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Research / Araştırma

Relationship Between Depression and Anxiety Symptoms in studies Conducted in Turkey: A Meta-analysis Study

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ABSTRACT

Relationship between depression and anxiety symptoms in studies conducted in Turkey: a meta-analysis study

Objective: This meta-analysis study aimed to test the relationship between depression and anxiety symptoms by analyzing the studies on depression and anxiety symptoms in Turkey. The study was carried out in two stages to determine the effect of depression sypmtoms on the anxiety sypmtoms, and the moderators that could affect the mean effect size obtained in this study.

Method: In order to determine the studies that will be included in the meta-analysis, a search was made in the National Higher Education Council's National Thesis Center, ULAKBIM Social and Humanities Database, ULAKBIM Medical Data Base and Google Academic Database. In this phase, all studies including depression and anxiety were recorded by using the terms related with anxiety and depression. The screening process was reduced to title, keyword and summary fields to create study pool (143 studies). Subsequently, with the detailed examination of studies, 74 studies were excluded and 69 studies were included in the sample in accordance with the study criteria. The Pearson Correlation Coefficient (r) was calculated as the effect size in the analysis and the random effect model was used.

Results: In the study, the mean effect size depression on anxiety was calculated as 0.53, with a lower limit value of 0.48 and an upper limit value of 0.58. In addition, there was a difference between the size of effect observed in the study and the size of the virtual effect generated according to the random effects model aimed to correct the effect caused by the publication bias.

Conclusion: Confidence intervals of 69 studies included in meta-analysis study were narrow, meaning that the decisions which will be made taking into consideration the data obtained from these studies are reliable. It has been found that depression has a positive effect on a wide range of anxiety. According to these findings, as depression levels increase, anxiety levels also increase, or as depression levels decrease, anxiety levels decrease. Overall, moderator variables of anxiety type, anxiety scale, and depression scale affect the relationship between depression and anxiety of individuals. Anxiety and depression levels can vary according to these moderator variables.

Keywords: Anxiety, depression, effect size, meta-analysis, random effect

ÖZ

Türkiye'de yapılan çalışmalarda depresyon ve kaygı ilişkisi: Bir meta-analiz çalışması

Amaç: Bu meta-analiz çalışmasında; Türkiye'de depresyon ve kaygı belirtileri üzerine yapılan araştırmaların analizi amaçlamış olup depresyon ve kaygı belirtileri arasındaki ilişki test edilmiştir. Çalışma iki aşamada gerçekleştirilmiştir. Birinci aşamada depresyon belirtilerinin kaygı belirtileri üzerine olan etkisi ve ikinci aşamada ise çalışmada elde edilen ortalama etki büyüklüğünü etkileyebilecek moderatörler belirlenmeye çalışılmıştır.

Yöntem: Meta-analize dâhil edilecek çalışmaları belirlemek için, Yükseköğretim Kurulu Ulusal Tez Merkezi, ULAKBİM Sosyal ve Beşeri Bilimler Veri Tabanı, ULAKBİM Tıp Veri Taban ve Google Akademik Veri Tabanında kaynak taraması yapılmıştır. Bu aşamada, kaygı, anksiyete ve depresyon terimleri kullanılarak, tarama işlemi başlık, anahtar kelime ve özet alanlarına indirgenerek depresyon ve kaygıyla ilgili bütün çalışmalar kaydedilerek çalışma havuzu (143 araştırma) oluşturulmuştur. Daha sonra çalışmalar detaylı bir incelemeye tabi tutularak 74 çalışma kapsam dışı bırakılmış olup, çalışma ölçütlerine uygun 69 çalışma örneklemi oluşturmuştur. Analizlerde etki büyüklüğü olarak Pearson Korelasyon Katsayısı (r) hesaplanmış ve rassal etki modeli kullanılmıştır.

Bulgular: Çalışmada depresyonun kaygı üzerindeki ortalama etki büyüklüğü değeri 0.53 olarak hesaplanırken alt sınır değeri 0.48, üst sınır değeri ise 0.58 olarak saptanmıştır. Ayrıca çalışmada gözlenen etki büyüklüğü değeri ile yayın yanlılığından kaynaklanan etkiyi düzeltmeye yönelik rassal etkiler modeline göre oluşturulan sanal etki büyüklüğü arasında farklılık saptanmıştır.

Sonuç: Çalışmada meta-analize dâhil edilen 69 araştırmaya ait güven aralıklarının dar olması, bu araştırmalara ilişkin elde edilen verilere dayalı olarak verilecek kararların güvenilir olduğu anlamına gelmektedir. Çalışmada depresyonun kaygı üzerinde geniş düzeyde pozitif etkiye sahip olduğu saptanmıştır. Bu bulgulara göre, depresyon düzeyleri arttıkça kaygı düzeyleri de artmaktadır ya da depresyon düzeyleri azaldıkça kaygı düzeyleri de azalmaktadır. Bu çalışmanın bulgularına genel olarak bakıldığında, kaygı türü, kaygı ölçeği, depresyon ölçeği moderatör değişkenleri bireylerin depresyon ve kaygı ilişkisini etkilemektedir. Kaygı ve depresyon düzeyi bu moderatör değişkenlere göre değişebilmektedir.

