The relationship between national cultural dimensions, maternal anxiety and depression, and national breastfeeding rates: An analysis of data from 122 countries

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Introduction: Breastfeeding is a natural and universal practice across countries and cultures. It is estimated that several thousand lives could be saved per year if optimal breastfeeding practices were adopted across countries. In addition, breastfeeding has numerous health, emotional and developmental benefits for both the mother and her infant. Despite widespread awareness of these benefits, rates of breastfeeding initiation and maintenance remain suboptimal, both in high- and in low- and middle-income countries. Unfavorable breastfeeding outcomes are related to several factors, including variations in cultural values and the occurrence of common mental disorders in women during pregnancy and in the postnatal period. However, the relative contributions of culture and mental health to variations in national breastfeeding rates have not been examined to date.

Methods: In the current study, recent United Nations International Children's Emergency Fund (UNICEF) data on lifetime breastfeeding rates is analyzed in two stages, to first explore and then confirm the impact of cultural values and maternal mental health status at a cross-national level.

Results: It was found that the estimated prevalence of both depression and anxiety disorders in women of childbearing age was negatively correlated with breastfeeding rates. Significant associations were also observed for the cultural dimensions of individualism-collectivism and masculinity-femininity. The association between anxiety disorders and breastfeeding outcomes remained significant in multivariate analysis incorporating demographic and health variables that could exert a confounding effect.

Discussion: These results suggest that both cultural values and the assessment and treatment of maternal mental illness should be components of any programme aimed at communicating the benefits of breastfeeding or at improving breastfeeding outcomes. The inclusion of these components could help promote the values of cultural sensitivity, inclusiveness and equity in breastfeeding from a global perspective.

Introduction

Breastfeeding is a universally practiced and natural form of infant nutrition that is normative in most countries and cultures. There is extensive evidence from the scientific literature that breastfeeding confers numerous medical and psychological benefits on the developing infant and toddler, and that these benefits may extend even to later childhood or adulthood (Kramer and Kakuma, 2012; Bar et al., 2016; Aryeetey and Dykes, 2018). Moreover, the benefits of breastfeeding are not confined to the child; there are substantial short- and long-term beneficial

effects of breastfeeding on maternal physical and mental health (Del Ciampo and Del Ciampo, 2018). It is estimated that if optimal breastfeeding practices could be ensured at a global level, this would lead to a decrease in 200,000–800,000 infant and child deaths per year (North et al., 2022). This has led to large-scale attempts to promote breastfeeding and to increase awareness of its benefits, such as the Baby-Friendly Hospital Initiative (BFHI), a joint initiative of the World Health Organization (WHO) and United Nations International Children's Emergency Fund (UNICEF) (Gomez-Pomer and Blubaugh, 2018). Despite such initiatives at both the national and international levels, the available data suggests that both the initiation and the maintenance of breastfeeding are suboptimal, even in developed countries: for example, it is estimated that exclusive breastfeeding in the first 6 months of life is practiced in only 33% of children at a global level (Philipp and Radford, 2006; Ip et al., 2007; Amoo et al., 2022).

The existence of this significant gap between ideal standards and real-world practices has led to the development and testing of several interventions aimed at promoting the initiation and maintenance of breastfeeding, particularly in the first 6 months after birth (Beake et al., 2012; Gómez et al., 2021). However, the evidence for the efficacy of these programmes has been mixed. A review of research from low- and middle-income countries suggested that structured interventions aimed at improving exclusive breastfeeding were generally effective (Olufunlayo et al., 2019); on the other hand, reviews of interventional studies in developed countries found that less than half of these interventions had a significant impact on breastfeeding outcomes (Skouteris et al., 2014, 2017).

One of the important reasons for the variable success of these interventions is the confounding effect of psychological and social factors. As noted by Kumar et al. (2015), the inability to understand health-related behaviors in the context of local family and community practices has limited the efficacy of interventions aimed at improving maternal and child health, despite their basis in scientific evidence. Moreover, many mothers experience significant mental health problems, both pre- and post-natally, and these factors may act as a significant barrier to successful breastfeeding (Bascom and Napolitano, 2016; Hoff et al., 2019). Breastfeeding is not a mechanical process: it involves a human interaction between a mother and her child (van Wijlen, 2019), and successful breastfeeding depends crucially on both the mother's emotional state and the support and advice provided by those in her immediate social circle (Russell et al., 2022). There is substantial evidence that maternal depression (Butler et al., 2013; Grigoriadis et al., 2013; Hedberg, 2013; Dias and Figueiredo, 2015; Slomian et al., 2019; Dadi et al., 2020; Woldeyohannes et al., 2021; Kim et al., 2022), anxiety (de Jager et al., 2013; Grigoriadis et al., 2013; Fallon et al., 2016a,b; Grigoriadis et al., 2019; Hoff et al., 2019) and post-traumatic stress disorder (Cook et al., 2018; Van Sieleghem et al., 2022) can all reduce the likelihood of both the initiation and the successful maintenance of breastfeeding.

