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Research paper

Efficacy of internet-based cognitive behavioral and interpersonal treatment for depression in Arabic speaking countries: A randomized controlled trial

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ABSTRACT

Background: Politically and economically unstable contexts have been associated with increased prevalence rates of depression. Despite high demand, the availability of mental health experts and care systems is limited in Arabic-speaking countries. Internet-based interventions might provide an opportunity to treat patients independently of location. Therefore, we investigated the efficacy of internet-based cognitive behavioral treatment (iCBT) and interpersonal treatment (iIPT) for depression in Arabic-speaking countries.

Methods: In total, 743 Arabic-speaking adults with depression were randomly allocated to iCBT ($n = 243$), iIPT ($n = 247$), or waitlist ($n = 253$). Depressive, anxiety, and somatoform symptoms, perceived social support and quality of life (QoL) were assessed at pre-, and post-treatment and at three months follow-up. Multiple imputation was performed for missing data. Changes associated with treatment were analyzed using regression in the completer and intention-to-treat sample.

Results: Participants in both treatment groups showed lower depressive and anxiety symptom severity, higher QoL, and perceived social support compared to the waitlist group ($p < .001$). Somatoform symptom severity was significantly lower in participants receiving iIPT compared to waitlist ($p < .001$). Differences between the two treatments in all outcomes were non-significant ($p > .05$). Three-month follow-up treatment effects regarding depressive symptoms were indicated.

Limitations: The sample mainly consists of educated, single, female adults. Three-month follow-up results rely on a small subsample and must be interpreted with caution.

Conclusions: This is the first randomized controlled trial to demonstrate the efficacy of iCBT and iIPT for depression in Arabic-speaking countries. It provides first indications that internet-based interventions might help specific individuals in this region.

1. Introduction

Arabic-speaking countries are geographically located in Southwest Asia and North Africa and represent about 6 % of the world's population (World Bank, 2022). Over the last decades, many Arabic-speaking countries have been exposed to war and political conflicts (Ahram, 2020; Pettersson and Öberg, 2020) which have been found to increase the risk of mental disorders (Al-ghzawi et al., 2014). Particularly high prevalence rates of depression (12 %–41 %) are observed for individuals in and from Arabic-speaking countries (Abdul Razzak et al., 2019; Eshak and Abd-El Rahman, 2022) and the rates are expected to increase further (Santomauro et al., 2021). According to the Global Burden of Disease study depression is one of the top five causes of years lived with disability in almost all Arabic-speaking countries (Vos et al., 2015) with an increasing trend (Moradinazar et al., 2022). Despite the high demand mental health professionals in the region are scarce. Egypt, Morocco, and Algeria for example have fewer than 0.5 psychologists and social workers per 100,000 people (Okasha et al., 2012). Therefore, there is a

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need to enlarge and broaden psychological interventions. From studies mainly conducted in Western countries, it is well known that depression treatment using cognitive behavioral and interpersonal approaches is effective in reducing depressive symptoms (Cuijpers et al., 2013, 2016; Weitz et al., 2018) and clinical guidelines therefore recommend both of these treatment forms (American Psychological Association, 2019; National Collaborating Centre for Mental Health (UK)., 2010; Schneider et al., 2017). Reviews and meta-analyses indicate that cognitive behavioral therapy (CBT) and Interpersonal psychotherapy (IPT) are equally effective in reducing depressive symptoms (Cuijpers et al., 2016; Jakobsen et al., 2012; Zhou et al., 2017). A successful treatment of depression using CBT involves understanding and challenging distorted perceptions within the interplay of thoughts, emotions, and behavior. IPT includes components of CBT and further emphasizes the crucial role of interpersonal relationships and social interactions in depression, with a focus on enhancing social skills and fostering the improvement of relationships. IPT might be especially effective for Arabic-speaking individuals due to the significant and distinct impact of social community and relationships on people from this region (Alananzeh et al., 2021; Hammad and Tribe, 2021).

In recent years, internet-based interventions have become an effective alternative for the treatment of depression (Andersson et al., 2019; Carlbring et al., 2018; Twomey et al., 2020). There is evidence from Western, Educated, Industrialized, Rich, and Democratic (WEIRD) samples regarding the efficacy of iCBT for depression (Andersson et al., 2019; Carlbring et al., 2018; Twomey et al., 2020) and research has also suggested that iIPT effectively reduces depressive symptoms, with effects comparable to those for iCBT (Donker et al., 2013). In particular, the characteristics of independence in terms of geography and time, as well as visual anonymity, seem to be major advantages that can help overcome existing treatment barriers and address hard-to-reach populations. Research has shown that well-known internal (e.g., stigma, fear) and external barriers (e.g., lack of personnel and/or mental health infrastructure) to treatment-seeking behavior are also reported by persons in Arabic-speaking countries (Elyamani et al., 2021; Ibrahim et al., 2022; Mohamed Ibrahim et al., 2020). A meta-analysis has already reported high effects for the internet-based treatment of depression in Arabic-speakers living in high-income countries and the acceptance of IBIs has been reported for Arabic-speaking individuals (Kayrouz et al., 2018).

In sum, there is initial evidence that IBIs are accepted and effective in Arabic-speaking populations with depression, but due to the high prevalence rates of depressive disorders in Arabic-speaking countries and the existing gap between psychological treatment services and the need for treatment in Arabic-speaking countries (WHO, 2019), it is important to extend and broaden the range of available therapeutic approaches. However, no valid conclusions can currently be made about the efficacy of these approaches, as this population is underrepresented in existing internet-based treatment studies on depression (i.e. 6.3 % of the studies recruited participants from non-Western countries, Børtveit et al., 2022). In order to broaden the range of treatment approaches (e.g. to take into account the participants' preferences) and to respond to the steady rise in the number of individuals in need of treatment in Arabic-speaking countries, two different treatment approaches (i.e. iCBT and iIPT) will be tested for their efficacy in the following study. To the best of our knowledge, no randomized controlled trial has investigated the efficacy of iCBT and iIPT treatment in participants living in Arabic-speaking countries to date. In this study, we therefore investigate the efficacy of these two internet-based approaches in terms of reducing depressive symptoms in Arabic-speaking persons. We hypothesize that iCBT and iIPT will show equal efficacy in terms of reducing depressive symptoms, and that both will be superior to a waitlist condition.

2. Methods

The present study is part of a project offering psychological treatment for people in Arabic-speaking countries (named "Ilajnafsy", Arabic for psychotherapy). The study was administered by a psychosocial center for the rehabilitation and treatment of war and torture victims in Berlin, Germany (Center ÜBERLEBEN) in cooperation with the Freie Universität Berlin, Germany. The Freie Universität Berlin Ethics Committee approved the study (185/2018), and the study was registered at the German Clinical Trials Register (DRKS00016652). There was a deviation from the registration protocol, as only the PHQ-9 was used as the primary outcome measure in this study and the BDI-II was not used for this purpose.

