). Accordingly, happiness was used as a dependent variable in the current analyses. There are no established criteria for identifying individuals with high or low levels of happiness according to the present measure. Meanwhile, low rankings reported for Arab

countries in the world survey were based on mean scores of a single-item measure of happiness that has 1 to 10 response categories (same as Fordyce measure) (Makdissi 2024). Therefore, the present study also aimed at investigating the cutoffs of Fordyce Global Happiness Scale to answer a cordial question: Can certain levels of (un)happiness reflect life dissatisfaction and undesirable levels of depressive symptoms? The answer should help us direct efforts toward the support of people with emotional vulnerability. A two-step procedure was used to address this goal. Clustering analysis (both Two-Step and k-means clustering) was used to determine multiple scale cutoff in a sample of students. To ensure stability of the results, clustering analysis was replicated in another sample, which comprised mothers of children with intellectual disabilities. In a second step, an optimal cutoff was determined based on conventional methods.

2 | Methods

2.1 | Design, Sample, and Procedure

Using a cross-sectional design and an anonymous digital survey, this study recruited a convenience sample of students ($N = 422$) from Umm Al-Qura University. The digital form used for data collection prompted the respondents to complete all items. It was also designed to be filled once on the same device (PC/smartphone) to ensure that one person does not fill it more than one time. So, we did not receive any incomplete or duplicated responses. According to the rule of thumb (10 participants for each scale item, 10:1), a sample of 140 respondents can be sufficient for running a model that comprises three scales of 14 items such as in the current study. However, given that non-normal distribution is common in data of negative emotions such as the Center for Epidemiological Studies Depression Scale Eight-item Version (CESD-8) and a bigger sample may be a better choice, we recruited a larger sample, which according to conservative standards meets the criteria of good-to-very good sample size (300–500 responses) (Boateng et al. 2018). Invitations to take part in the study were disseminated through students' mailing lists. The survey was delivered in Google Forms between December 25, 2020 and January 21, 2021. Inclusion of the students was based on the criteria of age > 18 years, Arabic fluency, and signing an informed consent form. Minimal sociodemographic characteristics were examined (e.g., gender, degree, and academic major), and potential respondents were assured that participation is anonymous and voluntary, with no effect of participation on their academic degrees. No compensation was awarded to participating students. The Research Ethics Committee of Ha'il University approved the study protocol (No. 16784/5/42. November 5, 2020).

Another convenience sample of mothers of children with intellectual disabilities ($N = 85$) was used to replicate the clustering analysis. Participants were recruited online through advertisements disseminated via WhatsApp and Facebook parent groups associated with Saudi childcare centers. Inclusion was limited to mothers who could speak Arabic and had access to the internet. The participants signed a digital informed consent, and the study was approved by the Research Ethics

Committee of Ha'il University (11/9/2023: H-2023-367). The sample and procedure are described in more detail elsewhere (Ali et al. 2026).

2.2 | Measures

Happiness was measured by Fordyce Global Happiness Scale, which is a single item that requests the respondents to rate the extent to which they generally felt happy over the last week on a scale from 0 (very unhappy) to 10 (extremely happy) (Fordyce 1988).

Satisfaction with life was measured by the Satisfaction with Life Scale (SWLS). The SWLS is a five-item measure, which has been developed by Diener et al. (1985) to detect global aspects of satisfaction with life—the judgment or cognitive component of subjective wellbeing. The respondents rate their responses on a seven-point scale ranging from 1 (strongly disagree) to 7 (strongly agree). Global scores range from 5 to 35, with higher scores indicating greater satisfaction with life (Diener et al. 1985). The Arabic SWLS has been recently validated, and it expressed robust construct validity and measurement invariance across genders for both the unidimensional and bidimensional structures (Ali et al. 2025a). The internal consistency of the SWLS in the student sample was excellent (Cronbach's $\alpha = 0.87$).

Depression was measured by the Eight-item Center for Epidemiological Studies Depression Scale (CESD-8). As the name implies the CESD-8 comprises eight items, which measure negative affect “for example, felt depressed, felt lonely, felt sad”, somatic complaints “for example, everything was an effort, restless sleep, could not get going”, and positive affect “for example, enjoyed life and felt happy”. The respondents rate the items of the CESD-8 on a four-point scale ranging from 0 (rarely) to 3 (most of the time). The two items of positive affect are inverse-coded. The overall scale score, which ranges from 0 to 24, captures depression, with higher scores indicating greater depression intensity (Karim et al. 2015). The Arabic CESD-8 has been recently validated, and its three-dimension structure expressed robust construct validity and measurement invariance across numerous characteristics over and above the unidimensional and bidimensional structures (Ali et al. 2025b). The internal consistency of the CESD-8 in the student sample is good (Cronbach's $\alpha = 0.75$).

The Arabic version of the Patient Health Questionnaire-2 (PHQ-2) is a two-item measure that evaluates depressive symptoms “losing interest” and “feeling down, depressed, or hopeless” during the last 2 weeks. Respondents rate items on a four-point response scale 0 (not at all) to 3 (almost every day). Accordingly, the minimum and maximum scale total scores are 0 and 6. Higher scores flag greater levels of depression and vice versa (Ali et al. 2025c). Its reliability in the mother sample is good (Cronbach's $\alpha = 0.75$).

Life satisfaction was evaluated in the mother sample through a single-item measure: “In general, how satisfied are you with your life?” Respondents rate their response on a ten-point response format ranging from 1 (Completely dissatisfied) to 10 (completely satisfied). Higher scores reflect greater life satisfaction and vice versa (Korajlija et al. 2019; Raudenská 2023).

The student sample was administered Fordyce Global Happiness Scale, the CESD-8, and the SWLS. Meanwhile, the mother sample was administered Fordyce Global Happiness Scale, the PHQ-2, and the single-item measure of life satisfaction.