Anahtar kelimeler: Kaygı, depresyon, etki büyüklüğü, meta-analiz, rassal etki

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INTRODUCTION

Anxiety is regarded as one of the most basic emotions of the individual. In general, anxiety refers to the state of restlessness and concern felt in the face of a threatening situation. Rollo May (1) in 1950 described the anxiety as the feeling of pressure towards adaptation regarding loneliness or that the individual is not liked or disliked. According to Kierkegaard (2), anxiety is related to the likelihood within the existence, and there is a special link between anxiety and freedom. Therefore, I am the only one who has the word, and all that I do is completely dependent on me. Freud (3), on the other hand, concluded anxiety was both an anticipation and an attenuated repetition of trauma.

Depression is the inability of people to enjoy the life and their experiences (4). Depression, as a mental condition, can occur with many somatic or mental diseases. Briefly, it is the principle finding of affect that increase with respect to sorrow (5). Difficulties such as differentiation of living conditions, extreme competition, working obligation, and emotional ties have become a shared state among the vast majority of people, and cause people to fall into depression (6).

From the Renaissance to the 18th, 19th century and even to the beginning of the 20th century, the term 'melancholy' comprised symptoms of both depression and anxiety. Although renowned German psychiatrist Emil Kraepelin (7), which enabled mental illnesses to be accepted as the diseases like somatic diseases for the first time, greatly contributed to the epistemology of psychiatric disorders, he did not make a clear distinction between depression and anxiety. On the other hand, while Freud (3) was the first to define anxiety as a separate concept, he proposed that it resulted from inhibited sexual tension and hence set the boundary between realistic and neurotic anxiety. Freud (3) generally tends to formulate the psychodynamic drives of patients, rather than the comprehensive factual description of the symptoms in patients. Thus, Freud's neurosis term includes symptoms of both anxiety and depression (8). Lewis (9) stated that there was continuity between anxiety and depression, and argued that the anxiety is part of depression. In the following years, there was no definite boundary between depression and anxiety in DSM-I and DSM-II. Roth et al. (10), who studied the relationship between anxiety and depression, found that these were characterized by two different groups of patients in the prevalence studies of the classification of affective disorders. Available findings made the anxiety and depression to be included in the definition of psychiatric disorders in DSM-III. So in the 1970s and early 1980s, anxiety and depression were considered as two separate disorders. It has become clear with the prevalence studies since the end of the 1980s that coincidence of anxiety and depression is relatively common (8). Nowadays, such coincidence is reported in 20% to 40% of individuals (11). As one can note, many papers have been published, reporting a relation between depression and anxiety. Depression and anxiety studies, which are the main study areas of both psychology and psychiatry research, bring following questions forward: what is the level of association between depression and anxiety according to published studies? What are the moderator variables that can modify the association between anxiety and depression? Do the studies regarding this association provide a simple and in-depth analysis? Which findings are obtained when the study results published on this association are compared? How do these study findings about association distribute?

Although the relationship between depression and anxiety is extensively investigated, the specific effects of depression on the anxiety and the direction of the association still remain controversial. While some studies reported high correlation coefficients between these two variables, many studies showed that low or intermediate correlation coefficients with respect to these two variables. In some experimental studies, depression was also found to have negative effects on anxiety. Several studies reported long and short-term effects of both depression and anxiety. However, to our knowledge, there is no meta-analysis regarding studies that investigate the association between

depression and anxiety in Turkey. Therefore, this study aimed to analyze the studies on depression and anxiety, performed in a two-step approach to determine (i) the effect of depression on anxiety and (ii) the moderators which may influence the magnitude of the mean effect in the study.

METHOD

Study Sample and Selection Criteria

There are studies in the literature about the cultural variation of depression and anxiety levels. As sufficient number of thesis/articles were found to exist in Turkey, the extent of this meta-analysis was determined to be restricted with the studies performed in the country. Although international databases include numerous studies or thesis projects, only Turkish databases were decided to be used for meta-analysis of thesis/articles as filtering of these through international databases seems very challenging and impractical. In this context, National Thesis Center of Council of Higher Education where Turkish theses were archived and ULAKBIM Social Sciences and Humanities Database, ULAKBIM (Turkish Academic Network and Information Center) Medical Database, and Google Scholar Database where Turkish articles were archived were used for this study. These databases were searched for terms of anxiety and depression. The search procedure was confined to title, keyword and summary fields, and full text of theses/articles on depression and anxiety were accessed (N=143 thesis & article). Afterwards, theses/articles were subjected to a detailed examination and coded by categorizing the studies containing appropriate data for the meta-analysis. A total of 74 theses/articles were excluded from the study for not being a depression and anxiety study (n=20), not having X, SS and r/R^2 coefficients (n=33), or being an experimental study (n=21). Remaining 69 thesis/article studies comprised the study sample, meeting the criteria of (i) being peer-reviewed articles, doctoral (specialization in medicine and PhD) or master thesis, and (ii) containing n, r or R^2 values (Figure 1).

The studies till September 2016 were included in this meta-analysis. The reason for inclusion of doctoral and master theses was to avoid the possibility of publication bias. Details of theses/articles included in the meta-analysis are presented in Table 1.