2.1. Participants

Between February 2021 and January 2023 participants were recruited via the project's website (www.ilajnafsy.bzfo.de), social media and social networking sites. Participants were included in the study if they consented to the privacy and study policy and met the diagnostic criteria for depression according to the Structured Clinical Interview for DSM-5 Disorders (SCID-5-CV; First et al., 2016). Additional inclusion criteria were a minimum age of 18 years, ability to speak and write Arabic, and at least mild depressive symptoms (Beck Depression Inventory (BDI) score $>$ 13). We excluded participants reporting a high risk of suicide, severe depressive symptoms (BDI score $>$ 44), psychotic symptoms, substance abuse, simultaneous psychotherapeutic treatment, or no stable dose of psychopharmacological medication i.e. starting psychopharmacological treatment within three months prior to inclusion, changes within the last four weeks prior to inclusion, or planned changes in the next four weeks). We had no age restriction for this study, as internet-based treatment for depression has been shown to be effective and applicable for older people (Dworschak et al., 2022). Especially the fact that the material is presented in written form (i.e. can be read repeatedly and the font size can be changed) as well as the visual anonymity of the counsellor and the overcoming of mobility restrictions are particular advantages for older people when seeking psychotherapy.

2.2. Procedure

Participants were provided with information about the study on the Ilajnafsy website. Individuals were required to register on the website and then received a personalized email containing secure access details to their individual account on the password-protected web portal. To assess eligibility, we used a two-step diagnostic process consisting of screening questionnaires via an online survey (T0) and a standardized clinical interview using voice-over-IP. Participants who met the inclusion criteria for depression in the clinical interview were randomly assigned to either the iCBT, iIPT, or waitlist condition, using a block randomization based on computer-generated random sequences (Snow, 2020). Waitlist participants were instructed to wait for five weeks and then complete the online survey again, before they were randomly assigned to receive either iCBT or iIPT. For data protection, treatments were conducted exclusively through a secure digital platform. Participants were asked to fill out questionnaires to examine changes in clinical symptoms and well-being after completing treatment (T1) and three months after treatment (T2). Furthermore, there was also a weekly intermediate measure, which served as a quality assurance measure to monitor possible deterioration. A detailed participant flow is illustrated in Fig. 1.

2.3. Internet-based treatment

Depression treatment in the Ilajnafsy program was developed based on cognitive-behavioral therapeutic and interpersonal approaches. Primarily orientated to the original approach, the content was translated by Arabic-native speakers and provided in both female and male modern standard Arabic. In addition to the language, metaphors and examples were culturally adapted. Furthermore, as it is known that anonymity and

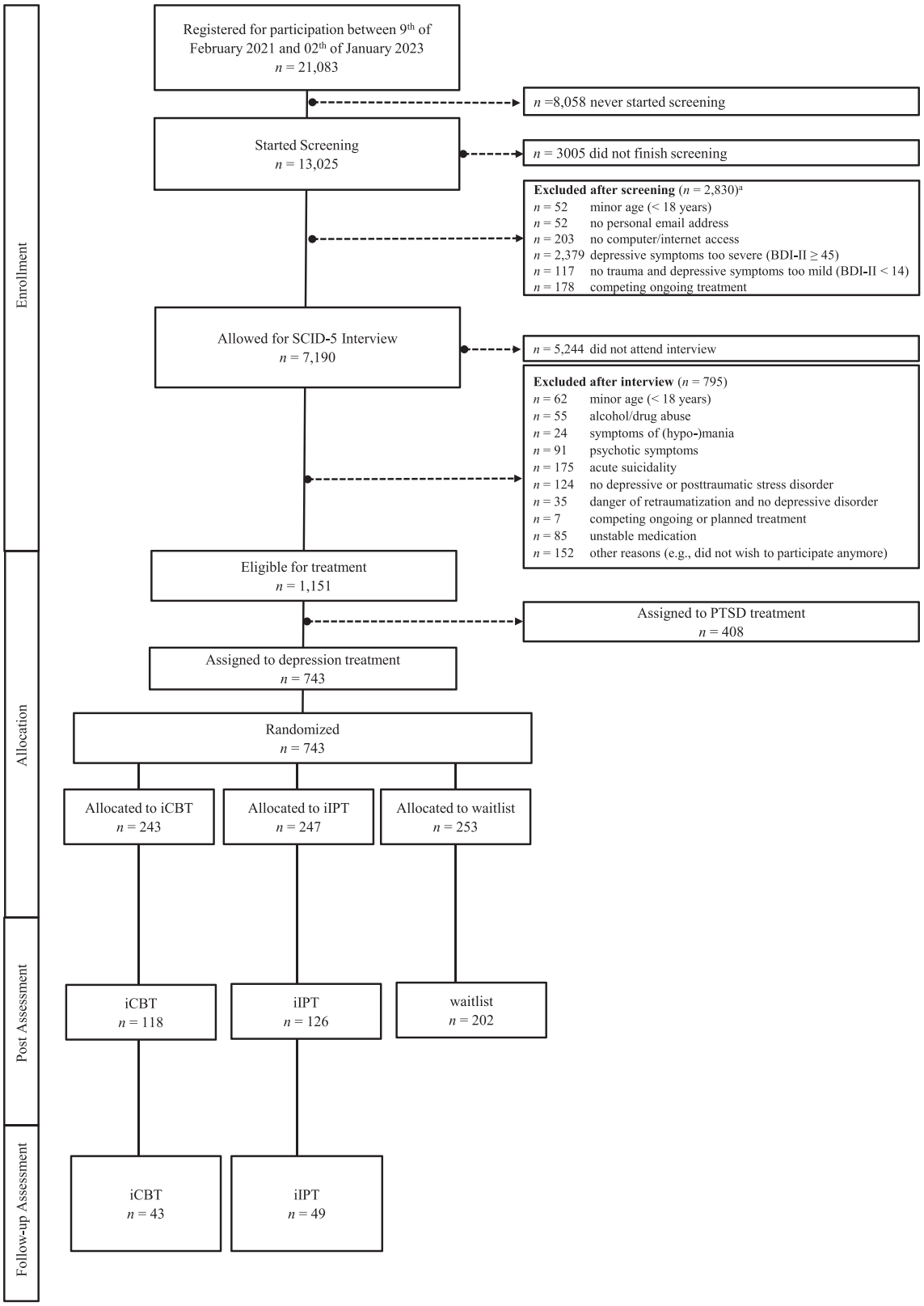

Fig. 1. Flowchart: [a]Some participants fulfill more than one exclusion criteria; [b]Includes cases that started the assessment without necessarily having completed all questionnaires; iCBT = Internet-based cognitive behavioral treatment; iIPT = Internet-based interpersonal treatment; BDI-II = Beck Depression Inventory II; SCID-5 = Structured Clinical Interview for DSM-5 Disorders; PTSD = Posttraumatic Stress Disorder.