The validated forms of the SWLS (Ali et al. 2025a), CESD-8 (Ali et al. 2025b), and PHQ-2 (Ali et al. 2025c) were used. Fordyce Global Happiness Scale was translated from English into Arabic following the translation-back-translation procedure recommended by Brislin (Brislin 1970). Firstly, it was translated by two independent bilingual experts from the English Department in Ha'il University. Afterward, the scale was back-translated into English by another bilingual expert. There was no disagreement between the translators, and the back-translated version was almost identical to the original English version, denoting minimal alterations in the meaning of the translated scale (Supporting Information S1).

2.3 | Statistical Analysis

Mean and standard deviation or median and interquartile range were used to report the descriptive statistics of continuous variables according to their distribution while frequencies and percentages were used to report the categorical characteristics of the subjects.

A latent variable model was used for convergent and divergent validity testing; it comprised Fordyce Global Happiness Scale as an outcome variable, with the SWLS and the three domains of the CESD-8 as independent variables. Criteria considered for good model fit included a non-significant chi-square index (χ^2), with Minimum Discrepancy Function by Degrees of Freedom divided (CMIN/DF) < 3 as well as thresholds of absolute fit indices > 0.95 of both Comparative Fit Index (CFI) and Tucker–Lewis Index (TLI) and < 0.05 of both Root Mean Square Error of Approximation (RMSEA) and Standardized Root Mean Square Residual (SRMR). Modification indices were consulted for suggestions on improving model fit (Ali et al. 2022b).

Percentile scores were used to report different levels of happiness in the student sample. These levels were further examined by Two-Step cluster analysis, which was used to classify the total sample by including happiness, SWLS, CESD-8, and its subscales as input variables. Two-Step clustering is one of the most robust approaches that can efficiently classify data/individuals into highly homogenous structures. It applies two steps: (1) pre-clustering, which involves scanning the data using a sequential approach and distance measures that allow grouping data in dense regions of the analyzed attribute variables resulting in a set of sub-clusters, and (2) clustering, stepwise statistical merging of homogenous sub-clusters until the optimal model is produced (Ali et al. 2023a). It uses statistical methods for indicating models that are most suitable for presenting the data: model fit is suggested by Silhouette measure of separation and cohesion greater than 0.5 and closer to 1 while low Akaike Information Criterion (AIC) flags the best cluster solution (Ali et al. 2023b; Benassi et al. 2020). Simultaneously, k-means clustering was performed using the z-scores of all variables—two- and three-cluster solutions were produced. To ensure stability of the clustering profiles, both clustering techniques were applied to the mother sample. Differences in

happiness between both samples were examined through independent sample *t*-test with adjusted degree of freedoms because of variations in sample sizes.

According to the method described by Colledani et al. (2025), one cluster membership variable was produced using k-means clustering (3 cluster solution) based on the z-scores of happiness only in each sample. Happiness means were calculated in all clusters. Accordingly, categories were labeled as low, moderate, and high. In a next step, receiver operating characteristic curve (ROC) analysis was performed using the raw scores of happiness (i.e., in its continuous form) and the single-item measure of life satisfaction or the SWLS to determine their cutoffs. Model fit was decided according to the criteria of area under the ROC curve (AUC) with 95% confidence interval (95% CI), rate of true-positive cases (sensitivity), and rate of true-negative cases (specificity). Ideally, values close to one indicate optimal fit (Ali et al. 2024b, 2024c).

One way ANOVA test with post-hoc Tukey HSD was used to examine the differences in the CESD-8 and its subscales between groups classified based on cutoffs determined from percentile scores and Two-Step clustering. Meanwhile, independent sample *t*-test was used to compare the difference in depressive variables between groups defined based on the optimal cutoff obtained from ROC analysis. Independent sample *t*-test was also used to compare mean differences in happiness in the student sample across groups of gender, academic degree (undergraduate vs. postgraduate), and specialty (theoretical vs. practical studies). Statistical analysis was performed using IBM SPSS version 25 and IBM Amos version 26. Significant values were set to a probability level < 0.05 in two-tailed tests.

3 | Results

The student participants were primarily females ($n = 319$, 75.6%) and undergraduates ($n = 301$, 71.3%) while the rest were males ($n = 103$, 24.4%) and postgraduates ($n = 121$, 28.7%). Most of them ($n = 280$, 66.4%) were doing theoretical studies (e.g., law, Sharia, languages, marketing, etc.) while the rest of the participants ($n = 142$, 33.6%) were doing practical studies (e.g., engineering, pharmacy, nursing, etc.) Table 1 presents the psychological characteristics of those students.

Mothers' mean age was 40.8 ± 8.3 years, and most of them were married (87.1%). Their average scores of happiness, life satisfaction, and depression (PHQ-2) were 6.2 (2.9), 6.6 (2.9), and 3.2

(1.1), respectively. The characteristics of participants of this sample are described in detail elsewhere (Ali et al. 2025c).

In the student sample, the latent variable model displayed excellent fit ($\chi^2 = 144.22$, $DF = 70$, $p = 0.001$, $CMIN/DF = 2.06$, $CFI = 0.976$, $TLI = 0.969$, $RMSEA = 0.050$, $RMSEA\ 95\% \text{ CI}: 0.038 \text{ to } 0.062$, $SRMR = 0.034$). The model explained 61%, 99%, and 51% of the variances in happiness, negative affect, and positive affect, respectively. Satisfaction with life, which was inversely correlated with somatic complaints ($r = -0.43$, $p < 0.01$), was the strongest predictor of happiness both directly (Figure 1) and indirectly through positive affect ($\beta = 0.096$, $95\% \text{ CI}: 0.031 \text{ to } 0.171$, $p = 0.016$). Satisfaction with life was a significant direct positive predictor of positive affect, which was also a significant direct positive predictor of happiness. On the other hand, somatic complaints significantly predicted the negative affect dimension of the CESD-8, which was inversely associated with happiness as shown in Figure 1. Meanwhile, negative affect mediated the indirect negative effect of somatic complaints on happiness ($\beta = -0.277$, $95\% \text{ CI}: -0.349 \text{ to } -0.202$, $p = 0.001$).