Culture has been defined as "the collective programming of the mind distinguishing the members of one group or category of people from others" (Hofstede et al., 2010). It includes the attitudes, beliefs and practices particular to a given community, which are not genetically predetermined but evolve in a manner contingent on environmental and historical factors. Each culture can be understood as an attempt to solve the problems of human existence, while maintaining the wellbeing the individual and stability

of the community as a whole (Hofstede et al., 2010; Moya and Henrich, 2016). There are several methods of describing a nation's culture in terms of more or less orthogonal dimensions (Hsu et al., 2013). Perhaps the most frequently cited and replicated cultural dimension is *individualism-collectivism*, which reflects the degree to which a given society privileges the rights of the individual as opposed to the rights of the community (Pelham et al., 2022). The influence of culture upon human behavior is pervasive, and it can exert a significant influence on both parenting and feeding practices (LeCuyer and Zhang, 2015; Enriquez and Archila-Godinez, 2022). The difficulties faced in promoting a desirable, health-related behavior at a global level may reflect differences in cultural values (Hopkins et al., 2021). Culture can also influence the relationships between women and their families at various stages of their life cycle. Insecurity in these relationships can lead to psychological distress and reduce the likelihood of successful breastfeeding (Scharfe, 2012), while culturally conditioned supportive relationships lead to positive breastfeeding outcomes (Ni and Lin, 2011). Therefore, exploring the associations between culture, maternal mental health and breastfeeding outcomes may yield valuable information on how these factors could be incorporated into programmes aimed at communicating the benefits of breastfeeding to mothers, and thereby enhancing the initiation and maintenance of breastfeeding in varied cultural settings.

This study is a preliminary investigation of the associations between cultural values, common mental disorders in women of childbearing age, and the likelihood of ever having breastfed at a cross-national level, while correcting for known confounding factors. These confounding factors, which have been highlighted in earlier systematic reviews (Cohen et al., 2018; Santana et al., 2018; Hashemi-Nazari et al., 2020; Normann et al., 2020), include sociodemographic variables (age, urban residence, income and education), maternal factors (age at childbirth, parity, tobacco use and obesity), and relational factors (marital status, mother-infant bonding, and experience of violence in intimate relationships). Some of these factors, such as obesity, interact with psychosocial factors in a complex manner to influence breastfeeding outcomes (Lyons et al., 2018).

Methodology

The current study is an ecological association study, carried out in two stages. In the first stage, a preliminary investigation of the associations between cultural values, the prevalence of common mental disorders, and global breastfeeding statistics was carried out based on Hofstede's model of national cultural values (Hofstede et al., 2010). This analysis included 74 countries, and was exploratory, with no examination of potential confounding factors. In the second stage, an attempt was made to replicate the findings of the initial study in a larger data set of 122 countries, using an independent and more recently calculated measure of cultural individualism-collectivism known as the Global Collectivism Index (Pelham et al., 2022). At this stage, an attempt was made to correct for confounding factors known to influence the initiation and maintenance of breastfeeding.

Data sources

Breastfeeding

The primary source of data on breastfeeding for both stages of the study was UNICEF's 2018 report entitled "Breastfeeding: A Mother's Gift, for Every Child" (UNICEF, 2018). This report provides statistics on the percentage of mothers who have ever breastfed their child, arranged according to four income groups—high, high middle, low middle and low. This publication contains data on a total of 122 countries.

Cultural dimensions

Though various dimensional models of national culture exist, each of them has its own inherent limitations (Hsu et al., 2013). For the purpose of this study, Hofstede's dimensional classification of national cultural values was used as it provides data for a larger number of countries than competing models, and has been associated with several health-related behaviors in prior research (Mansyur et al., 2009; Masood et al., 2019; Matus, 2021). In the first stage of the study, data on national cultural values based on Hofstede's model was obtained *via* queries from the Hofstede Insights database (Hofstede Insights, 2022). This database provides estimates of national cultural values along six independent dimensions: *power distance, individualism-collectivism, masculinity-femininity, uncertainty avoidance, long-term orientation,* and *indulgence-restraint.* Each dimension is assigned a score ranging from 0 to 100. Higher or lower scores indicate that cultural values are closer to one end of a bipolar spectrum. For example, an individualism-collectivism score of 20 indicates high cultural individualism (closeness to the individualism "pole"), while a score of 90 denotes high cultural collectivism (closeness to the collectivism "pole") (Hofstede Insights, 2022). A description of these six dimensions and their potential influence on breastfeeding is provided in Table 1. Scores on the various dimensions of this model have been significantly associated with other health-related factors at a national level, such as obesity, prescription patterns for specific medications, and interactions between patients and the healthcare system (Borg, 2012; Borisova et al., 2017; Tekeş et al., 2019). The Hofstede Insights database contains data on 115 countries. Breastfeeding data from the UNICEF report was available for 74 of these 115 countries, and these were included in the first-stage analysis.

In the second stage of the study, data on the cultural dimension of *individualism-collectivism* was obtained from a recent publication on the Global Collectivism Index (GCI). The CGI was developed to address certain limitations with earlier measures of individualism-collectivism, most notably (a) a bias toward data from industrialized, high-income "Western" countries in earlier estimates, (b) a relative underrepresentation of African countries, and (c) cultural changes in certain countries previously considered "collectivistic," such as China and Japan, which impair the validity of earlier measures (Gerlach and Eriksson, 2021; Pelham et al., 2022). Estimates of the GCI are available for 188 countries. Breastfeeding data from the UNICEF report was available for 122 of these 188 countries, and these were included in the second-stage analysis.

Common mental disorders

Anxiety disorders and depression are commonly referred to as "common mental disorders" because of their high prevalence across populations and cultures (Steel et al., 2014). Both these conditions are often present during pregnancy and in the post-partum period, though they often go undiagnosed (Falana and Carrington, 2019). There is no existing data source on the prevalence of depression or anxiety disorders in pregnant or lactating women at a cross-national level. As an approximation to this variable, the prevalence of these disorders in women of child-bearing age (15–49 years) for the year 2018, based on estimates from the Global Burden of Disease Study, was used as an indirect measure of maternal mental health. This data was retrieved through a query from the Global Burden of Disease Collaborative Network database, which provides estimates of global and national prevalence for all major physical and mental disorders for the period 1990–2019 (Global Burden of Disease Collaborative Network, 2020).