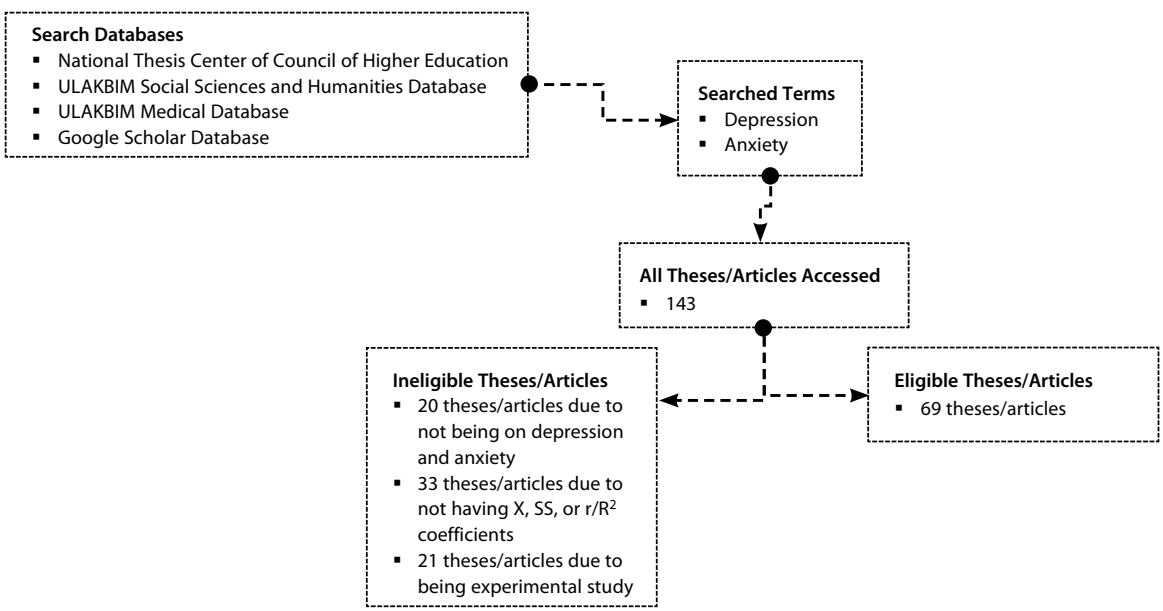

Figure 1: Thesis/article search process to be included in the meta-analysis

Coding Procedure

The coding procedure is a data sorting process in order to extract clear and appropriate data from the complex information, to be analyzed (12). Before going through the statistical analyses in the study, a coding form was created and the coding was carried out in accordance with this form. The generated coding form consisted of the following components:

- Study reference
- Type of study
- Sample knowledge
- Data collection tool
- Methodological information
- Quantitative values

Effect Size Analyses

The mean effect size obtained in the meta-analysis is a standard measure used in determining the strength and direction of the association in the study (13). In current study, Pearson correlation coefficient (r) was calculated as the effect size. Since the correlation coefficient is between +1 and -1, this r value was calculated by being transformed to the corresponding value in Fisher's z table (14). In correlational meta-analysis studies, when more than one r value is given when the variable consists of more than one factor, there are two different approaches to select one of the r values to be used in the meta-analysis (15). In this study; (i) if correlations had been independent, all relevant correlations would be considered as independent studies, and included in the analysis; (ii) if correlations had been dependent, the mean of correlations would be calculated. Although there exist different methods for correcting these mean correlations, most of these methods lead to high correlation estimates (16). As using the mean correlation constitute a conservative estimate of the overall correlation, a conservative prediction was preferred in this study.

Regardless of the method for mean effect size, there are two basic models in meta-analysis studies: fixed effect model and random effect model. When deciding which model to use, it is necessary to review which model's prerequisites meet the characteristics of the studies included in the meta-analysis (14,15). Fixed effect model (i) assumes that studies are functionally identical, and (ii) aims to calculate the effect size for a defined population only. If it is considered that the studies are not functionally identical and it is desired to make a generalization to larger populations, the model to be used is the random effect model (17). Taken all together, the random effect model was used in this meta-analysis, for which the Comprehensive Meta-Analysis software was used.

Moderator Variables and Moderator Analysis

Moderator analysis is a method of analysis that allows testing the differences between the mean effect sizes of variables (moderators) and the direction of differences between subgroups. The statistical significance of the difference between the moderator variables is tested by the Q statistic method developed by Hedges and Olkin (15). In this method, Q was divided into $Q_{between}$ (Q_b) and Q_{within} (Q_w); and the analyzes are executed over these two different Q's. While Q_w tests the homogeneity of the moderator variable in itself, Q_b tests the homogeneity between groups (12). Since the statistical significance of the differences between the moderators was desired in this study, only Q_b values were used. In this context, we identified nine moderator variables that we predicted to play a role in the mean effect size.