According to the percentile score distribution of Fordyce Global Happiness Scale, students' levels of happiness could be classified as low (≤ 4 : 10th percentile), mild ($> 4 - \leq 6$: 20–30th percentiles), moderate ($> 6 - \leq 7$: 40–50th percentiles), high ($> 7 - < 9$: 60–70th percentiles), and optimal (≥ 9 : 75–90th percentiles). According to these scores, 14.0%, 15.9%, 24.6%, 19.4%, and 26.1% of the students exhibited low, mild, moderate, high, and optimal levels of happiness.

As shown in Figures 2 and 3, Two-Step cluster analysis including happiness as an input variable, along with all psychological variables, classified the total student and mother samples into two clusters. Silhouette measure of separation and cohesion indicates acceptable fit whereas AIC indicates that the two-cluster solution is the best while the ratio of sizes of the largest cluster to smallest cluster was < 3 (1.07). The importance of happiness as a predictor in the first model was moderate relative to depressive symptoms captured by the CESD-8 (48% vs. 84%–100%). However, its importance was higher than that of depressive symptomatology detected by the global PHQ-2 (87% vs. 37%) in the second model among mothers of children with intellectual disabilities.

According to Clusters and Cluster comparison charts (Figure 2, Figure 3: panel (d), panel (e)), students and mothers in the first

TABLE 1 | Descriptive statistics of the psychological characteristics of participating students and the differences in these characteristics across the groups of academic degree (undergraduates vs. postgraduates: $N = 422$).

Characteristics	Mean $\pm$ SD	MD (Q1-Q3)	<i>t</i>	DF	<i>p</i>
Happiness	6.9 (2.3)	7 (5–9)	−4.26	244.5	0.001
Satisfaction with life	24.2 (6.9)	25 (20–30)	−4.65	249.0	0.001
Positive affect	3.1 (1.6)	3 (2–4)	−1.47	224.1	0.144
Negative affect	3.6 (2.6)	3 (1–6)	2.76	209.1	0.006
Somatic complaints	4.2 (2.4)	7 (5–9)	2.99	218.7	0.003
Depression	10.9 (4.2)	10 (8–13)	2.85	206.3	0.005

Note: Boldface values are statistically significant.

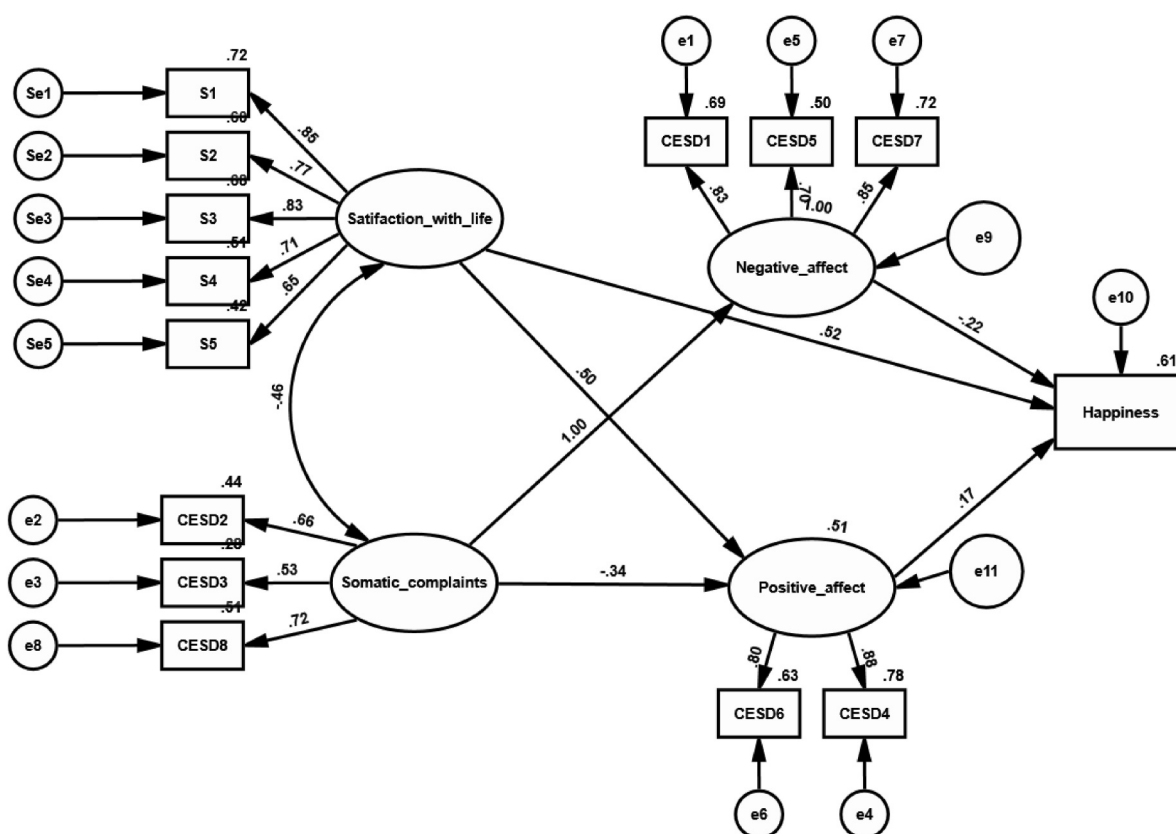


FIGURE 1 | Latent variable model using happiness scores to predict satisfaction with life and different domains comprising depression (the CESD-8) in the student sample ($N = 422$). Straight lines between key variables reflect standardized regression weights. All paths in the model are significant at the level of 0.001, except for one path (between happiness and positive affect $p = 0.003$). The curved line reflects the association between satisfaction with life and positive affect, which was statistically significant ($p < 0.01$). Numbers next to boxed identifying happiness, negative affect, and positive affect reflect percentages of variance explained.

clusters expressed low levels of all depressive symptoms and higher levels of happiness and satisfaction with life unlike participants in the second clusters who experienced low levels of happiness/satisfaction with life and greater levels of depressive symptoms. According to the means of happiness, which are plotted on Clusters charts, students' levels of happiness can be described as low/mild (< 5), moderate (5–8), and high (> 8). According to these cutoffs, 14.0%, 60.0%, and 26.0% of the students had low/mild, moderate, and high levels of happiness. In the mother sample, happiness means in the first cluster were slightly smaller than those noticed in the corresponding cluster in the student sample (3.98 vs. 5.60) while similar means were noticed in the second cluster in both samples (Figure 2, Figure 3: (d) Clusters chart). Therefore, cutoffs of (< 4), (4–8), (> 8) on the happiness measure would define mothers with low/mild, moderate, and high levels of happiness: 22.4%, 54.1%, and 23.5%, respectively. The difference in happiness between students and mothers was statically significant $t(104.8) = 2.30$, $p = 0.030$, 95% CI: 0.07–1.40.