security policies are important criteria for participants from Arabic-speaking countries (Abi Ramia et al., 2018; Burchert et al., 2019) these were emphasized. Formal conditions for both iCBT and iIPT consist of two 45-min weekly structured writing assignments over five weeks (eight tasks in total), with manualized assignments providing space for individual therapist feedback. Counselors respond to participants' written work within 48 h. The treatment begins with general information on the concept of the intervention and psychoeducation on depressive symptoms. Throughout screening and treatment, automated email reminders are sent after periods of inactivity, leading to exclusion after 14 consecutive inactive days (21 days including interviews). During the treatment phase, if participants had not responded to the email reminders, they were contacted by telephone (if they had consented to receive calls) and encouraged to continue participation. If participants did not respond within 14 days, they were considered as dropouts.

2.3.1. iCBT

The first phase (behavioral analysis) includes two writing tasks and focuses on depressive behavior by helping participants gain an understanding of the symptoms. The aim of the second phase (behavioral activation), which likewise includes two writing tasks, is to (re-)establish positive activities in participants' daily life. The third phase (cognitive restructuring) consists of three writing tasks and aims to replace unhelpful thoughts with new adaptive thoughts and to learn new skills (e.g., for setting limits). The final phase (relapse prevention) is implemented to minimize the risk of relapse by creating an emergency plan with one last writing task.

2.3.2. iIPT

The first phase (communication analysis), with two writing tasks, focuses on communication and includes an analysis of the participant's communication skills. The aim of the second phase (clarification of and coping with interpersonal conflicts), with three writing tasks, is to gain an understanding of individual interpersonal role disputes. The third phase (working on withdrawal behavior and isolation) likewise consists of three writing tasks and seeks to help participants gain an understanding of isolation and its consequences, and to learn coping strategies. Again, the final phase (relapse prevention) is used to prevent relapse.

2.4. Counselors

The treatment was conducted by 11 native Arabic speakers residing in Egypt and Germany. All counselors held a diploma in psychology or psychology-related fields. Counselors received a four-day training program for iCBT and/or iIPT, covering information about depression, (specific) treatment approaches, general and technical aspects of internet-based treatment, handling challenging situations, and providing Ilajnafsy. Before working with their own patients, counselors underwent a two-phase mentoring process: First, they received training in which they analyzed two sets of previous patients writing assignments with the support of an experienced mentor. Second, they received writing assignments from two newly registered patients. After counselors had written their responses to these assignments, the responses were thoroughly reviewed by a mentor, who provided feedback, before the responses were sent to the patients. For both phases, this process was accompanied from the first to the last writing assignment. Only when all writing assignments were successfully completed did the counselors receive their own patients. Furthermore, counselors participated in regular monthly supervision meetings. In terms of treatments offered, 3 offered iCBT only and 8 offered both therapies. Further training in the respective treatment approach was not linked to personal preferences. Counselors were not randomized but were allocated on the basis of their current time capacity for the respective type of treatment.

2.5. Assessment

Participants were informed about the contents and goals of the study. After providing written consent, they were able to begin the screening process. In addition to sociodemographic variables (e.g., gender, age, marital status, education, country of origin, country of residence), participants completed different questionnaires on the password-protected platform. Questionnaires that were not available in standard Arabic were translated by independent native Arabic speakers using the backward-forward translation procedure. The interview was conducted in Arabic by trained native Arabic speakers.

2.6. Primary outcome measures

2.6.1. Depressive symptoms

An Arabic version of the Patient Health Questionnaire-9, (PHQ-9; Kroenke and Spitzer, 2002) was used to assess depressive symptoms. This self-report measure consists of nine items rated on a four-point scale (0–3) with higher values indicating greater symptom severity. Sum scores were calculated. The PHQ-9 has been shown to be reliable in Arabic-speaking populations (AlHadi et al., 2017; Sawaya et al., 2016). Internal consistency in the present sample was α=0.78.

2.7. Secondary outcome measures

2.7.1. Anxiety

To assess anxiety symptoms, we used an Arabic version of the Generalized Anxiety Disorder-7 scale, (GAD-7, Spitzer et al., 2006). The GAD-7 consists of seven items rated on a four-point scale ranging from never (0) to almost every day (3). Higher sum scores indicate more severe levels of anxiety. Acceptable psychometric properties in Arabic-speaking populations have been reported (Sawaya et al., 2016). In the present sample, internal consistency was α=0.83.

2.7.2. Quality of life (QoL)

The EUROHIS-QoL-8 (Schmidt et al., 2006) assesses psychological, physical, social, and environmental aspects of QoL, using eight items rated on a five-point Likert scale (1–5). Higher sum scores indicate better QoL. The scale was translated into Arabic for the purpose of the present study. While there is not yet a validated Arabic version of the EUROHIS-QoL-8, international studies have found that the scale performs well cross-culturally(Rocha et al., 2012; S. Schmidt et al., 2006). Internal consistency in the present study was α=0.75.

2.7.3. Somatoform symptoms

To evaluate somatoform symptoms, we used a translated version of the Patient Health Questionnaire-15(PHQ-15; Kroenke and Spitzer, 2002). The scale consists of 15 items rated on a three-point scale (0–2), with higher sum scores indicating greater symptom severity. The instrument has shown strong psychometric properties in Arabic-speaking populations (AlHadi et al., 2017; Schlechter et al., 2021). In the current sample, internal consistency was α=0.78.

2.7.4. Social support

A validated Arabic version of the Multidimensional Scale of Perceived Social Support (MSPSS; Zimet et al., 1988) was used to measure social support. The scale consists of 12 items assessing social support from friends, family, and significant others, rated on a seven-point Likert scale (1–7), with higher scores indicating higher perceived social support. The mean score for each subscale was calculated in the present study. The scale has shown good psychometric properties in Arabic-speaking populations (Fekih-Romdhane et al., 2022; Merhi and Kazarian, 2012). Internal consistency in our sample was α=0.90.

2.8. Treatment experiences

To assess treatment experiences all participants (completers and dropouts) were asked to rate items developed for the purpose of the present study using a five-point scale. Specifically, they were asked to rate satisfaction ("totally satisfied" to "unsatisfied"), helpfulness ("very helpful" to "not helpful"), likelihood of recommending the treatment ("definitely" to "definitely not"), and their perception of the treatment duration ("too short" to "too long"). Additionally, participants indicated the average time spent on treatment per week (less than one hour, one to two hours, two to four hours, or more than four hours).