Confounding factors

A number of factors have been found to significantly influence the initiation and maintenance of breastfeeding. For the purposes of this study, confounding factors were selected based on two considerations: (a) replicated evidence of an association between the concerned factor and breastfeeding outcomes, reported in a systematic review or meta-analysis, and (b) availability of a reliable data source for the concerned factor at a cross-national level. Based on examination of relevant systematic reviews and meta-analyses, the following factors satisfied criterion (a): maternal age, marital status, urban residence, maternal education, income, parity, maternal smoking, maternal body mass index, intimate partner violence, and mother-infant bonding (Cohen et al., 2018; Santana et al., 2018; Hashemi-Nazari et al., 2020). While mother-infant bonding cannot be easily quantified at a national level, and no reliable source of cross-national data was found for maternal marital status/single motherhood, information on the other variables was obtained from various sources. These are summarized in Table 2.

Data analysis

In the first, exploratory analysis, all study variables were tested for normality using the Shapiro-Wilk test. As none of the variables conformed to a Gaussian distribution ($p < 0.05$ for all variables, Shapiro-Wilk test), a cube root transformation was used prior to data analysis. Bivariate (Pearson's r) correlations were used to examine the following associations: (a) correlations between cultural dimensions and breastfeeding, (b) correlations between the prevalence of common mental disorders and breastfeeding, and (c) correlations between cultural dimensions and the prevalence of anxiety and depression. The threshold for significance was set at $p < 0.05$. In view of the exploratory nature of this analysis, corrections for multiple comparisons were not carried out at this stage. In the event of significant correlations being identified in (c), partial correlation analyses were carried out to examine the relative strength of the associations with cultural dimensions and common mental disorders.

In the second, confirmatory analysis, study variables were tested for normality using the same procedure. As a non-normal distribution was again observed for study variables ($p < 0.05$ for all variables, Shapiro-Wilk test), a cube root transformation was used prior to data analysis. Bivariate correlations were carried out as described above; in addition, correlations with the confounding factors listed in Table 2 were also examined. As this was a

TABLE 1 Description of Hofstede's cultural value dimensions and their potential relevance to breastfeeding initiation and maintenance.

Cultural dimension	Description	Possible influence on breastfeeding
Power distance	This score measures the extent to which inequality and hierarchy are expected and accepted; a society with high power distance is characterized by a "top-down" organization and dependence on authority. High scores indicate a greater power distance.	Cultural power distance may influence the pattern of interaction between mothers and infants; for example, high power distance may be associated with schedule-based rather than on-demand breastfeeding (Demuth, 2013).
Individualism-collectivism	This score measures the degree of interdependence among members of a society, and the extent to which individual rights are accorded privilege in comparison to community-related duties. High scores indicate a priority for individual rights and low interdependence (individualism); low scores indicate the prioritization of community rights and high interdependence (collectivism).	Collectivist social values may favor a family-based approach toward breastfeeding, in which this practice is encouraged and supported by the mother's relatives (Dornan et al., 2015).
Masculinity-femininity	Masculinity refers to social values favoring competition, accomplishment and measures of success at work, education, and so forth. Femininity refers to social values favoring nurturance, care for others and overall quality of life. High scores indicate a more "masculine" society, while low scores indicate a more "feminine" one.	Feminine values such as nurturing and caring for the weak and vulnerable may favor the initiation and maintenance of breastfeeding (Van Esterik, 1996). In contrast, an emphasis on competition and professional achievement may serve as a barrier to breastfeeding (Hanser and Li, 2017).
Uncertainty avoidance	Uncertainty avoidance refers to the way in which societies handle uncertainty or ambiguity regarding the future. A high score on this dimension indicates a high level of prior planning and ritual, a reluctance to carry out an action without precedents, and a tendency to carefully consider risk before embarking on a new project.	According to Hofstede, high cultural uncertainty avoidance may be associated with higher levels of anxiety (Hofstede et al., 2010); anxiety is known to be associated with impairments in the initiation and maintenance of breastfeeding (Fallon et al., 2016b; Hoff et al., 2019).
Long-term orientation	This score measures the extent to which a society maintains links with its past traditions as against facing present and future challenges. Low scores on this parameter indicate a preference for older traditions and norms and a resistance to change, while high scores indicate a more "practical" approach with a higher acceptance of modernity and an orientation toward the future.	Traditional beliefs and practices relating to the postnatal period and breastfeeding vary significantly across cultures. The impact of these customs on breastfeeding initiation and maintenance is mixed (Bandyopadhyay, 2009; Wren et al., 2015; Sharma et al., 2016) and may be more prominent in societies with a low long-term orientation score.
Indulgence-restraint	This score measures the extent to which a society attempts to control individual desires and impulses, especially those toward pleasure. High scores indicate a more "positive" attitude, characterized by optimism and a higher importance accorded to leisure time and pleasurable activities; low scores indicate a more pessimistic attitude and a high degree of restraint of individual impulses by social norms.	Women may perceive exclusive breastfeeding as imposing constraints on their leisure activities (Chow and Dong, 2013). In a society with a high indulgence score, the priority given to leisure time may hinder the maintenance of breastfeeding over time.

TABLE 2 Confounding factors influencing breastfeeding initiation and maintenance examined in this study, with their data sources.