Two- and three-cluster solutions were produced from K-means clustering using the z-scores of Fordyce Global Happiness Scale, along with the SWLS, the CESD-8, and its three subscales in the student sample or life satisfaction and the PHQ-2 in the mother sample. All variables were significant contributors in both models according to the ANOVA table (Supporting Information S3: Figures: 1, 2). However, clusters in the two-

cluster solution were more distinct than those in the three-cluster solution (Supporting Information S3: Figures: 1, 2). One cluster in the latter had a mix of slight levels of depression, along with low levels of happiness and life satisfaction or slight levels of happiness and life satisfaction, along with high levels of depressive symptoms (Supporting Information S3: Figures: 1, 2). K-means clustering involving the z-scores of happiness only was used to cluster the participants in both samples to prepare a categorical form of happiness for use in ROC analysis. As for the three happiness categories identified from the z-scores of Fordyce Global Happiness Scale alone (Figures 2 and 3: panel (f)), there were no differences in the means of happiness in the same clusters in both samples (5.51, 8.93 vs. 5.98, 8.98), except for the third cluster—happiness means in the mother sample were considerably lower than in the student sample (1.33 vs. 3.19).

In the ROC analysis, the AUC for Fordyce Global Happiness Scale showed excellent discrimination between high happiness and low/mild/moderate levels of happiness in both samples (AUC = 1.00; 95% CI: 1.00–1.00). Figure 4 shows a point on the ROC curve falling on the upper left corner of the ROC space (0.1), indicating perfect accuracy of the classifier. AUC values were also excellent for discriminating students and mothers according to SWLS/life satisfaction between happiness groups (AUC = 0.86, 0.93; 95% CI: 0.83–0.90, 0.88–0.99, respectively). In both models, a range of happiness cutoffs (0.5–7.5) with high sensitivity (100%) was obtained. However, specificity remained



FIGURE 2 | Two-Step cluster analysis using happiness, satisfaction with life, the CESD-8, and its three subscales to classify university students ($N = 422$). Model fit information: Silhouette measure of separation and cohesion = 0.5; AIC for 1 and 2 cluster solution = 1776.0 and 1198.3; Predictor importance: Negative affect = 100%, Somatic complaints = 96%, CESD-8 = 84%, Happiness = 48%, Satisfaction with life = 34%, Positive affect = 34%. Panel (a) reports the number of clusters and the silhouette index, panel (b) describes the size of each cluster, panel (c) spots the most and least important predictors in the model, panel (d) reports variable means in each cluster, panel (e) compares clusters according to the means of each variable, panel (f) is a graphical presentation of k-means clusters based on z-scores of Fordyce Global Happiness Scale among university students.

acceptably high (74, 62%) until the cutoff 4.5, but it steadily decreased with increasing values of happiness cutoffs beyond the point of 4.5 in the student and mother samples (from 45 or 32% to 0), respectively. According to this cutoff, 86.0% and 77.6% of the students and mothers had happiness scores equal to or above the cutoff relative to 14.0% and 22.4% who had low happiness scores, respectively. In the student sample, the SWLS at the cutoff of 4 had both sensitivity and specificity of 100%—this point was the closest to the y axis (Figure 4: panel (a)). Sensitivity remained high (90%) until the cutoff 23.5 but specificity remained high (80%) until the cutoff 15.5. In the mother sample, all cutoffs reported for the single-item measure of life satisfaction had sensitivity of 100%, but specificity declined considerably with rising cutoffs ranging from 88% at the cutoff 1.5 to 62 at the cutoff of 4.5. Examination of the ROC curve (Figure 4: panel (b)) indicates that 4.5 is most likely the optimal cutoff of this measure—the point closest to the upper left corner of the ROC space.

Among the student respondents, all ANOVA tests revealed statistically significant differences in the levels of depression, negative affect, somatic complaints, and positive affect among groups classified based on cutoffs resulting from cluster analysis or percentile distribution (all p values < 0.001). The highest levels of depressive symptoms were recorded in individuals with happiness scores < 5 or ≤ 4 whereas the lowest levels were recorded in individuals with happiness scores > 8 or ≥ 9 . However, post-hoc analysis indicates no overlap between cutoffs determined by cluster analysis only that is, all differences between groups were significant. Meanwhile, several instances of overlap (non-significant differences) were noticed among groups classified based on percentile scores such as (≤ 4 with > 4 – < 6) and (> 6 – ≤ 7 with > 7 – < 9). As for the cutoff originating from ROC analysis, independent sample t -test revealed significantly higher levels of depressive symptomatology among those scoring below 4.5 on Fordyce Global Happiness Scale relative to those scoring 4.5 or above (all p values < 0.001).