2.9. Statistical analyses

R version 2023.03.0 + 386 was employed for the analyses. Post-assessment data revealed a 40 % missing rate after randomization. Little's test (Little, 1988), indicated that the missing data were missing completely at random ($\chi 2(328) = 348.39, p = .210$). To address this, 100 imputed datasets with 500 iterations were generated using the R package "MICE" (van Buuren and Groothuis-Oudshoorn, 2011) through predictive mean matching, considering all outcome variables on sum scores. As correlation analyses found no auxiliary variables ($r < 0.30$) none were used in imputation models. Imputation was conducted separately for each condition. Convergence diagnostics included the potential scale reduction factor and graphical diagnostics. Pooled estimates across all imputed datasets were reported for the intention-to-treat (ITT) sample.

The various group difference tests were investigated using Welch tests, Chi-square tests, or *t*-tests. Sociodemographic and clinical characteristics were compared between non-starters (individuals who did not begin the treatment) and starters (those who completed at least one writing assignment), and between dropouts (participants who began treatment but did not complete all eight writing assignments) and completers (participants who completed all eight writing assignments). Additionally, we analyzed differences in the proportion of completers between the treatments. Treatment experience was compared between the two treatment conditions and between completers and dropouts. In traditional comparative studies, the burden of proof is on demonstrating differences in efficacy, and if the evidence is not strong enough to support this, equality between the entities being compared cannot be rejected (Walker and Nowacki, 2011). Therefore, to assess whether the two treatments were similarly effective regarding the primary outcome, an equivalence test was conducted. Equivalence is demonstrated by proving that the true difference between two treatments is sufficiently small to prevent the classification of one as superior or inferior to the other. Therefore, an equivalent margin, which describes a specific range of values that can be considered equivalent, must be defined(Walker and Nowacki, 2011). The original validation study of the PHQ-9 established intervals of five steps for varying depression severity (Titov et al., 2011). Thus, the lower bound (ΔL) was set at −5 and the upper bound (ΔU) at +5 (Titov et al., 2011). Equivalence testing was performed using the "TOSTER" R-package which is based on the *t*-test (Lakens and Lakens, 2018) for ITT and completers as recommended by Walker and Nowacki (2011).

In a second step, regression analyses were conducted to investigate the efficacy of the treatments compared to waitlist. Primary and secondary post-assessment outcomes were defined as dependent variables, while pre-assessment outcomes were independent variables. Additionally, dummy variables for group, with waitlist as the reference group, were included as independent variables. Adjusted determination coefficient *f* effect sizes were calculated with 0.10, 0.25 and 0.40 indicating small, medium, or large effects respectively (Cohen, 1988; Cohen, 1992). Moreover, regression analyses were repeated to investigate differences in secondary outcomes between the two treatment conditions with the exclusion of waitlist. Normal distribution was examined using the Kolmogorov-Smirnov test, homoscedasticity of the residuals was assessed using the Breusch-Pagan test, and independence of residuals was tested using the Durbin-Watson test. Long-term treatment effects were investigated using paired t-test analysis. Measurement time (pre-treatment and three-months follow-up) was used as the independent variable and PHQ-9 as dependent variable. Cohen's *d* was used to describe effect sizes, with 0.20, 0.50, and 0.80 indicating small, medium, and large effects, respectively (Cohen, 1988). Mauchly's test was used to test the assumption of sphericity. All hypotheses were tested using both, the ITT and the completer sample. Due to multiple comparisons, a Bonferroni-Holm correction was applied to the seven treatment outcome measures, requiring an adjusted *p*-value $< .007$ for significance. Clinical significance was assessed in three ways: First, reliable change (depression improvement) was defined as a decrease of least five points in the PHQ-9 (Titov et al., 2011), with an increase or decrease of five points or more indicating reliable deterioration or improvement. Participants with a difference of less than five points from pre- to post-assessment were considered as showing no change. Second, an index of remission was established by calculating the proportion of participants who scored ≥10 on the PHQ-9 at pre-assessment and subsequently scored below this cutoff at post-assessment. Third, reliable and clinically significant improvement (RCSI) was determined by the proportion of participants showing reliable improvement and remission. Pooled chi-square tests across imputed data sets were used to examine the relation between all three groups and the rates of participants with reliable change, remission, and RCSI (Enders, 2010).

3. Results

3.1. Participants

A total of 743 participants were enrolled in the study, with 247 participants assigned to the iIPT, 243 to the iCBT, and 253 to the waitlist group. The majority of participants were female (69.5 %), young (M = 25.8; SD = 7.95), single (63.1 %), highly educated (88.9 %), and living in a town or city (90.1 %). The largest proportion originated from Egypt (36.2 %), followed by Saudi Arabia (18.7 %), Jordan (9 %), Syria (8.2 %), Iraq (4.2 %), Morocco (3.9 %), and Algeria. (3.5 %). In terms of current residence, the largest proportion were living in Egypt (38.2 %), followed by Saudi Arabia (14.4 %), Jordan (9.2 %), Germany (4.7 %), Morocco (4 %), Iraq, Turkey, and Algeria (3.5 %). Only a small number of participants (5.8 %) indicated that they were taking medication such as Fluoxetine, Dormival or Paroxetine. For details, please see Table 1.

3.2. Treatment use and attrition

Overall, 89.88 % of the iIPT participants and 89.72 % of the iCBT participants began the treatment. There were no significant differences between starters and non-starters with regard to sociodemographic and clinical characteristics (see Supplement 1 for more details).

3.3. Completers vs Dropouts

In total, 47.14 % of participants dropped out, with 60.32 % of participants randomized to iIPT and 62.14 % randomized to iCBT dropping out during the treatment. The dropout rate did not differ significantly between the treatment groups; $\chi 2(\mathrm{df} = 1) = 0.35, p = .556$. The reasons for dropout are unknown for 91.12 % of participants. Reported reasons for discontinuation in this study were the treatment was not suitable (2.8 %), time problems (1.75 %), motivational problems (1.48 %), other treatment started (0.81 %), significant symptom reduction (0.54 %), technical problems (0.27 %) and other problems (e.g. death in the family; 0.94 %). The comparison between completers and dropouts revealed no meaningful differences in terms of sociodemographic and clinical characteristics (Table 2).

Table 1
Sociodemographic, and clinical characteristics of total sample and subsamples in each condition.