Factor influencing breastfeeding	Variable included in analysis	Data source	Number of countries for which data was available
Maternal age	Median age at first birth in women aged 25–49	CIA World Factbook (The World Factbook, 2019)	89
Maternal parity	Total fertility rate (mean number of births per woman)	World Bank database (The World Bank, 2020)	122
Maternal education	Mean years of schooling per woman	United Nations Human Development Report (United Nations Development Programme, 2018)	115
Maternal body mass index	Mean body mass index, female adults	WHO Global Health Observatory (World Health Organization, 2016)	120
Maternal smoking	Prevalence of current tobacco use in women	World Bank database	107
Family income	Gross national income per capita, PPP method	United Nations Human Development Report (United Nations Development Programme, 2018)	122
Urban residence	Percentage of the total population residing in urban areas	World Bank database	122
Intimate partner violence	Estimated lifetime frequency of intimate partner violence in women aged 15–49, percentage	World Health Organization Report (World Health Organization, 2021)	101

confirmatory analysis, corrections for multiple comparisons were applied at this stage. Following this, a stepwise multivariate linear regression analysis was carried out to identify variables significantly associated with breastfeeding rates. In this analysis, the lifetime breastfeeding rate was the independent variable, and all factors significantly associated with this variable at $p < 0.05$ or lower in bivariate analyses were included as independent variables. In the event of significant multicollinearity between confounding factors, the factor most significantly associated with the independent variable in bivariate analyses was included in the model.

TABLE 3 Exploratory correlations between national lifetime breastfeeding rates, Hofstede's cultural values, and the prevalence of anxiety and depression in women aged 15−49.

Variables	1	2	3	4	5	6	7	8	9
	Breastfeeding, lifetime %	PD	I-C	M-F	UA	LTO	I-R	DEP	ANX
1	–	0.40	−0.53	−0.26	−0.01	−0.13	−0.11	−0.28	−0.40
		(<0.001)	(<0.001)	(0.028)	(0.940)	(0.306)	(0.422)	(0.017)	(<0.001)
2		–	−0.61	0.07	0.24	0.10	−0.30	−0.29	−0.45
			(<0.001)	(0.536)	(0.042)	(0.462)	(0.020)	(0.012)	(<0.001)
3			–	0.02	−0.20	0.07	0.25	0.42	0.41
				(0.865)	(0.088)	(0.576)	(0.055)	(<0.001)	(<0.001)
4				–	−0.08	−0.10	−0.06	−0.06	0.03
					(0.515)	(0.463)	(0.639)	(0.631)	(0.804)
5					–	−0.03	−0.14	0.19	0.24
						(0.798)	(0.280)	(0.109)	(0.041)
6						–	−0.38	−0.36	−0.32
							(0.004)	(0.005)	(0.012)
7							–	0.15	0.29
								(0.249)	(0.027)
8								–	0.49
									(<0.001)

PD, power distance; I-C, individualism-collectivism; M-F, masculinity-femininity; UA, uncertainty avoidance; LTO, long-term orientation; I-R, indulgence restraint; DEP, prevalence of depression (%) in women aged 15–49; ANX, prevalence of anxiety disorders (%) in women aged 15–49.
All results are given as Pearson's correlation coefficient (significance level). Values marked in italics are significant at p < 0.05.

Results

Exploratory analysis

The first stage of the analysis included data on 74 countries. Reported rates of lifetime breastfeeding by mothers in these countries ranged from a maximum of 99.4% in Sri Lanka to a minimum of 55% in Ireland, with a median of 95.8% and an inter-quartile range (IQR) of 4.4.