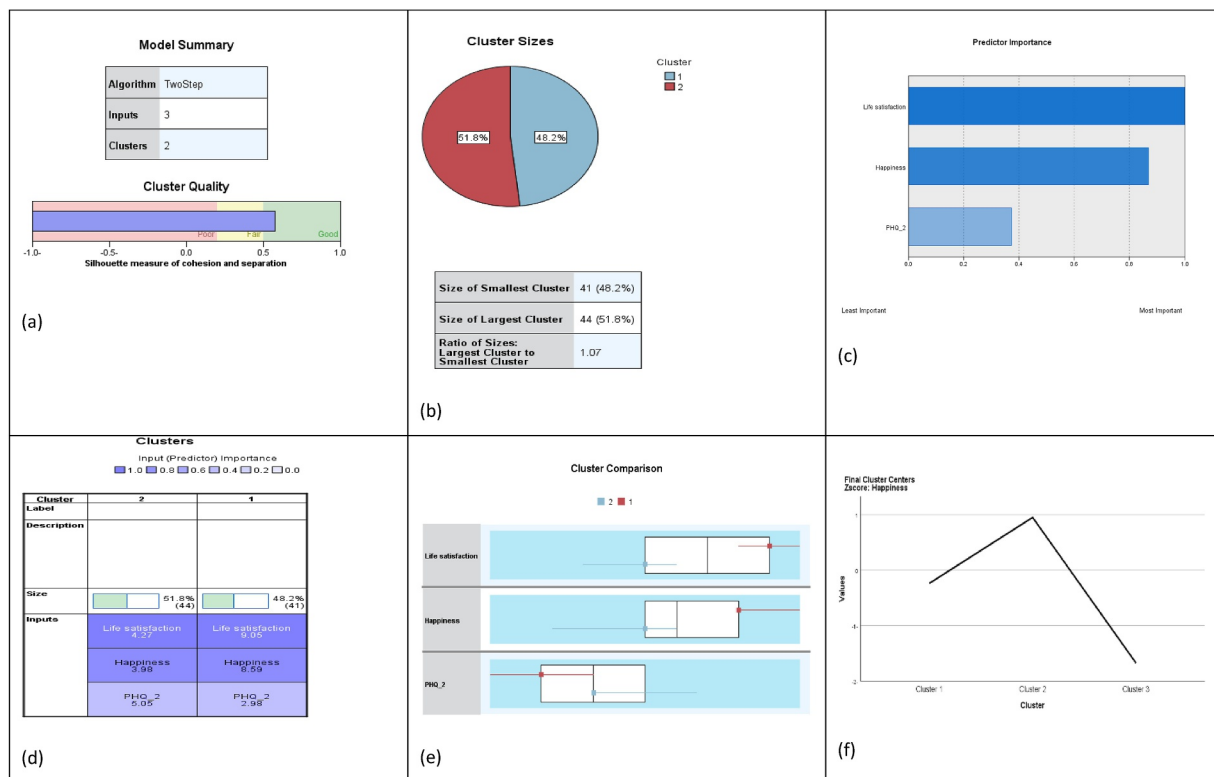


FIGURE 3 | Two-Step cluster analysis using happiness, life satisfaction, and the PHQ-2 to classify mothers of children with intellectual disabilities ($N = 85$). Model fit information: Silhouette measure of separation and cohesion = 0.58; AIC for 1 and 2 cluster solution = 72.0 and 48.3; Predictor importance: Life Satisfaction = 100%, Happiness = 87%, PHQ-2 = 37%. Panel (a) reports the number of clusters and the silhouette index, panel (b) describes the size of each cluster, panel (c) spots the most and least important predictors in the model, panel (d) reports variable means in each cluster, panel (e) compares clusters according to the means of each variable, panel (f) is a graphical presentation of k-means clusters based on z-scores of Fordyce Global Happiness Scale among mothers of children with intellectual disabilities.

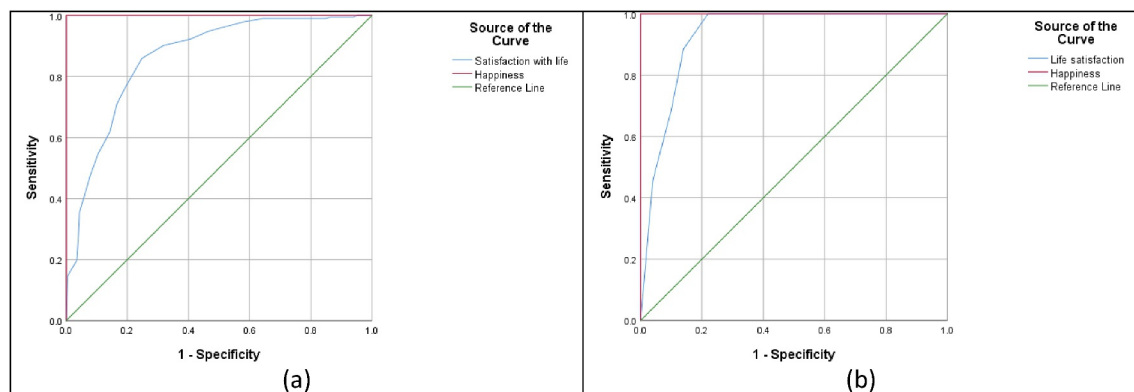


FIGURE 4 | Receiver operating characteristic curve (ROC) determining cutoffs of Fordyce Global Happiness Scale and single-item measure of life satisfaction or the Satisfaction with Life Scale (SWLS) across happiness categories identified from k-means clustering analysis in the student sample (a) and the mother sample (b).

Males' scores of happiness were higher than female scores (7.2 vs. 6.8), albeit the difference was not significant ($t(183.8) = -1.58, p = 0.131$). No statistical difference was found between those having theoretical and practical studies ($t(314.8) = 0.45, p = 0.655$). Meanwhile, happiness scores were considerably lower among undergraduate students relative to postgraduate students (6.6 vs. 7.6; $t(244.5) = 4.26, p = 0.001$). Accordingly, we investigated the differences in all the measures between undergraduate and postgraduate students. As shown in

Table 1, undergraduate students scored lower on the SWLS and higher on the somatic, negative affect, and depressive measures than postgraduate students.