		Total (N = 743)	iIPT (N = 247)	iCBT (N = 243)	WG (N = 253)
Sociodemographic characteristics					
Age	M (SD)	25.8 (7.95)	26.22 (9.38)	25.57 (6.93)	25.64 (7.37)
Male sex	n (%)	231 (30.5 %)	69 (27.8 %)	81 (32.5 %)	81 (31 %)
Marital status					
Single	n (%)	478 (63.1 %)	159 (64.1 %)	155 (62.2 %)	164 (62.8 %)
Married/in arelationship	n (%)	251 (33.1 %)	80 (32.3 %)	84 (33.7 %)	87 (33.3 %)
Divorced	n (%)	29 (3.8 %)	9 (3.6 %)	10 (4 %)	10 (3.8 %)
Education					
High education[a]	n (%)	699 (94.1 %)	235 (95.1 %)	226 (93 %)	238 (94.1 %)
Low education[b]	n (%)	44 (5.9 %)	12 (4.9 %)	17 (7 %)	15 (5.9 %)
Kind of residence					
Town[c]	n (%)	670 (90.2 %)	216 (87.4 %)	226 (93 %)	228 (90.1 %)
Village[d]	n (%)	73 (9.8 %)	31 (12.6 %)	17 (7 %)	25 (9.9 %)
Perceived social support (MSPSS)					
Family social support	M (SD)	3.32 (1.65)	3.39 (1.64)	3.23 (1.63)	3.35 (1.67)
Friends social support	M (SD)	3.26 (1.78)	3.42 (1.83)	2.98 (1.74)	3.39 (1.73)
Significant other social support	M (SD)	3.79 (1.88)	3.7 (1.85)	3.87 (1.92)	3.8 (1.88)
Clinical characteristics					
Depressive symptom severity (PHQ-9)	M (SD)	17.03 (5.15)	17.15 (4.99)	16.81 (5.25)	17.13 (5.22)
Anxiety symptom severity (GAD-7)	M (SD)	14.05 (4.76)	14.63 (4.68)	13.15 (4.82)	14.36 (4.68)
Somatoform symptom severity (PHQ-15)	M (SD)	13.83 (5.13)	14.12 (4.99)	13.53 (5.38)	13.84 (5.03)
Quality of life (EUROHIS-QOL-8)	M (SD)	13.32 (4.99)	12.85 (5.06)	13.41 (4.83)	13.68 (5.06)

Notes: iIPT = internet-based interpersonal treatment; iCBT = internet-based cognitive behavioral treatment; WG = waiting control list; M = Mean; SD = Standard Deviation. MSPSS = Multidimensional scale of perceived social support; PHQ-9 = Patient Health Questionnaire-9; GAD-7 = Generalized Anxiety Disorder Scale-7; PHQ-15 = Patient Health Questionnaire-15; EUROHIS-QOL = EUROHIS Quality of Life 8-item index.
[a] high school or university/college diploma.
[b] no or intermediate school diploma.
[c] metropolitan city, small town, suburb.
[d] village or single farmstead.

3.4. Testing equivalence between iIPT and iCBT

To examine whether treatment showed similar efficacy regarding depressive symptom severity in participants randomized to the iIPT and iCBT conditions, we conducted an equivalence test using the depression change scores from pre- to post-assessment as outcome. Given $\Delta L = 5$, $\Delta U = 5$ and an alpha of 0.05, the equivalence test of the intention-to-treat sample indicates that the outcome was statistically equivalent, $t(486.07) = -23.779$, $p < .001$. The two interventions did not differ significantly in terms of change scores in depressive symptoms assessed by the PHQ-9. The completer analysis supports these results, $t(232.65) = -17.18$, $p < .001$.

3.5. Regression: Treatment effect pre- to post-assessment compared to waitlist

Homoscedasticity and independence of the residuals can be assumed for all outcomes and multicollinearity can be excluded (Supplement 2). Compared to waitlist, iCBT participants (b = −3.69, p < .001) as well as iIPT participants (b = −5.34, p < .001) showed significantly lower depressive symptom severity at post-treatment. Significant symptom reductions were also identified for anxiety in both treatment groups compared to the WG. With regard to somatization symptoms, the participants of iIPT reported significantly fewer symptoms compared to WG. In addition, higher QoL and perceived social support from different sources were reported in both groups compared to the WG (see Table 3). The completer analysis revealed significant results for all outcomes (Supplement 3). The established models showed large effects (f ranged between 0.50 and 0.89 for ITT and between 0.65 and 0.89 for completer analysis).There was also a significant reduction in anxiety symptoms in both treatment groups compared to the WG. With regard to symptoms of somatization, iIPT participants reported significantly fewer symptoms compared to WG. In addition, a higher quality of life and perceived social support from various sources were reported in both groups compared to the WG.

3.6. Regression: Comparison of iCBT and iIPT

The regression analysis revealed no significant differences between the two treatment conditions for any of the secondary outcomes (n = 490; p ranged between 0.022 and 0.897). Please see Table 4 for the ITT results and Supplement 4 for the completer results.

3.7. Follow-up results

At the three-months follow-up, 92 of the 490 participants randomized to treatment (18.8 %) completed the questions on depressive symptoms. There were no meaningful differences between participants lost to follow-up and follow-up completers regarding sociodemographic and clinical characteristics (Supplement 5). The paired t-test analysis of depressive symptoms before treatment (M = 17.12, SD = 5.00) and three months after treatment (M = 9.85, SD = 6.58) revealed significant differences (ITT: $t(127) = 7.23$;$p < .001$, $d = 0.96$; completers: $t(91) = 10.74$; $p < .001$, $d = 1.12$).

Treatment satisfaction.

In total, 252 participants (iCBT: completers (92), dropouts (31); iIPT: completers (96), dropouts (33)) provided information about treatment satisfaction. Of these, 83.7 % (n = 103) of the iCBT group and 76 % (n = 98) of the iIPT group stated being at least satisfied with the treatment (χ^2=3.25(4), p = .516). Additionally, 91.9 % (n = 113) of the iCBT group and 83.7 % (n = 108) of the iIPT group experienced the treatment as at least "rather helpful" (χ^2=5.13 (4), p = .274). Furthermore, 91.9 % (n = 113) of the iCBT group and 91.5 % (n = 113) of the iIPT group would recommend the intervention to someone else (χ^2=4.72 (4), p = .317), and 62.6 % (n = 77) of the iCBT group and 64.3 % (n = 83) of the iIPT group experienced the treatment duration as sufficient (χ^2=2.23 (2),p =

Table 2
Characteristics of and comparison between participants who completed less than eight letters (dropouts) compared to participants who wrote all eight letters (completers).