Bivariate correlations

A complete correlation matrix is presented in Table 3 and significant findings are illustrated graphically in Figures 1A–C. Lifetime rates of breastfeeding were positively correlated with the cultural dimension of power distance ($r = 0.39$, $p < 0.01$) and negatively correlated with the cultural dimensions of individualism-collectivism ($r = −0.53$, $p < 0.01$) and masculinity-femininity ($r = −0.26$, $p = 0.028$). Breastfeeding rates were negatively correlated with the prevalence of both depression ($r = −0.28$, $p = 0.017$) and anxiety disorders ($r = −0.40$, $p < 0.01$) in women of childbearing age.
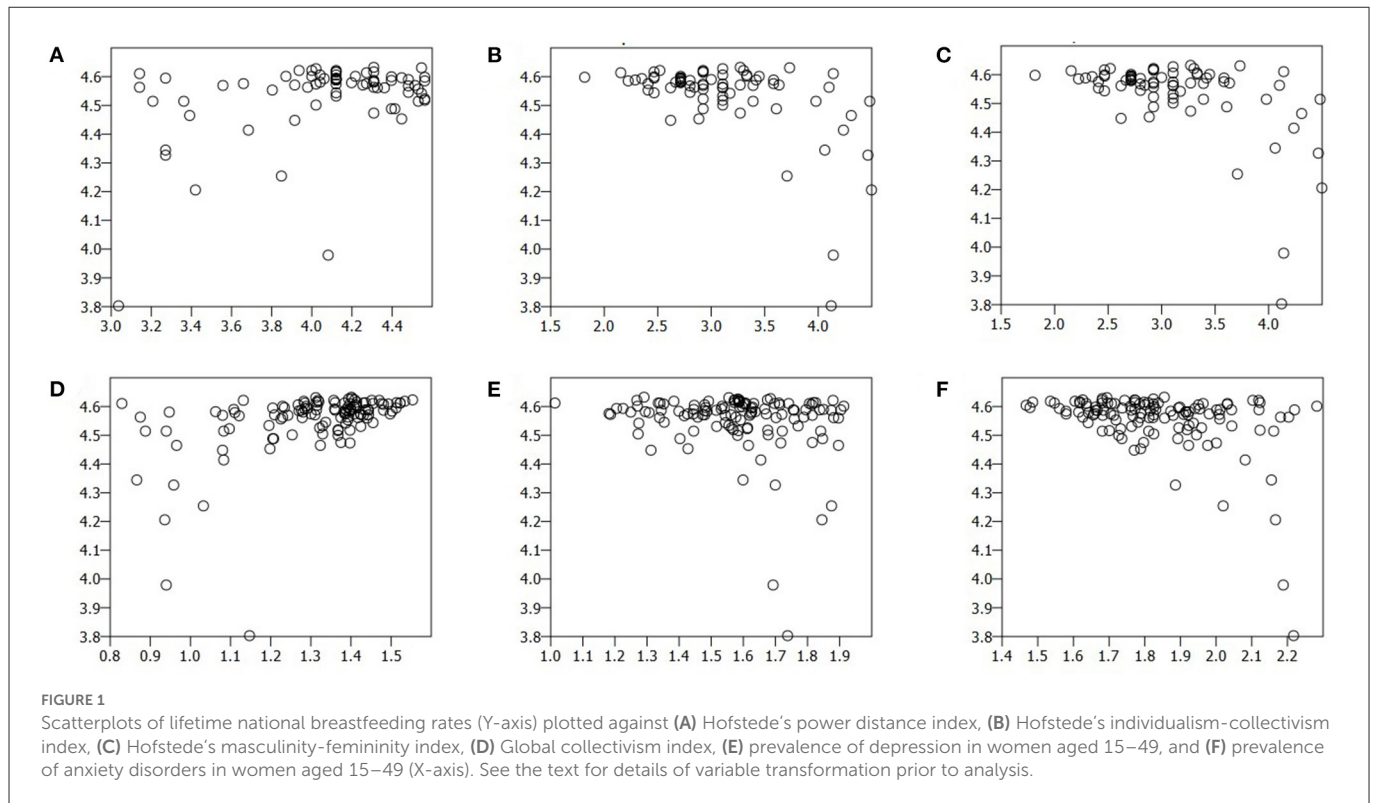
Examinations of correlations between independent variables revealed that the prevalence of both depression and anxiety disorders were negatively correlated with power distance and long-term orientation, and positively correlated with individualism-collectivism. In addition, anxiety was positively correlated with uncertainty avoidance and indulgence-restraint. The prevalence of depression and anxiety were modestly and positively correlated with each other ($r = 0.49$, $p < 0.01$).

Partial correlation analyses

When conditioned on the prevalence of depression and anxiety disorders, lifetime breastfeeding rates remained positively correlated with power distance (partial $r = 0.26$, $p = 0.03$) and negatively correlated with individualism-collectivism (partial $r = −0.43$, $p < 0.01$) and masculinity-femininity (partial $r = −0.28$, $p = 0.018$); though there was some attenuation of the strength of the associations with power distance and individualism-collectivism, these remained statistically significant. On the other hand, when conditioned on scores for power distance and individualism-collectivism, the associations between lifetime breastfeeding rates and the prevalence of depression (partial $r = −0.07$, $p = 0.569$) and anxiety disorders (partial $r = −0.22$, $p = 0.063$) were no longer significant, though there was a trend toward a negative association with anxiety disorders.

Confirmatory analysis

The second stage of the analysis included data on 122 countries. The maximum and minimum reported values for lifetime breastfeeding were the same as those noted above, while the median (IQR) for the larger sample was 96.3 (4.2). When breastfeeding rates were compared between high-, high middle-, low middle- and low-income countries, a significant difference was noted across groups overall (Kruskal–Wallis $H = 30.1$, $p < 0.01$). *Post-hoc* examination of the data revealed that between-group differences were significant only between high-income countries and the other three groups ($p < 0.001$ for all comparisons); no significant difference could be identified between the high middle, low middle and low-income countries.

FIGURE 1
Scatterplots of lifetime national breastfeeding rates (Y-axis) plotted against **(A)** Hofstede's power distance index, **(B)** Hofstede's individualism-collectivism index, **(C)** Hofstede's masculinity-femininity index, **(D)** Global collectivism index, **(E)** prevalence of depression in women aged 15−49, and **(F)** prevalence of anxiety disorders in women aged 15−49 (X-axis). See the text for details of variable transformation prior to analysis.

Bivariate correlations

A complete correlation matrix is presented in Table 4 and significant associations are depicted graphically in Figures 1D–F. Breastfeeding rates were positively correlated with the GCI ($r = 0.47$, $p < 0.01$) and negatively correlated with the prevalence of anxiety disorders ($r = -0.40$, $p < 0.01$) and depression ($r = -0.19$, $p = 0.035$); however, the association with depression was weak and did not survive correction for multiple comparisons. The prevalence of anxiety disorders was negatively correlated with the GCI ($r = -0.33$, $p < 0.01$), but no significant association between the GCI and the prevalence of depression was noted ($r = -0.02$, $p = 0.810$). The prevalence of anxiety and depression were correlated positively, with a strength similar to that observed in the exploratory analysis ($r = 0.39, p < 0.01$).