Validation and Reliability of the Study

When performing a meta-analysis, one of the most critical issues is to decide how similar these studies are, as these are inevitably not identical. Despite the absence of a completely objective methodology for this, important considerations to ensure validity and reliability in this study are as following:

- The most important critique of meta-analysis is the

Table 1: Characteristics of the studies included in the meta-analysis

Study	Year	Type	Study site	Sex	Age group	Type of anxiety	Anxiety scale	Depression scale	n	r
Motan and Gencoz, 2007	2007	Research article	Ankara	Mixed	Young	Generalized Anxiety	BAI	BDI	145	0.52
Murat, 2011	2011	Research article	Sivas	Mixed	Young/Adult	Death Anxiety	OTHER	OTHER	116	0.56
Siyez, 2003	2003	Master thesis	Izmir	Mixed	Young	Social Anxiety	OTHER	OTHER	358	0.62
Arifoglu, 2006 (1)	2006	Doctoral thesis	Ankara	Mixed	Child	Trait Anxiety	STAI-CH	CES-DC	31	0.45
Arifoglu, 2006 (2)	2006	Doctoral thesis	Ankara	Mixed	Child	Situational Anxiety	STAI-CH	CES-DC	31	0.55
Colak, 2010 (1)	2010	Master thesis	Istanbul	Mixed	Young/Adult	Situational Anxiety	SAI	BDI	70	0.00
Colak, 2010 (2)	2010	Master thesis	Istanbul	Mixed	Young/Adult	Trait Anxiety	SAI	BDI	70	0.12
Yilmaz, 2007	2007	Doctoral thesis	Ankara	Mixed	Adult	Generalized Anxiety	BAI	BDI	551	0.44
Tunc, 2014	2014	Doctoral thesis	Mersin, Adana	Female	Adult	Generalized Anxiety	BAI	BDI	103	0.61
Aka, 2011	2011	Doctoral thesis	Istanbul	Mixed	Young	Social Anxiety	LSAS	OTHER	530	0.40
Bozkurt, 2004	2004	Research article	Izmir	Mixed	Young	Trait Anxiety	SAI	BDI	363	0.21
Gokkaya, 2016	2016	Master thesis	Istanbul	Mixed	Young	Social Anxiety	LSAS	BDI	196	0.38
Ocak, 2013 (1)	2013	Doctoral thesis	Istanbul	Mixed	Child/Young	Trait Anxiety	STAI-CH	CES-DC	50	0.80
Ocak, 2013(2)	2013	Doctoral thesis	Istanbul	Mixed	Child/Young	Situational Anxiety	STAI-CH	CES-DC	50	0.69
Abatan, 2013	2013	Doctoral thesis	Bolu	Mixed	Adult	Generalized Anxiety	HAS	HDS	37	0.70
Ulev, 2014	2014	Master thesis	Ankara	Mixed	Young	Generalized Anxiety	OTHER	OTHER	414	0.83
Gurkan, 2012	2012	Master thesis	Bursa	Mixed	Young/Adult	Situational Anxiety	SAI	BDI	136	0.72
Oz Corut, 2014	2014	Master thesis	Istanbul	Male	Adult	Generalized Anxiety	BAI	BDI	100	0.62
Cebe, 2005 (1)	2005	Master thesis	Istanbul	Mixed	Child	Situational Anxiety	SAI	BDI	86	0.55
Cebe, 2005 (2)	2005	Master thesis	Istanbul	Mixed	Child	Trait Anxiety	SAI	BDI	86	0.45
Safak, 2014	2014	Master thesis	Istanbul	Mixed	Young/Adult	Generalized Anxiety	STAI-CH	OTHER	280	0.73
Yilmaz, 2006 (1)	2006	Master thesis	Istanbul	Female	Adult	Trait Anxiety	SAI	BDI	47	0.50
Yilmaz, 2006 (2)	2006	Master thesis	Istanbul	Female	Adult	Situational Anxiety	SAI	BDI	47	0.48
Sahin, 2015 (1)	2006	Master thesis	Istanbul	Mixed	Young/Adult	Generalized Anxiety	HAS	BDI	40	0.67
Sahin, 2015 (2)	2006	Master thesis	Istanbul	Mixed	Young/Adult	Generalized Anxiety	HAS	BDI	40	0.66
Sahin, 2015 (3)	2006	Master thesis	Istanbul	Mixed	Young/Adult	Generalized Anxiety	HAS	BDI	40	0.68
Sahin, 2015 (4)	2006	Master thesis	Istanbul	Mixed	Young/Adult	Generalized Anxiety	HAS	BDI	40	0.75
Sahin, 2015 (5)	2006	Master thesis	Istanbul	Mixed	Young/Adult	Generalized Anxiety	HAS	BDI	40	0.69
Sahin, 2015 (6)	2006	Master thesis	Istanbul	Mixed	Young/Adult	Generalized Anxiety	HAS	BDI	40	0.68
Ayar, et al., 2015 (1)	2015	Research article	Bursa	Mixed	Adult	Situational Anxiety	SAI	BDI	100	0.62
Ayar, et al., 2015 (2)	2015	Research article	Bursa	Mixed	Adult	Trait Anxiety	SAI	BDI	100	0.64
Yaris, 2010	2010	Master thesis	Istanbul	Mixed	Adult	Generalized Anxiety	BAI	BDI	200	0.53
Bilgin, 2012 (1)	2012	Master thesis	Bursa	Female	Young/Adult	Trait Anxiety	SAI	BDI	39	0.65
Bilgin, 2012 (2)	2012	Master thesis	Bursa	Male	Young/Adult	Trait Anxiety	SAI	BDI	27	0.69

Table 1: Characteristics of the studies included in the meta-analysis (Continued)