		iIPT		iCBT			
		Dropouts (n = 149)	Completers (n = 98)	Dropouts (n = 151)	Completers (n = 92)	Chi-square/t-test[1]	p
Sociodemographic characteristics							
Age	M (SD)	25.68 (7.2)	27 (11.99)	24.67 (6.68)	26.9 (7.27)	2.33	0.02
Male sex	n (%)	101 (67.8 %)	78 (79.6 %)	102 (67.5 %)	61 (66.3 %)	1.26	0.26
Marital status						2.52	0.28
Single	n (%)	89 (59.7 %)	69 (70.4 %)	97 (64.2 %)	56 (60.9 %)		
Married/in a relationship	n (%)	53 (35.6 %)	27 (27.6 %)	47 (31.1 %)	33 (35.9 %)		
Divorced	n (%)	7 (4.7 %)	2 (2 %)	7 (4.6 %)	3 (3.3 %)		
Education						0.05	0.83
High education[a]	n (%)	66 (91.7 %)	48 (88.9 %)	78 (85.7 %)	35 (89.7 %)		
Low education[b]	n (%)	6 (8.3 %)	6 (11.1 %)	13 (14.3 %)	4 (10.3 %)		
Kind of residence						1.11	0.29
Town[c]	n (%)	131 (87.9 %)	85 (86.7 %)	143 (94.7 %)	83 (90.2 %)		
Village[d]	n (%)	18 (12.1 %)	13 (13.3 %)	8 (5.3 %)	9 (9.8 %)		
Perceived social support (MSPSS)							
Family social support	M (SD)	3.32 (1.64)	3.5 (1.65)	3.21 (1.55)	3.2 (1.74)	0.63	0.53
Friends social support	M (SD)	3.44 (1.88)	3.36 (1.76)	3.09 (1.72)	2.69 (1.69)	−1.36	0.75
Significant other social support	M (SD)	3.65 (1.93)	3.78 (1.74)	3.93 (1.85)	3.68 (2.02)	−0.32	0.75
Clinical characteristics							
Depressive symptom severity (PHQ-9)	M (SD)	17.4 (5.14)	16.89 (4.61)	17.1 (4.79)	16.96 (5.55)	−0.70	0.48
Anxiety symptom severity (GAD-7)	M (SD)	14.76 (4.9)	14.53 (4.28)	12.87 (4.46)	14.02 (5.2)	1.08	0.28
Somatoform symptom severity (PHQ-15)	M (SD)	13.46 (5.05)	15.23 (4.62)	13.81 (5.51)	13.36 (5.11)	1.44	0.15
Quality of life (EUROHIS-QOL-8)	M (SD)	12.73 (4.81)	12.93 (5.35)	13.44 (4.55)	12.78 (4.8)	−0.51	0.61

Notes: iIPT = internet-based interpersonal treatment; iCBT = internet-based cognitive behavioral treatment. MSPSS = Multidimensional scale of perceived social support; PHQ-9 = Patient Health Questionnaire-9; GAD-7 = Generalized Anxiety Disorder Scale-7; PHQ-15 = Patient Health Questionnaire-15; EUROHIS-QOL = EUROHIS Quality of Life 8-item index.

[1] Group comparisons were conducted for categorical variables with a Chi-square test (degrees of freedom (df) = 1; except for marital status df = 2) and for metric variables with a two-sample t-test (df = 488); M = Mean; SD = Standard Deviation.

[a] high school or university/college diploma.

[b] no or intermediate school diploma.

[c] metropolitan city, small town, suburb.

[d] village or single farmstead.

.321). While there were no significant differences between the two treatment conditions, meaningful differences were indicated between completers and dropouts within each treatment condition. Specifically, fewer persons who dropped out were satisfied (iCBT: 54.9 % (n = 17); $\chi^2(4) = 34.87$; $p < .001$; iIPT: 36.3 % (n = 12); $\chi^2(4) = 37.95$; $p < .001$), experienced the treatment as helpful (iCBT: 58 % (n = 21); χ^2 (4) = 43.39; $p < .001$; iIPT: 51.5 % (n = 17); $\chi^2(4) = 38.21$; $p < .001$), or would recommend the intervention to someone else (iCBT: 80.6 % (n = 25); $\chi^2(4) = 30.29$; $p < .001$; iIPT: 72.7 % (n = 24); $\chi^2(4) = 32.55$; $p < .001$).

3.8. Reliable change, remission, reliable and clinically significant improvement (RCSI)

Rates of reliable change differed significantly between the iIPT and the waitlist group (ITT: $F(2, 844.77) = 10.498$, $p < .001$, completers: $\chi^2 = 36.95$ (2), $p < .001$) as well as between the iCBT group and the waitlist group (ITT: $F(2, 912.76) = 14.052$, $p < .001$, completers: $\chi^2 = 33.49$ (2), $p < .001$), showing significantly more improvements and less deterioration in both treatment groups compared to waitlist (ITT: Table 5; completers: Supplement 6). Rates of remission likewise differed significantly between iIPT and waitlist (ITT: $F(1,752.4) = 29.316$, $p < .001$, completers: $\chi^2 = 55.81$ (1), $p < .001$) and between iCBT and waitlist (ITT: $F(1, 671.24) = 28.566$, $p < .001$, completers: $\chi^2 = 37.43$ (1), $p < .001$), with significantly higher remission rates for both treatments compared to waitlist. With regard to rates of RCSI, significant differences emerged between iIPT and waitlist (ITT: $F(1,752.4) = 29.316$, $p < .001$, completers: $\chi^2 = 58.06$ (1), $p < .001$) and between iCBT and waitlist (ITT: $F(1,693.31) = 33.601$, $p < .001$, completers: $\chi^2 = 44.20$ (1), $p < .001$), indicating higher rates of reliable and clinically significant improvement for both treatment conditions compared to waitlist. No significant differences were identified between the two treatments regarding rates of reliable change (ITT: $F(2, 595.81) = 0.54$, $p = .584$, completers: $\chi^2 = 0.20$ (2), $p = .906$), remission (ITT: $F(1, 1151.51) = 0.48$, $p = .490$, completers: $\chi^2 = 1.43$(1), $p = .232$) or RCSI (ITT: $F(1, 1141.34) = 0.58$, $p = .448$, completers: $\chi^2 = 0.70$ (1), $p = .403$).

4. Discussion

Our primary aim was to examine the efficacy of iCBT and iIPT in reducing depressive symptoms in Arabic-speaking participants living in Arabic-speaking countries, who mainly originated from Egypt, Algeria, Iraq, Morocco, Saudi Arabia, and Syria. Participants who were randomized to receive iCBT and iIPT reported a significant decrease in depressive symptoms as well as secondary outcomes such as anxiety symptoms compared to waitlist controls. An equivalence test indicated that iCBT and iIPT are comparably effective in reducing depressive symptoms, and we found no significant differences between the two treatment conditions for any of the outcomes. Moreover, at post-assessment, participants who received iIPT reported lower somatization symptoms, higher perceived social support from family, and higher QoL compared to waitlist, and those receiving iCBT reported higher perceived social support from friends. Follow-up results revealed significantly lower depressive symptoms from pre-treatment to three months after treatment in both treatment groups.

Among the participants in the present study, 10.2 % did not begin the treatment, which is lower than the rate of non-starters reported in a previous review examining the rate of non-starters in treatments for

Table 3
Multiple Regression Analysis for primary and secondary post-outcomes regressed on groups and controlled for baseline outcomes.