All the confounding factors examined in this stage of the study were significantly correlated with breastfeeding rates. Moderate negative correlations with the breastfeeding rate were observed for maternal age at first birth ($r = -0.54$, $p < 0.01$), per capita income ($r = -0.49$, $p < 0.01$) and tobacco use in women ($r = -0.42$, $p < 0.01$), whereas weak negative correlations were observed for mean years of education in women ($r = -0.37$, $p < 0.01$), urbanization ($r = -0.29, p < 0.01$) and mean body mass index in women ($r = -0.18$, $p = 0.049$). Weak positive correlation between the total fertility rate and the breastfeeding rate ($r = 0.35$, $p < 0.01$), and between the prevalence of intimate partner violence and the breastfeeding rate ($r = 0.24$, $p = 0.018$), were observed. All these correlations, except the associations with body mass index, urbanization, and intimate partner violence, remained significant after correction for multiple comparisons.

When examining correlations between the GCI, the prevalence of common mental disorders, and these confounding factors, it was noted that the GCI was positively correlated with the total fertility rate ($r = 0.78$, $p < 0.01$) and negatively correlated with all other confounders, with particularly strong associations noted for age at first birth ($r = -0.84$, $p < 0.01$), per capita income ($r = -0.79$, $p < 0.01$) and women's education ($r = -0.74$, $p < 0.01$). The prevalence of depression in women of childbearing age was significantly but weakly correlated with urbanization ($r = 0.22$, $p = 0.013$). On the other hand, the prevalence of anxiety disorders in this population was moderately and positively correlated with per capital income, weakly positively correlated with urbanization, age at first birth, mean female body mass index, women's education and tobacco use, and weakly negatively correlated with the total fertility rate. The prevalence of intimate partner violence was positively correlated with the GCI, the prevalence of depression, and the total fertility rate, and negatively correlated with age at first birth, women's education, urbanization and tobacco use.

Partial correlation analyses

When conditioned on the GCI, lifetime breastfeeding rates remained negatively associated with the prevalence of anxiety disorders ($r = -0.29$, $p < 0.01$); similarly, when conditioned on the prevalence of anxiety disorders, the GCI remained positively correlated with the breastfeeding rate ($r = 0.39$, $p < 0.01$). No such analysis was attempted for the prevalence of depression, as it was not significantly correlated with the GCI.

Multivariate analysis

All variables significantly associated with the lifetime breastfeeding rate at $p < 0.05$ were included in this model. As there was significant multicollinearity between the gross national income and the age at first childbirth ($r = 0.85$, $p < 0.01$), the latter

TABLE 4 Confirmatory correlations between national lifetime breastfeeding rates, individualism-collectivism, the prevalence of anxiety and depression in women aged 15−49, and confounding factors.

Variable	1	2	3	4	5	6	7	8	9	10	11	12
	BF	GCI	DEP	ANX	AGE	BMI	EDU	TFR	TOB	GNI	URB	IPV
1	–	0.47 (<0.001)	−0.19 (0.035)	−40 (<0.001)	−0.54 (<0.001)	−0.18 (0.049)	−0.37 (<0.001)	0.35 (<0.001)	−0.42 (<0.001)	−0.49 (<0.001)	−0.29 (0.001)	0.24 (0.018)
2		–	−0.02 (0.822)	−0.33 (<0.001)	−0.84 (<0.001)	−0.28 (0.002)	−0.74 (<0.001)	0.78 (<0.001)	−0.49 (<0.001)	−0.79 (<0.001)	−0.56 (<0.001)	0.48 (<0.001)
3			–	0.39 (<0.001)	−0.08 (0.431)	0.13 (0.175)	−0.08 (0.427)	0.151 (0.097)	0.017 (0.858)	0.053 (0.559)	0.224 (0.013)	0.25 (0.013)
4				–	0.38 (<0.001)	0.37 (<0.001)	0.33 (<0.001)	−0.35 (<0.001)	0.31 (0.001)	0.44 (<0.001)	0.36 (<0.001)	−0.07 (0.485)
5					–	0.29 (0.005)	0.72 (<0.001)	−0.78 (<0.001)	0.58 (<0.001)	0.85 (<0.001)	0.50 (<0.001)	−0.60 (<0.001)
6						–	0.56 (<0.001)	−0.36 (<0.001)	0.03 (0.689)	0.41 (<0.001)	0.38 (<0.001)	−0.13 (0.198)
7							–	−0.76 (<0.001)	0.37 (<0.001)	0.74 (<0.001)	0.58 (<0.001)	−0.42 (<0.001)
8								–	−0.49 (<0.001)	−0.74 (<0.001)	−0.50 (<0.001)	0.59 (<0.001)
9									–	0.35 (<0.001)	0.18 (0.061)	−0.25 (0.016)
10										–	0.69 (<0.001)	−0.50 (<0.001)
11											–	−0.42 (<0.001)

BF, lifetime breastfeeding rate; GCI, Global Collectivism Index; DEP, prevalence of depression (%) in women aged 15–49; ANX, prevalence of anxiety disorders (%) in women aged 15–49; AGE, mean maternal age at first birth; BMI, mean body mass index (kg/m^2) in women; EDU, mean years of education for women; TFR, total fertility rate (number of births per woman); TOB, prevalence of tobacco use in women; GNI, gross national income per capita; URB, percentage of the population living in urban areas; IPV, prevalence of intimate partner violence (%) in women aged 15–49.

All results are given as Pearson's correlation coefficient (significance level). Values marked in italics are significant at p < 0.05.

TABLE 5 Stepwise multivariate linear regression analysis of variables significantly associated with national lifetime breastfeeding rates.