Study	Year	Type	Study site	Sex	Age group	Type of anxiety	Anxiety scale	Depression scale	n	r
Bilgin, 2012 (3)	2012	Master thesis	Bursa	Mixed	Young/Adult	Trait Anxiety	SAI	BDI	66	0.69
Eyuboglu, 2009	2009	Master thesis	Istanbul	Mixed	Young/Adult	Death Anxiety	SAI	BDI	135	0.37
Dumanoglu, 2006	2006	Master thesis	Izmir	Mixed	Young/Adult	Generalized Anxiety	SAI	BDI	65	0.14
Sancakoglu, 2011	2011	Master thesis	Istanbul	Mixed	Child	Generalized Anxiety	STAI-CH	CES-DC	106	0.62
Seker, 2014	2014	Master thesis	Mugla	Mixed	Young	Generalized Anxiety	SAI	BDI	207	0.82
Cetinkaya, et al., 2009 (1)	2013	Research article	Sivas	Mixed	Adult	Situational Anxiety	SAI	BDI	170	0.21
Cetinkaya, et al., 2009 (2)	2013	Research article	Sivas	Mixed	Adult	Trait Anxiety	SAI	BDI	170	0.48
Bayraktaroglu, 2009 (1)	2010	Master thesis	Istanbul	Female	Adult	Situational Anxiety	SAI	BDI	200	0.59
Bayraktaroglu, 2009 (2)	2010	Master thesis	Istanbul	Female	Adult	Trait Anxiety	SAI	BDI	200	0.44
Nadir, 2010	2010	Master thesis	Ankara	Female	Young/Adult	Trait Anxiety	SAI	BDI	155	0.64
Ozcan, et al., 2013 (1)	2013	Research article	Erzurum	Female	Child/Young	Social Anxiety	OTHER	BDI	176	0.43
Ozcan, et al., 2013 (2)	2013	Research article	Erzurum	Female	Child/Young	Generalized Anxiety	BAI	BDI	176	0.63
Karakas and Arkar, 2012 (1)	2012	Research article	Izmir	Mixed	Young	Trait Anxiety	SAI	BDI	241	0.60
Karakas and Arkar, 2012 (2)	2012	Research article	Izmir	Mixed	Young	Situational Anxiety	SAI	BDI	241	0.49
Karakas and Arkar, 2012 (3)	2012	Research article	Izmir	Mixed	Young	Trait Anxiety	SAI	BDI	241	0.43
Karakas and Arkar, 2012 (4)	2012	Research article	Izmir	Mixed	Young	Situational Anxiety	SAI	BDI	241	0.42
Deniz, et al., 2009	2009	Research article	Konya	Mixed	Child	Trait Anxiety	STAI-CH	CES-DC	98	0.67
Evren, et al., 2002	2003	Research article	Istanbul	Male	Adult	Generalized Anxiety	BAI	HDS	105	0.25
Uluc, 2008 (1)	2008	Research article	Ankara	Mixed	Young	Generalized Anxiety	OTHER	OTHER	182	0.62
Uluc, 2008 (2)	2008	Research article	Ankara	Mixed	Young	Generalized Anxiety	OTHER	BDI	182	0.58
Yarpuz, et al., 2008 (1)	2008	Research article	Ankara	Mixed	Adult	Social Anxiety	LSAS	HDS	83	0.36
Yarpuz, et al., 2008 (2)	2008	Research article	Ankara	Mixed	Adult	Generalized Anxiety	OTHER	HDS	83	0.62
Bumin, et al., 2008	2008	Research article	Ankara	Female	Young/Adult	Trait Anxiety	SAI	BDI	107	0.35
Durak and Durak, 2013	2013	Research article	Bolu	Mixed	Young	Generalized Anxiety	LSAS	BDI	448	0.27
Cetinkaya, et al., 2007 (1)	2008	Research article	Sivas	Mixed	Adult	Situational Anxiety	SAI	BDI	177	0.09
Cetinkaya, et al., 2007 (2)	2008	Research article	Sivas	Mixed	Adult	Trait Anxiety	SAI	BDI	177	0.33
Aslan, et al., 1996	1996	Research article	Adana	Female	Young/Adult	Trait Anxiety	SAI	BDI	41	0.67
Kaya, et al., 2003 (1)	2003	Research article	Konya	Mixed	Adult	Generalized Anxiety	HAS	HDS	62	0.48
Kaya, et al., 2003 (2)	2003	Research article	Konya	Mixed	Adult	Generalized Anxiety	HAS	BDI	62	0.83
Toros, et al., 2002 (1)	2002	Research article	Mersin	Mixed	Child/Young	Generalized Anxiety	BAI	CES-DC	61	0.64
Toros, et al., 2002 (2)	2002	Research article	Mersin	Mixed	Child/Young	Situational Anxiety	STAI-CH	BDI	61	0.32
Toros and Tataroglu, 2002 (1)	2002	Research article	Mersin	Mixed	Child	Trait Anxiety	STAI-CH	CES-DC	93	0.54
Toros and Tataroglu, 2002 (2)	2002	Research article	Mersin	Mixed	Child	Situational Anxiety	STAI-CH	CES-DC	93	0.61
Eldeklioglu, 2006 (1)	2006	Research article	Ankara	Mixed	Young	Trait Anxiety	SAI	BDI	325	0.34
Eldeklioglu, 2006 (2)	2006	Research article	Ankara	Mixed	Young	Situational Anxiety	SAI	BDI	325	0.06

n: Sample size, r: Correlation coefficient, BAI: Beck Anxiety Inventory, STAI-CH: State-Trait Anxiety Inventory for Children, SAI: Spielberger State Anxiety Scale, LSAS: Liebowitz Social Anxiety Scale, HAS: Hamilton Anxiety Scale, BDI: Beck Depression Inventory, CES-DC: Depression Scale for Children, HDS: Hamilton Depression Scale

criticism of the collection of apples and oranges. However, this is also a symbol of the power of the meta-analysis studies, where the aim of the literature search is to generalize the findings of a group of different studies. In this study, all features of the study field (depression and anxiety) were evaluated together when the inclusion and exclusion criteria were determined. Appropriate criteria were identified considering these sensitive criteria, and studies that were as identical as possible were included in the study. Thus, this limitation was tried to be minimized.