	B	SE (B)	P	Adj. R^2
Depression T1				0.20
Depressive symptom severity (PHQ-9) T0	0.41	0.05	**< 0.001**	
Cognitive behavioral treatment[a]	−3.69	0.79	**< 0.001**	
Interpersonal treatment[b]	−5.34	0.81	**< 0.001**	
Anxiety T1				0.22
Anxiety symptom severity (GAD-7) T0	0.38	0.05	**< 0.001**	
Cognitive behavioral treatment[a]	−3.40	0.74	**< 0.001**	
Interpersonal treatment[b]	−5.01	0.74	**< 0.001**	
Somatization T1				0.28
Somatoform symptom severity (PHQ-15) T0	0.55	0.05	**< 0.001**	
Cognitive behavioral treatment[a]	−1.80	0.70	0.011	
Interpersonal treatment[b]	−2.82	0.62	**< 0.001**	
Quality of Life T1				
Quality of life (EUROHIS-QOL-8) T0	0.57	0.05	**< 0.001**	0.27
Cognitive behavioral treatment[a]	1.92	0.68	0.005	
Interpersonal treatment[b]	3.90	0.70	**< 0.001**	
Social support from family T1				0.44
Perceived social support from family (MSPSS)T0	0.68	0.04	**< 0.001**	
Cognitive behavioral treatment[a]	0.40	0.19	0.031	
Interpersonal treatment[b]	0.60	0.20	**< 0.001**	
Social support from friends T1				0.41
Perceived social support from friends (MSPSS)T0	0.65	0.04	**< 0.001**	
Cognitive behavioral treatment[a]	0.79	0.21	**< 0.001**	
Interpersonal treatment[b]	0.36	0.23	0.121	
Social support from significant other T1				0.34
Perceived social support from significant other (MSPSS) T0	0.59	0.04	**< 0.001**	
Cognitive behavioral treatment[a]	0.48	0.20	0.019	
Interpersonal treatment[b]	0.44	0.27	0.106	

Notes: T1 = Post assessment; T0 = Baseline.
PHQ-9 = Patient Health Questionnaire-9; GAD-7 = Generalized Anxiety Disorder Scale-7; PHQ-15 = Patient Health Questionnaire-15; EUROHIS-QOL = EUROHIS Quality of Life 8-item index; MSPSS = Multidimensional scale of perceived social support; B = unstandardized regression coefficient; SE = standard error; Adj. R^2 = adjusted R square; significant *p*-values are marked in bold.
[a] Cognitive behavioral treatment group coded with 1 and waiting group with 0.
[b] Interpersonal treatment group coded with 1 and waiting group with 0.

depression in WEIRD samples (27 %, Etzelmueller et al., 2020). One reason for this might be that the intervention examined in the present study is sometimes the only therapeutic offer for people in Arabic-speaking countries, while those in Western countries may have various different options. With regard to sociodemographic and clinical characteristics, we did not find any significant differences between starters and non-starters or between completers and dropouts. Nevertheless, a high dropout rate was found for both treatment groups (iCBT: 60.32 %; iIPT: 62.14 %). It was challenging to determine the reasons for this high level of dropout, as most participants (91.12 %) did not respond to our contact requests after dropping out. Among those who did respond, some mentioned (2.8 %) that the internet-based treatment does not fit for them personally (e.g. because of difficulties with writing) others mentioned motivational problems (1.48 %) as a key reason, which is in line with previous research (Ciharova et al., 2023). Some participants reported that they had no time for the treatment because of daily tasks (1.75 %) or other problems/issues (0.94 %) like death in family or exams. Some reported technical problems (0.27 %), which have also been noted in previous research as a major cause of dropout, especially in Arabic-speaking countries (Karyotaki et al., 2015; Knaevelsrud et al., 2015; Schmidt et al., 2019). A further reason might be a lack of privacy, especially during the COVID-19 pandemic. Additionally, the definition of dropouts and completers varies across studies, and in this study, we defined completers as participants who had completed all eight writing assignments. Meta-analyses suggest that more stringent definitions of dropout generally result in higher dropout rates (Linardon et al., 2019). Comorbid anxiety symptoms, which were identified in our participants, have previously been associated with dropout in unguided IBIs (meta-analysis: Karyotaki et al., 2015). Moreover, we did not account for sudden gains or losses, which could also contribute to dropouts due to changes in psychopathology (Lawler et al., 2021). One further reason may lie in an insufficient cultural adaptation of the intervention to adequately address the needs of this population. We decided to mainly follow existing treatment approaches for the intervention, focusing mainly on language adaptation, and did not adapt all elements suggested by Heim and Kohrt (2019). However, further research is needed to better understand the reasons for discontinuation of Internet interventions.

The present findings illustrate that iCBT and iIPT are comparably effective in reducing depressive symptoms in individuals living in Arabic-speaking countries. Statistical and clinical significance was found, with about two thirds of participants showing improvement after treatment and approximately half achieving remission in both groups. These results are in line with previous research conducted online and in face-to-face contexts in different samples (Cuijpers et al.,2016; Donker et al.,2013; Zhou et al.,2017) as well as in Arabic-speaking samples living in Western countries (Kayrouz et al., 2016; Lindegaard et al., 2021).

Additionally, our findings correspond to the literature reporting a significant decrease in anxiety symptoms from pre- to post-treatment for both treatment types. Depression and anxiety are often comorbid disorders, and a meta-analysis showed that interventions for depression also have an impact on anxiety symptoms (Weitz et al., 2018).

No meaningful differences were identified between the two active treatment groups regarding primary and secondary outcomes, which is in line with previous research reporting no meaningful differences between CBT and IPT in the context of face-to-face interventions, but also internet-based interventions (Donker et al., 2013; Lemmens et al., 2020). Our results further confirm these findings for participants from Arabic-speaking countries.

In the present study, we further investigated follow-up effects and found an initial indication that both treatments might also be effective

Table 4
Multiple Regression Analysis for primary and secondary post-outcomes regressed on groups and controlled for baseline outcomes.