Variable	Linear regression coefficient (β)	Significance level	Part correlation	Variance inflation factor
Age at first birth (years)	−0.39	<0.001	−0.36	1.18
Prevalence of anxiety disorders in women aged 15–49 (%)	−0.34	0.002	−0.32	1.18

The following variables were excluded from the final model due to a lack of statistical significance: Global Collectivism Index, prevalence of depression in women aged 15–49, total fertility rate, women's education, urbanization, body mass index, and prevalence of intimate partner violence in women aged 15–49.

variable was included in the model as it was more significantly correlated with the breastfeeding rate. The final model is presented in Table 5 and included only two variables: maternal age at first birth ($\beta = -0.39$, $p < 0.001$) and prevalence of anxiety disorders in women aged 15–49 ($\beta = -0.34$, $p = 0.002$). This model attained statistical significance overall ($F = 20.41$, $p < 0.001$), and explained around 36% of the variance in national breastfeeding rates ($R^2 = 0.38$, adjusted $R^2 = 0.36$).

Similar results were obtained when the regression analysis was carried out using alternate methods ("enter," forward and backward): age at first birth and prevalence of anxiety disorders remained significantly associated with breastfeeding rates.

Discussion

In the current study, the exploratory analysis found support for the hypotheses that both cultural factors and maternal mental health were associated with cross-national variations in breastfeeding rates. While the confirmatory analysis was able to replicate the association between mental health factors—particularly anxiety—and breastfeeding rates, even after controlling for several confounding factors, a direct association with cultural dimensions could not be established. These findings and their implications are discussed below.

Relationships between culture and breastfeeding

In the current study, lifetime breastfeeding rates were found to be associated with three cultural dimensions in the initial analysis: power distance, individualism-collectivism and masculinity-femininity. Countries with higher breastfeeding rates tended to be characterized by a higher power distance, greater collectivism and more feminine values. In the confirmatory analysis, cultural collectivism remained associated with breastfeeding rates in the bivariate analysis, but was excluded from the final regression model. However, cultural collectivism was strongly correlated with both the variables in this model—age at first birth and the prevalence of anxiety disorders in women—suggesting that it may have influenced breastfeeding rates through its influence on these intermediate variables.

There are several mechanisms through which cultural values may influence breastfeeding rates. A collectivist cultural orientation may privilege the mother-infant dyad, and may be associated with greater family support for the initiation and maintenance of breastfeeding. Moreover, collectivist cultural values are associated with a greater fertility rate (Levine et al., 1995; Basabe and Ros, 2005; Pelham et al., 2022), which may be associated with more successful breastfeeding

outcomes. On the other hand, a woman in an individualist culture may feel pressured to resume academic or professional duties soon after the birth of her child, and may receive less social support (Corrigan et al., 2015). There is also some evidence that pro-social values are positively associated with mother-infant bonding, while values centered on personal financial success impair the mother-infant bond (Jin et al., 2012; Obikane et al., 2020). Likewise, it is logical to assume that cultures with a more feminine orientation would be more oriented toward successful breastfeeding, as this cultural orientation is associated with values such as nurturance, care for the weak and the maintenance of stable and secure relationships. Feminine cultures may be associated with greater levels of responsiveness and support in childcare activities from husbands (Hofstede et al., 2010), which can also lead to better breastfeeding outcomes (Davidson and Ollerton, 2020). When correcting for other cultural values associated with breastfeeding, the link with a feminine cultural orientation was strengthened rather than attenuated (partial $r = 0.30$, $p = 0.009$), suggesting that this association may merit further investigation.

It is not immediately clear why power distance should be associated with breastfeeding rates, as this cultural value may be associated with a less flexible and less infant-centered approach to breastfeeding (Demuth, 2013). However, it should be noted that in the dataset analyzed in this study, power distance was strongly correlated with individualism-collectivism as well as with the prevalence of depression and of anxiety disorders (Table 3). When these associations were accounted for, the link between power distance and breastfeeding rates was weak and not statistically significant (partial $r = 0.08$, $p = 0.494$).

Despite the plausibility of these associations, it should be emphasized that a significant association between cultural values and breastfeeding was not established in the second phase of this study. It is therefore likely that these associations—if genuine and not due to chance—may be mediated by intermediate social and demographic factors, or by the effects of culture of mental health.

Relationship between mental health variables and breastfeeding

Maternal mental health has sometimes been described as the "neglected" component of maternal and child health (Rahman et al., 2008). Despite the availability of extensive data on the relationship between maternal maternal health and infant outcomes, this aspect of maternal health tends to be neglected, particularly in low- and middle-income countries where there are already significant constraints on the availability of manpower and infrastructure (Nakku et al., 2016). Though it was formerly assumed that depression and anxiety were rare during pregnancy, current evidence suggests that this is not the case; it is estimated that the prevalence of

antepartum depression is around 15–16%, which is comparable to the estimated prevalence (18%) of post-partum depression (Hahn-Holbrook et al., 2018; Okagbue et al., 2019). Maternal depression or anxiety can interfere with successful bonding between a mother and her child (Tolja et al., 2020; Höflich et al., 2022), leading to difficulties in the dyadic interactions that are an essential part of breastfeeding. The neuroendocrine changes associated with these disorders, such as altered patterns of cortisol secretion, may also interfere with successful breastfeeding (Spratt et al., 2016; Bublitz et al., 2019). Women with depression may also be more likely to cease breastfeeding prematurely if they perceive themselves as being overwhelmed by other duties (Bascom and Napolitano, 2016).