4 | Discussion

Single-item measures are flexible and easy to administer; respondents find them not monotonous to complete, which lowers response bias (Karim et al. 2015). This study aimed to feature

the psychometric properties of the Arabic version of Fordyce Global Happiness Scale and report on its cutoffs in two samples. As hypothesized, the Arabic Fordyce Global Happiness Scale was positively associated with measures of satisfaction with life and positive affect and inversely associated with measures of negative affect and depressive somatic complaints. ROC analysis indicated that a threshold of 4.5 may be an optimal cutoff of the measure with sensitivity of 100% and specificity of 74% and 62% in the two samples. Based on the results of Two-Step cluster analysis, the study offers a dual cutoff approach that would minimize loss in the continuous variable when it is converted into a categorical format.

Consistent with the literature (Lukoševičiūtė et al. 2022), the Arabic version expressed adequate convergent and divergent validity: higher happiness was associated with greater satisfaction with life and more positive affect as well as lower levels of negative affect and somatic complaints. While investigations of Fordyce happiness training are common (Khodabakhsh 2021), studies validating Fordyce Global Happiness Scale are scarce. However, similar associations are reported with other measures of happiness (Cheng and Furnham 2003). Therefore, the findings identically comply with the philosophical definition of happiness as a belief that people get the important things they want and experience pleasant affect that normally go along with this belief (Lukoševičiūtė et al. 2022). They also show that happiness is not a synonym for life satisfaction or positive affect, albeit they were strongly related. In this sense, the results are consistent with those of former investigations combining positive affect, harmony in life, and life satisfaction to produce the multidimensional phenomenon of subjective wellbeing (Hernández-Torrano et al. 2020; Nima et al. 2024). Thus, subjective wellbeing in our students comprised happiness, life-satisfaction, and positive affect, in addition to low levels of/lack of negative affect and somatic complaints.

Happiness was negatively predicted by somatic complaints, and negative affect mediated its indirect effect on happiness (Figure 1). Collateral physical symptoms (e.g., chronic pain) are highly prevalent among people with higher levels of emotional negativity, and they adversely impair different aspects of functioning and quality of life (Ali et al. 2023a). In the same way, negative emotions, especially sadness, are reported as a strong predictor of somatic complaints among youth, and their effect is greater than the effect of key psychosocial and physical factors such as social support and health behaviors (Lovis-Schmidt et al. 2022). Therefore, this finding may have important implications for research and clinical practice. University students are more able to reflect on themselves and their lives, which explains why they benefit from happiness training more than younger children (Bergsma et al. 2020). Indeed, interventions that promote happiness may express positive effects on physical health. Among depressed women with somatic complaints, listening to music perceived as happy and low in arousal (ranging from calming to energizing) predicts lower intensity of and impairment by somatic symptoms (e.g., pain) while music perceived as sad predicted higher intensity of and impairment by somatic symptoms (Feneberg et al. 2021). Accordingly, initiatives taken by universities to improve academic performance may consider happiness training (e.g., SKY Campus Happiness) as a multidimensional modality that may minimize negative

affect and somatic complaints and raise positive affect and satisfaction with life (Bergsma et al. 2020; Seppälä et al. 2020).

To our knowledge, there are no statistically tested cutoffs of Fordyce Global Happiness Scale. Percentiles as cutoffs may not be the best choice, but in the absence of comparable thresholds, percentile distribution represents a convenient method for establishing reliable cutoff scores in population-based studies. They can be even as reliable as conventional cutoffs (Ali et al. 2025d; Hsieh et al. 2023). ANOVA test indicates significant differences in depressive symptoms in student groups classified based on happiness cutoffs resulting from percentile scores. However, non-significant differences were repeatedly found between some categories (Supplementary materials: S2 excel 1). On the other hand, post-hoc analysis revealed persistently statistically significant differences between student groups classified based on cutoffs originating from Two-Step cluster analysis, which makes these three cutoff scores more favorable than cutoffs originating from percentile scores. Given lack of gold standard measures in our analysis, two clustering methods were applied to the student sample and replicated in a sample of mothers of children with intellectual disabilities. Clustering procedures do not count on external gold standards (Colledani et al. 2025). The solutions produced from both techniques in both samples were consistent, indicating stability of the results. However, the lower bound of the first cutoff in the mother sample was smaller than that occurring in the student sample (3.98 vs. 5.60). In ROC analysis, the same range of happiness cutoffs appearing in cluster analysis reappeared in both samples, they largely expressed high sensitivity. However, 4.5 emerged as an optimal cutoff in both samples as it retained acceptable specificity, while specificity dropped remarkably with increasing cutoffs. Nonetheless, specificity was slightly lower in the mother sample. This single cutoff from ROC analysis corresponds to the lowest cutoff originating from clustering analysis, which differentiates low/mild from moderate happiness. The variation in the lower bound noticed between the student and mother samples coincides with significantly lower overall happiness scores among mothers of children with disabilities relative to university students. Therefore, this result may prove an aspect of known-group validity. Particularly, caring for a child with disability may be viewed as a crisis that discourages mothers from pursuing their set goals as they may dwell on negative emotions and self-blame. Those mothers exhibit significantly higher levels of stress, anxiety, depression, and poor physical relative to the general population (Ali et al. 2025d, 2026).

Unlike results of one study (Rashmi 2022), our undergraduate students were less happy and more depressed than postgraduate students. In line, the levels of mental wellbeing of domestic and international university students in Australia during the COVID-19 pandemic were higher among postgraduate students relative to their undergraduate counterparts (Dodd et al. 2021). Research also shows significant variations in happiness among undergraduates from different academic years, with higher levels among those close to graduation (Tien Nam et al. 2024). While postgraduate students have obtained their academic degree, unmet expectations and uncertainties surrounding degree completion/graduation and employment are reported threats of undergraduates' wellbeing (Khatri et al. 2024). Postgraduates are also generally older than