	B	SE (B)	P	Adj. R^2
Depression T1				0.07
Depressive symptom severity (PHQ-9) T0	0.32	0.07	**< 0.001**	
Cognitive behavioral treatment[a]	1.66	0.98	0.093	
Anxiety T1				0.07
Anxiety symptom severity (GAD-7) T0	0.28	0.07	**< 0.001**	
Cognitive behavioral treatment[a]	1.75	0.95	0.068	
Somatization T1				0.21
Somatoform symptom severity (PHQ-15) T0	0.51	0.07	**< 0.001**	
Cognitive behavioral treatment[a]	1.04	0.82	0.207	
Quality of Life T1				0.40
Quality of life (EUROHIS-QOL-8) T0	0.58	0.07	**< 0.001**	
Cognitive behavioral treatment[a]	−1.98	0.85	0.022	
Social support from family T1				0.40
Perceived social support from family (MSPSS)T0	0.68	0.05	**< 0.001**	
Cognitive behavioral treatment[a]	−0.20	0.25	0.432	
Social support from friends T1				0.37
Perceived social support from friends (MSPSS)T0	0.64	0.06	**< 0.001**	
Cognitive behavioral treatment[a]	0.43	0.28	0.137	
Social support from significant other T1				0.30
Perceived social support from significant other (MSPSS) T0	0.58	0.06	**< 0.001**	
Cognitive behavioral treatment[a]	0.04	0.31	0.897	

Notes: B = unstandardized regression coefficient; SE = standard error; Adj. R^2 = adjusted R square; T1 = Post assessment; T0 = Baseline. PHQ-9 = Patient Health Questionnaire-9; GAD-7 = Generalized Anxiety Disorder Scale-7; PHQ-15 = Patient Health Questionnaire-15; EUROHIS-QOL = EUROHIS Quality of Life 8-item index; MSPSS = Multidimensional scale of perceived social support; significant p-values are marked in bold.
[a] Cognitive behavioral treatment group coded with 1 and Interpersonal treatment group with 0.

Table 5
Rates of participants showing reliable change, remission and RCSI at post-treatment (intention-to treat sample)[a].

		Baseline to post-assessment (PHQ-9)		
		iIPT (n = 247)	iCBT (n = 243)	waitlist (n = 253)
Reliable change				
Improvement	n (%)	153 (61.94 %)	161 (66.25 %)	96 (37.94 %)
No change	n (%)	17 (6.88 %)	13 (5.35 %)	17 (6.72 %)
Deterioration	n (%)	77 (31.17 %)	69 (28.39 %)	140 (55.34 %)
Remission	n (%)	122 (49.39 %)	120 (49.38 %)	52 (20.55 %)
RCSI	n (%)	117 (47.37 %)	114 (46.91 %)	44 (17.39 %)

Notes: PHQ-9 = Patient Health Questionnaire-9; iIPT = internet-based interpersonal treatment; iCBT = internet-based cognitive behavioral treatment; An increase or decrease of 5 PHQ-9 points between baseline and post assessment was defined as reliable deterioration or improvement, respectively; Remission was defined as a score of ≥10 at baseline and a score < 10 at post-assessment; Reliable and clinically significant improvement (RCSI) was defined as experiencing both remission and reliable improvement from baseline to post-assessment.
[a] All results are pooled across 100 imputed data sets, thus counts have decimals.

three months after treatment. The results of a systematic review and meta-analysis also showed these positive effects on depressive symptoms in iCBT in follow-up assessments (Königbauer et al., 2017) and positive effects were also found in Arabic-speaking samples in the follow-up period (Kayrouz et al., 2018). However, the findings in our study must be interpreted with caution due to the small number of completers at the three-months follow-up.

A strong association between depression and perceived social support has already been reported in individuals in Arabic-speaking countries (Alananzeh et al., 2021; Donnelly et al., 2019; Tajvar et al., 2013). For both treatments investigated in the present study, participants reported more perceived social support from either family members or friends at post-treatment. This might be attributed to the reduction of depressive symptoms, enabling participants either to receive more social support due to the alleviated interpersonal problems and the behavioral activation in social activities, or to actually perceive the support they were already receiving from their community. Further research is necessary to better understand the underlying mechanisms in this regard. In sum, the present findings demonstrate the beneficial impact of both treatment types for depression on QoL in that Arabic-speaking sample, which corresponds to previous meta-analyses that reported a positive effect of depression treatment on QoL (Hofmann et al., 2017; Kolovos et al., 2016; Maj et al., 2023) as well as studies in cross-cultural settings and Arabic-speaking countries (Abdul Razzak et al., 2019; Kessler and Bromet, 2013).

5. Limitation

Some limitations of the present study should be acknowledged. First, the sample consists of mainly educated, single, female adults, indicating that IBIs appear to reach a specific group. This is a common bias in internet-based interventions in Arab and non-Arab populations (Børtveit et al., 2022; Kayrouz et al., 2018; Kelders et al., 2013), and underlines the need to examine more heterogenous samples and to direct efforts at addressing the needs of older individuals, those with lower educational attainment, and adult males. Furthermore, gender was only assessed as a dichotomous variable. Additionally, the sample consists of participants from specific Arabic-speaking countries, mainly Egypt, Algeria, Iraq, Morocco, Saudi Arabia, and Syria. Accordingly, the conclusions need to be interpreted with caution and cannot be generalized to all Arabic-speaking countries. Second, the results on the efficacy of the intervention relied on self-report questionnaires. Incorporating clinical interviews at the end of the treatment would have enabled a more precise clinical diagnosis after treatment. Third, results regarding the follow-up rely on a small sample size and should therefore also be interpreted with caution. Fourth, treatment integrity was monitored before the start of the trial but not during or after the trial, which is a limitation. Monitoring of treatment integrity at different stages of the trial allows us to assess whether the intervention was delivered as intended (Cox et al., 2019). This should be verified by independent raters in future studies.

6. Conclusion

To the best of our knowledge, the present study is the first randomized controlled trial to assess the efficacy of iCBT and iIPT for depression in Arabic-speaking countries. In a region with about 500

million inhabitants and a limited mental health care structure, providing comprehensive and adequate healthcare for the citizens remains an enormous challenge. To narrow the gap between the supply of mental health support and the demand due to high prevalence rates of mental health problems, geographically and temporally independent internet-based approaches might provide the opportunity to reach a specific underserved population. This study, examining a non-WEIRD sample living mainly in Arabic-speaking countries, provides a first indication that existing internet-based treatment approaches are promising and effective, but our findings highlight the need for further research to gain a better understanding of interventions in those samples.

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Author contributions

RE carried out the statistical analyses and, interpretation of the results and was the main contributor in writing the manuscript. MB, CK, and BW designed the study. All authors have reviewed and approved the manuscript.

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CRediT authorship contribution statement

Rayan El-Haj-Mohamad: Writing – review & editing, Writing – original draft, Visualization, Methodology, Investigation, Formal analysis. **Jana Stein:** Writing – review & editing. **Nadine Stammel:** Writing – review & editing. **Yuriy Nesterko:** Writing – review & editing. **Birgit Wagner:** Writing – review & editing, Conceptualization. **Maria Böttche:** Writing – review & editing, Supervision, Project administration, Funding acquisition, Conceptualization. **Christine Knaevelsrud:** Writing – review & editing, Conceptualization.

Declaration of competing interest

The authors affirm that the study was carried out without any commercial or financial affiliations that could be perceived as a potential conflict of interest.

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