- Another is the criticism of ignoring differences across different studies included in the meta-analysis. The differences between the studies were tested using nine moderator variables to overcome this limitation of the study.
- Because the works included in meta-analysis could not be functionally identical, the random effects model was preferred in the study.
- Another criticism in meta-analysis research is publication bias. The publication bias was tested by using Funnel Plot and the Trim and Fill tests of which outcomes were presented in the Results section.
- For the detection of the reliability of the coding procedure, coding was carried out independently by the investigators. Intercoder Cohen's Kappa reliability coefficient value was calculated as 0.96.
- The main condition for the study to be sampled for accurate results is that the sample best represents the universe. However, no matter how good a sample is chosen, there are random errors that occur in the groups that are included and not included in the sampling, and the sampling error will never be the same as your universe. If the study consisted of an infinite sample, the sampling error would then be zero. On the other hand, since the samples of studies included in meta-analysis are not infinite, and statistical calculations have been considered in the analysis of how much of the effect size in the study is due to sample error (13), no further intervention was performed in this context.

RESULTS

Findings Related to the Publication Bias

Publishing bias is primarily based on the assumption that all of the research on a topic has not been published. In particular, as the studies detecting statistically non-significant associations or weak correlations are usually considered as not worth to be published, this negatively influence overall effect level and increases the magnitude of the mean effect in a biased manner (13). This publication bias effect, which we can also refer to as missing data, can unfavorably affect the overall impact of the meta-analysis. Therefore, the likelihood of publication bias is taken into account in meta-analysis studies. In order to investigate the bias in this study, the answers to the following questions were sought:

- Is there evidence of any publication bias?
- Could the overall effect size be a consequence of publication bias?
- How much of the total effect depends on the bias?

In meta-analysis, a number of calculation methods are used to give a statistical answer to the questions with the above probabilities. On top of these stays the funnel plot method. The shape provided by this method reveals whether the studies obtained by the subjective assessment are influenced by the publication bias. The funnel plot of the studies included in the current meta-analysis is presented in Figure 2, which showed no evidence of publication bias. A funnel plot indicating a publication bias is expected be substantially asymmetric. The fact that the studies in the lower parts of the funnel concentrates on a particular side of the line showing the mean effect size (especially on the left side) indicates the possibility of publication bias. There was no evidence of such bias in 69 studies included in the meta-analysis.

While there is no evidence of publication bias in the funnel plot, the result of the Trim and Fill test that was performed to evaluate the size of publication bias effect obtained by random effect model is presented at Table 2. The Table showed a difference between

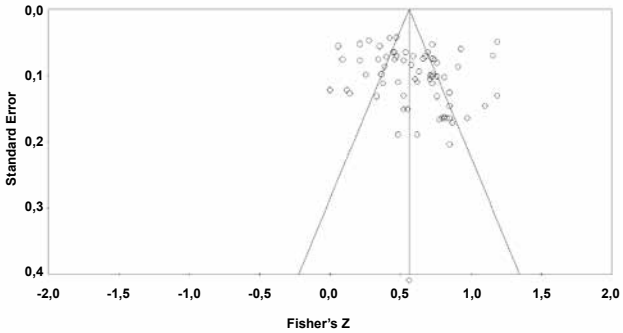

Figure 2: Funnel plot of effect size regarding publication bias

the size of observed effect and the size of virtual effect generated according to the random effect model to correct the effect resulting from the publication bias. This suggests that the studies which detect an association between depression and anxiety are likely to be published.

Findings Related to Mean Effect Size

The results of the meta-analysis between depression and anxiety is summarized in Table 3. The mean effect size of depression on anxiety was calculated as 0.53, with a lower limit of 0.48 and an upper limit of 0.58. This value indicates that depression has a wide level of mean effect size on anxiety (18).

Moderator analysis showed no moderating effect of gender between depression and anxiety. However, the studies in meta-analysis studies revealed depression to have a broad effect on the anxiety in women (r=0.52), men (r=0.54), and mixed group (r=0.53). The strongest effect detected belonged to men. Although the anxiety effect values of depression differed in terms of gender, the mean effect size difference in the moderator analysis according to the random effect model was not statistically significant (Q_b=0.04, p>0.05).

The age group was not found to have a moderating role between depression and anxiety. Nevertheless, meta-analysis showed that depression had a broad effect on anxiety in children (r=0.57), children+young people (r=0.60), young people (r=0.50), young people+adults (r=0.57), and adults (r=0.50). The strongest effect was observed in children+young population. Although the anxiety effect values of depression differed in the age group, the difference of the mean effect sizes in the moderator analysis according to the random effects model was not statistically significant (Q_b=3.87, p>0.05).