undergraduate students and may have their own families and paying jobs that support their living and education. These characteristics generally correlate with increased happiness (Boyadjieva and Ilieva-Trichkova 2022; Khatri et al. 2024; Moussa and Ali 2022). Therefore, this result coincides with a multi-dimensional model that emphasizes achieved individual characteristics (e.g., employment status and acquired level of education) as components of wellbeing that complement other components (e.g., happiness and life satisfaction) (Boyadjieva and Ilieva-Trichkova 2022). They also align with another broader framework that presents wellbeing as an integration of subjective, psychological, psychosocial, and socio-community aspects, with emphasis on economic determinants in situations of social inequality and poverty (Sarriera and Bedin 2017). Accordingly, variations in happiness as a single component of well-being between postgraduate and undergraduate students are embedded into varying socio-economic contexts (Boyadjieva and Ilieva-Trichkova 2022; Sarriera and Bedin 2017). The literature notes greater levels of happiness among older and married students relative to younger and single students (Abbasi et al. 2018). In contrast, university students in most Arab countries are largely dependent on their parents who may simultaneously support many other children, rendering families prone to financial strain (Ali et al. 2021a). Indeed, financial difficulties represent a major risk factor for depression and suicidality among students (Sheldon et al. 2021). Age-related differences in happiness and spirituality/religion have been observed, with older participants typically exhibiting higher levels of both (Delle Fave et al. 2016). Meanwhile, wellbeing is often linked to experiences in family life, work, and other community activities (El-Gazar et al. 2024; Ryff 2014), which seem to enrich the psychological wellbeing of postgraduate students. Indeed, an investigation of how lay people in 12 countries define happiness shows that social connectedness (family and social relations) is a major environmental component of happiness in addition to inner harmony. Inner harmony was the most prominent psychological component followed by satisfaction, positive emotions, positive states, optimism, meaning, absence of negative emotions, etc. In that study, married or cohabiting respondents largely noted social/family relations in their definition of happiness (Delle Fave et al. 2016). Thus, early recognition of altered wellbeing and its relevant health risks (e.g., depression, anxiety, suicidality, substance abuse) among undergraduates may be pivotal because of their limited social connections (Sheldon et al. 2021). Ill mental health alters students' educational productivity. Because resources devoted for treating mental disorders among students are limited, proactive and preventive programs designed to raise their wellbeing are adopted to yield more benefits among undergraduates (Seppälä et al. 2020).

Previous studies report higher happiness among females, particularly those from European countries (Lukoševičiūtė et al. 2022), or Asian countries that have been culturally influenced by European customs (e.g., Hong Kong) (Chen et al. 2020). In contrast, happiness did not vary across genders in our sample, albeit females tended to have lower happiness scores than males. This might be justified by the fact that our female participants had significantly higher somatic complaints

than males; they tended toward depression and lower satisfaction with life than males. In accordance, there were no gender differences in happiness among Kuwaiti university students while males had significantly higher scores of self-efficacy and mental health than females (Abdel-Khalek and Lester 2017). Likewise, happiness and self-esteem were clearly defined among Indian male students, but not among females (Furr 2005). Lower subjective wellbeing among females in these studies can be attributed to the fact that both India, Kuwait, and Saudi Arabia are located in Asia where gender inequality tends to increase, allowing fewer resources and opportunities for females than males (Chen et al. 2020). However, more happiness was noticed among Italian male adolescent, which was associated with greater levels of hope and optimism, unlike their female counterparts (Colombo et al. 2006). Likewise, Australian female university students displayed significantly lower levels of subjective wellbeing than males during the COVID-19 pandemic (Dodd et al. 2021)—the same time our data were collected. Therefore, the geographical location alone may not sufficiently explain gender differences, and the interplay of gender with other psychological traits should be considered.

Interestingly, reports on happiness among students from 15 Arab countries show considerable gender variations when it is associated with religiosity—males tended to have stronger religiosity-happiness in Saudi Arabia, Oman, Lebanon, Libya, Algeria, and Tunisia whereas the opposite was true for females from Qatar, Egypt, Iraq, Jordan, Palestine, Bahrain, and Morocco. Considerable variations in religiosity and happiness were found in students from two neighboring countries that exist in the Gulf region in Asia: Kuwait and Qatar (Abdel-Khalek 2019). Although Arabs are jointly related through their common language and Islamic religion, enormous and rapid changes have largely influenced the Arab cultural heritage (e.g., economic failures, occupation, and civil wars). For instance, non-religiosity increased from 8% to 13% over the period of 6 years in seven Arab countries (BBC 2019; Sabah et al., 2024a, 2024b; Tessler 2020). Many Arab countries have witnessed a remarkable shift from collectivistic (group norms/values) to individualistic (own personal values/interests) cultural orientations, with numerous associated changes in the psychological characteristics of individuals (Sabah et al., 2024a, 2024b). Arab countries express considerable variations in the associations between Islamic values and gender equality whereas Arab societies with women movements support female empowerment despite strong religious affiliations. Muslim feminists appear as a function of women employment, increased levels of communication, single social status, and distrust in legal institutions (Glas and Alexander 2020). Therefore, differences in happiness in relevance to religiosity among Arabs may be related to variations in factors that influence basic socialization. Because the relationship between religiosity and happiness is a compelling topic, future investigations of Fordyce Global Happiness Scale should involve Arabs from different countries and include deeper evaluations of Arabs' religious/cultural orientations to provide valuable information on the features of this measure across genders.

This study expands our understanding of the performance of Fordyce Global Happiness Scale among Arab university

students. This single-item measure was associated with greater life satisfaction and more positive affect while depression's key features of negative affect and somatic complaints were largely prevalent among less happy students that is, those with Fordyce Global Happiness Scale scores below 4.5. Thus, this ultra-brief scale may be used to quickly detect students' levels of happiness and reflect variables that are considered primary indicators of mental and physical wellbeing. This issue is very crucial since response rates, which are generally low among Arabs (Zeinoun et al. 2022), increase in surveys implementing ultra-short measures (Ali et al. 2022a). Meanwhile, resources allocated for the diagnosis and management of student mental health problems in Arab universities are limited because of the economic and political instabilities in most countries of the region (Maddah et al. 2021; Sabah et al., 2024a, 2024b). Accordingly, this short measure may help overcome the logistic challenges implicated in the detection of mental health problems among Arab students. Almost similar results were obtained in mothers of children with disabilities. Therefore, the scale may be used in different groups, and those scoring below the cutoff of 4.5 on this scale may benefit from further screening for psychopathogenicity (e.g., depressive disorders). Meanwhile, those scoring between 4.5 and 8 would benefit from health promotion activities that aim at maximizing mental wellbeing. However, further testing is warranted to ensure stability of the results in varying Arab contexts.