The psychological diagnosis of the study groups did not observe to play a moderating role between depression and anxiety. The strongest effect detected belonged to those with a psychological diagnosis. Although the anxiety effect values of depression differ in the context of disease/psychological diagnosis, the difference in the mean effect sizes in the moderator analysis according to the random effect model was not statistically significant (Q_b=1.57, p>0.05).

The type of anxiety was found to have a moderating role between depression and anxiety. In the moderator analysis, the difference in the mean effect level between the anxiety types was statistically significant (Q_b=9.73, p<0.05). Depression was detected to have a broad effect on generalized (r=0.62) and trait (r=0.57) anxiety, an intermediate effect on death (r=0.46), social (r=0.45), and state anxiety (r=0.44). The strongest effect was observed in generalized anxiety.

The anxiety scales used in the studies included in the meta-analysis were detected to have a moderating role between depression and anxiety. In the moderator analysis, the difference of the mean effect level between the anxiety scales was statistically significant (Q_b=50.79, p<0.01). Depression had a broad effect on anxiety in the studies where Hamilton Anxiety Scale

Table 2: Trim and fill test results

	Excluded study (Sol)	Point Estimation	CI (Confidence interval)		Q
			Lower Limit	Upper Limit	
Observed values		0.53	0.48	0.58	762.2
Corrected values	13	0.47	0.42	0.53	1180.0

Table 3: Meta-analysis results regarding correlation between depression and anxiety

Variable	k	N	r	CI (Confidence interval)		Q	Q_b
				Lower Limit	Upper Limit		
Depression and Anxiety	69	10158	0.53*	0.48	0.58	762.2*	
Moderator [Sex]							0.04
Female	11	1291	0.52*	0.21	0.74		
Male	3	232	0.54*	0.47	0.60		
Mixed	55	8635	0.53*	0.47	0.59		
Moderator [Age Group]							3.87
Child	8	624	0.57*	0.51	0.62		
Child+Young	6	574	0.60*	0.45	0.71		
Young	16	4639	0.50*	0.37	0.61		
Young+Adult	19	4639	0.57*	0.47	0.66		
Adult	20	2774	0.50*	0.42	0.57		
Moderator [Diagnosis]							1.57
Diagnosis of a disease	24	2615	0.50*	0.41	0.58		
Psychological diagnosis	24	2624	0.56*	0.52	0.61		
No diagnosis	21	4919	0.53*	0.42	0.62		
Moderator [Type of Anxiety]							9.73**
Generalized anxiety	26	3809	0.62*	0.54	0.69		
Social anxiety	5	1343	0.45*	0.33	0.55		
Trait anxiety	21	2727	0.51*	0.44	0.58		
Situational anxiety	15	2028	0.44*	0.31	0.56		
Death anxiety	2	251	0.46*	0.26	0.63		
Moderator [Anxiety Scale][1]							50.79*
BAI	8	1441	0.53*	0.45	0.60		
STAI-CH	10	893	0.62*	0.53	0.69		
SAI	31	4655	0.46*	0.38	0.54		
LSAS	4	1257	0.35*	0.27	0.41		
HAS	9	401	0.69*	0.61	0.75		
Other anxiety scales	7	1511	0.62*	0.48	0.73		
Moderator [Depression Scale][2]							10.91*
BDI	49	7295	0.50*	0.45	0.56		
CES-DC	9	613	0.63*	0.57	0.68		
HDS	5	370	0.48*	0.30	0.63		
Other depression scales	6	1880	0.64*	0.47	0.77		
Moderator [Geographical Region]							1.60
Central Anatolian	21	3646	0.50*	0.38	0.60		
Aegean	8	1957	0.50*	0.33	0.64		
Marmara	32	3751	0.56*	0.49	0.62		
Mediterranean	6	452	0.57*	0.48	0.65		
Eastern Anatolian	2	352	0.53*	0.31	0.70		
Moderator [Year Of Publication]							5.54
2005 and before	12	1471	0.53*	0.40	0.63		
2006-2010	30	3926	0.46*	0.40	0.54		
2011 and after	27	4761	0.60*	0.52	0.66		
Moderator [Type Of Publication]							5.98*
Research article	32	5245	0.47*	0.41	0.67		
Master thesis	29	3530	0.58*	0.51	0.65		
Doctoral thesis	8	1383	0.58*	0.47	0.67		

[1]BAI: Beck Anxiety Inventory, STAI-CH: State-Trait Anxiety Inventory for Children, SAI: Spielberger State Anxiety Scale, LSAS: Liebowitz Social Anxiety Scale, HAS: Hamilton Anxiety Scale
[2]BDI: Beck Depression Inventory, CES-DC: Depression Scale for Children, HDS: Hamilton Depression Scale, *p<0.01; **p<0.05; k: number of studies; N: sample size; r: effect size

(HAS) (r=0.69), State-Trait Anxiety Inventory for Children (STAI-CH) (r=0.62), other anxiety scale (r=0.53), or Beck Anxiety Inventory (BAI) (r=0.50) were used; and an intermediate effect on anxiety in the studies where Spielberger State Anxiety Inventory (STAI) (r=0.46) or the Liebowitz Social Anxiety Inventory (LSRS) (r=0.35) were used. The strongest effect detected was observed in studies in which the HAS was used.