On the other hand, further gaps in the literature erupted as the study has many limitations, which should be considered while interpreting the findings. While failure to search for and achieve happiness in Western cultures comes among the greatest failures that one can experience (e.g., in the US individuals think of happiness at least once a day) (Joshanloo et al. 2014), Arabs put their happiness within a frame of Arab/spiritual values and own personal needs (Atari-Khan and Gerstein 2024; D'raven and Pasha-Zaidi 2015). Moreover, many Arabs express negative views of happiness and positive emotions that is, it is not uncommon that Arabs expect bad things to come after excessive laughter (Lambert et al. 2022). Therefore, future research may assess Fordyce Global Happiness Scale in relevance to key variables such as personal values, cultural orientations, fear of happiness, fragility of happiness, etc. Additionally, happiness was found to predict some aspects of cognitive functioning (e.g., speed and visuospatial memory performance) associated with depression risk over 10 years (Zhu et al. 2024) while longitudinal data show that affective experiences do not directly influence subjective wellbeing although they may operate through indirect lifetime pathways (Kwak 2024). Happiness is also more stable than life satisfaction, which is easily affected by shifts in the aspiration level (Ng 2022). In the meantime, research on the associations between happiness and life satisfaction shows that happiness promotes resilience, leading to life satisfaction not the opposite (Cohn et al. 2009). Therefore, an obvious limitation in this study is failure to use longitudinal data to confirm the cause-effect relations reported in the latent variable model that is, it is not possible to affirm the directions of those relations within the light of the present cross-sectional design. Relative to multi-item measures, it is not possible to test the construct validity or internal consistency of single-item scales because they do not tap the latent construct from different dimensions (Karim et al. 2015). While the absence of

negative affect does not equate to happiness, we did not measure happiness using another measure, the gold standard. Accordingly, future studies may yield better results should they overcome this shortcoming, especially when its concurrent validity is evaluated against multi-item happiness measures. Including a convenience sample by selecting readily available and easily accessible participants (largely females) from only one university or parent groups from a single Arab country introduces a risk of selection bias entailing systematic errors associated with the presence of specific traits or experiences that are not representative of the general student/mother Arab population. This may compromise the accuracy of the study's conclusions. This risk may be great because of online surveying as students/mothers who took part in the study were those who only had internet access and smartphones/PC. Thus, the findings are limited in their external validity that is, they may not be applicable to other student/mother populations from different contexts that is, other Arab universities and countries.

Gender seems to cordially influence youth perceptions of wellbeing (Abdel-Khalek 2019; Abdel-Khalek and Lester 2017; Chen et al. 2020; Colombo et al. 2006; Furr 2005; Lukoševičiūtė et al. 2022). This study comprised homogeneous samples in which females were a majority that is, the participants do not accurately reflect the experiences or characteristics of the broader population. Likewise, postgraduates were fairly represented relative to postgraduate students. Unequal number of participants in groups may influence the statistical power and Type I error rates in tests involving subgroups such as ANOVA and *t*-test, albeit we reported results for adjusted degrees of freedom (equal variance not assumed) to minimize bias. Because we wanted to increase participation in the study, we used a limited number of measures while many factors that are integral to students' wellbeing may be assessed in future inquiries, including academic performance, student employment, family functioning and family relationships, financial strains, lifestyle factors (e.g., sleeping hours, diet, exercise), academic burnout, quality of the educational service, cultural influence (e.g., orientation, religiosity), fear of happiness, etc.

5 | Conclusion

Fordyce Global Happiness Scale acted as a criterion variable that can be significantly predicted by the emotional and cognitive components of subjective wellbeing: satisfaction with life and positive affect—negative affect and somatic complaints were associated with lower levels of happiness, with no gender difference. One optimal cutoff (4.5) with 100% sensitivity and specificity of 74% and 62% resulted from ROC analysis involving two samples. Three scale cutoffs originated from clustering analysis, and they classified the participants into low/mildly, moderately, and highly happy, with significantly greater intensity of all depressive symptoms among participants who were low/mildly happy. Undergraduate students, especially females, exhibited lower levels of happiness and satisfaction with life and higher depression scores relative to postgraduate and male students, respectively. University policymakers may enhance students' mental wellbeing through proactive and preventive interventions that focus on raising students' perceptions of happiness in order to maximize their educational productivity and lower the occurrence of ill-mental health.

Author Contributions

Amira Mohammed Ali: conceptualization, methodology, writing – review and editing, supervision, project administration. **Saeed A. Al-Dossary:** conceptualization, methodology, writing – review and editing, data curation, funding acquisition. **Feten Fekih-Romdhane:** validation, formal analysis, writing – original draft preparation. **Maha Atout:** software, resources, writing – original draft preparation. **Abdulnaser Fakhrou:** software, resources, writing – original draft preparation. **Mohamed M. H. Suliman:** investigation, writing – original draft preparation. **Abdalla S. M. Gaballa:** investigation, writing – original draft preparation. **Ahmad M. A. Zayed:** investigation, formal analysis. **Souheil Hallit:** formal analysis, writing – original draft preparation. **Carlos Laranjeira:** visualization, validation, writing – original draft preparation, writing – review and editing.

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Ethics Statement

The Research Ethics Committee of Ha'il University approved the study protocol (No. 16784/5/42. November 5, 2020) and (11/9/2023: H-2023-367).

Consent

The authors have nothing to report.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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Supporting Information

Additional supporting information can be found online in the Supporting Information section.

Supporting Information S1: mpr70079-sup-0001-suppl-data.pdf.

Supporting Information S2: mpr70079-sup-0002-suppl-data.docx.

Supporting Information S3: mpr70079-sup-0003-suppl-data.docx.