Depression scales used in studies included in meta-analysis were found to play a moderating role between depression and anxiety. In the moderator analysis, the difference in mean level of anxiety was statistically significant (Q_b=10.91, p<0.01). Accordingly, depression had a broad effect on anxiety in studies using other depression scale (r=0.64), Depression Scale for Children (CES-DC) (r=0.63) or Beck Depression Inventory (BDI) (r=0.50) scales, and an intermediate effect on anxiety using HDS (r=0.48). The strongest effect detected belonged to the studies where other scales were used.

The geographical area where the research was conducted did not have a moderating role between depression and anxiety. Nevertheless, depression was observed to have a broad effect on anxiety in subjects participated from the Mediterranean (r=0.57), Marmara (r=0.56), Eastern Anatolian (r=0.53), Central Anatolian (r=0.50), and Aegean (r=0.50) regions. The strongest effect was detected in the Mediterranean region. Although the depression effect values of depression differed in the age group, the difference of the mean effect sizes in the moderator analysis according to the random effect model was not statistically significant (Q_b=1.60, p>0.05).

The research did not support the H9 hypothesis that the year of publication played a moderating role between depression and anxiety. Depression was found to have a broad effect on anxiety in studies performed in 2005 and before (r=0.53) and in 2011 and after (r=0.60), whereas an intermediate effect in studies performed between 2006 and 2010 (r=0.46). The strongest effect was detected in studies performed in 2011 and after. Although the anxiety effect values of depression differed in the context of the publication year, the difference of the mean effect sizes in the moderator analysis according to the random effect model was not statistically significant (Q_b=5.54, p>0.05).

The type of study included in the meta-analysis played a moderating role between depression and anxiety. In the moderator analysis, the difference in the mean effect level between the types of studies was statistically significant (Q_b=5.98, p<0.01). Depression had a broad effect on anxiety in master and doctoral thesis (r=0.58) and intermediate effect on anxiety in articles (r=0.47).

DISCUSSION

This meta-analysis aimed to examine the effect of depression on anxiety. The narrower confidence intervals for the 69 studies included in the meta-analysis suggest more reliable decisions given based on the data from these studies (13,15,19).

The difference between the size of the virtual effect created by the random effect model for correction of the effect resulting from the publication bias and the size of effect observed in the study indicate publication bias. Accordingly, it can be suggested that the studies that investigate the relation between depression and anxiety and detected high correlation rates are likely to be published.

It has been found that depression has a positive effect on anxiety on a large scale. According to these findings, the level of depression increases with increasing level of anxiety, or vice versa. However, the study supports the view that depression and anxiety are closely related. The Three Partition Model (20), which is one of the most important models emphasizing the common and dissimilar aspects of depression and anxiety, overlaps with findings of the meta-analysis. According to this model, the increase in negative affect is the common feature of these two variables, while the decrease in positive affect is foregrounded only as a feature specific to depression. The effect size coefficient obtained was also closely related to the results obtained from international studies (21-23). It was concluded that there was a significant negative relationship between the age of

Table 4: Summary of analyses

Independent Variable		Dependent Variable	Mean Effect Size	Result
Depression	→	Anxiety	0.53	
Moderator				
Sex				Non-significant
Age group				Non-significant
Psychological diagnosis				Non-significant
Type of anxiety				Significant
Scale of anxiety				Significant
Scale of depression				Significant
Study region				Non-significant
Year of publication				Non-significant
Type of publication				Significant

the individual and the level of trait anxiety. It was highest in childhood and youth, intermediate in childhood and adulthood, and lowest in adulthood. Accordingly, it was revealed that as the age progressed, the level of anxiety decreased. This finding was also consistent with the study by Wittchen et al. (24), reporting that depression occurred most often at the end of the twenties and at the beginning of the thirties, while it could do at any age.

Overall, moderator variables of anxiety type, anxiety scale, and depression scale affect individuals' depression and anxiety association. Anxiety and depression levels can vary according to these moderator variables. Particularly, the fact that depression and anxiety relationship differed in terms of both anxiety and depression scales is an evidence that there are errors on construct validity and norm-reference reliability in scales. The findings of the study and the moderator variables are summarized in Table 4.

Limitations of the Study and Recommendations

Based on published data from primary studies, the major disadvantage of the study is that the data obtained are based on only difference and correlational studies. It is not exactly right to claim that results in correlation studies can fully explain causal influences. In addition, the fact that current meta-analysis mostly consists of cross-sectional studies indicate the potential of method bias.

Despite many strategies that have been developed to reach all studies which were related with the subject of meta-analysis, it is impossible to access all of the studies in the literature. This is mainly due to the inability to access the full text of some of the studies in the databases searched for this study. For this reason, some studies that are probably considered to contain appropriate data for this study have been left out of meta-analysis. Having a statistical evidence of publication bias and difficulty in reaching unpublished studies is also an indication that publication bias cannot be clearly determined. Another limitation is that the study sample consisted of articles and theses published only in between years of 2000 and 2016.

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Category 1	Concept/Design	E.K.
	Data acquisition	N.S.
	Data analysis/Interpretation	E.K., N.S.
Category 2	Drafting manuscript	E.K., N.S.
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