In both stages of this study, breastfeeding rates were inversely correlated with the prevalence of depression and anxiety disorders in women aged 15–49. This association was stronger for anxiety disorders than for depression, and remained significant even after correcting for other variables strongly associated with breastfeeding outcomes. A meta-analytic review of 28 studies found that around 20.7% of women fulfilled criteria for an anxiety disorder either during pregnancy or in the post-partum period (Fawcett et al., 2019). A more recent meta-analysis, focused on low- and middle-income countries, replicated these findings, with 25–30% of women experiencing significant anxiety symptoms during this period, 8% receiving an anxiety disorder diagnosis during pregnancy, and 16% receiving such a diagnosis post-natally (Nielsen-Scott et al., 2022). It can be seen from these results that anxiety disorders during and after childbirth occur at a frequency comparable to that of post-partum depression.

From a mechanistic perspective, anxiety may interfere with milk production and ejection *via* elevations in cortisol, increased insulin resistance and reduced oxytocin release (Nagel et al., 2022), and can also impair a mother's sense of self-efficacy, leading to a loss of confidence in her ability to sustain breastfeeding over time (Corby et al., 2021; Melo et al., 2021). Anxiety during pregnancy has been linked to a lower likelihood of initiating breastfeeding (English et al., 2020), a shorter duration of breastfeeding (Riedstra and Aubuchon-Endsley, 2019; Stuebe et al., 2019), and an earlier introduction of formula feeds (Stuebe et al., 2019). Anxiety in the post-natal period has been associated with a shorter duration of exclusive breastfeeding (Davies et al., 2022), a lower likelihood of colostrum feeding (Sun et al., 2020), increased rates of bottle feeding (Sun et al., 2020), and reduced rates of exclusive breastfeeding at 3 months after delivery (Coo et al., 2020). Thus, the association found in this study between the prevalence and anxiety of disorders and lower breastfeeding rates is both biologically plausible and supported by the results of studies in individual mother-infant dyads.

Relationships between breastfeeding and other demographic or health-related variables

In the confirmatory component of this study, the association between breastfeeding rates and all the variables listed in Table 2 was replicated. The strengths of these associations were comparable to those identified for cultural or mental health variables. These findings suggest that the variables associated with the initiation or maintenance of breastfeeding in individuals also show a similar relationship at a population level. While the prevalence of depression was not significantly correlated with any of these variables

except urbanization, both cultural individualism-collectivism and the prevalence of anxiety were significantly correlated with several of these variables. The relationship between demographic variables and cultural values is complex (Hofstede et al., 2010; Pelham et al., 2022). On multivariate analysis, the only demographic variable significantly associated with breastfeeding was the age at first birth; a lower age was associated with higher breastfeeding rates. This result should be interpreted with caution given that some authors have found a positive association between higher maternal age and breastfeeding continuation in large samples of mother-infant dyads (Tracz and Gajewska, 2020; Chooniedass et al., 2021), while others have reported results in line with this study's findings (Ballesta-Castillejos et al., 2021; Dong et al., 2022). There is also some evidence to suggest that breastfeeding may be optimal in mothers aged 26–35—in other words, both maternity at a very early age and advanced maternal age may be associated with reduced breastfeeding rates (Moshi et al., 2021). Moreover, age at first birth was significantly collinear with variables such as individualism-collectivism ($r = -0.84$), total fertility rate ($r = -0.78$) and gross national income ($r = 0.85$). Thus, it is not clear to what extent this finding can inform strategies aimed at improving breast feeding.

The interaction between culture, intimate partner violence, and mental health

Recent literature has drawn attention to the role of intimate partner violence, whether physical, psychological or sexual in nature, as a significant barrier to breastfeeding (Normann et al., 2020). In the current study, the prevalence of IPV was weakly but positively correlated with national breastfeeding rates ($R^2 = 0.006$, Bonferroni adjusted $p > 0.2$). At first glance, this finding seems paradoxical. However, it should be noted that in the Normann et al. meta-analysis, no significant association between IPV and breastfeeding initiation could be found in 5 of the 6 studies reviewed; more significant effects of IPV were observed for the maintenance of breastfeeding and exclusive breastfeeding. Thus, it is possible that the noxious effects of IPV may be observed more clearly when examining rates of continuous breastfeeding. In the current study, IPV was positively correlated with both the prevalence of depression and the Global Collectivism Index. Prior research has identified cultural collectivism as contributing to IPV through its emphasis on family and group cohesiveness and "saving face" at the expense of the health and wellbeing individual women (Do et al., 2013; Sears, 2021; Natal, 2022), particularly in low- and middle-income countries. Thus, the overall impact of collectivism on breastfeeding may be complex, involving a combination of positive effects (mediated through social support and reduced depression or anxiety) and negative effects (mediated through intimate partner violence and the enforcement of strict gender-related norms) (Jackson et al., 2022). The current data supports this contention: when taking IPV into consideration, the apparent positive association between cultural collectivism and breastfeeding reduces in significance (unadjusted $r = 0.47$, adjusted $r = 0.38$). Such findings can be seen as supporting an ecological systems approach to understanding breastfeeding, in which both large- and small-scale systemic factors interact to determine long-term outcomes (Jackson et al., 2022). Further examination of the effects of IPV on mental health and breastfeeding outcomes is certainly warranted on the basis of the current results.

Implications of the study findings for the communication of breastfeeding benefits

Cultural sensitivity

The study findings suggest the possibility of a direct or indirect link between cultural values and breastfeeding rates. As noted by earlier authors, attempts to modify health-related behaviors are likely to be ineffective if they are not adapted to specific cultures and settings. Without the involvement of local social networks and communities, the dissemination of information on the benefits of breastfeeding for a mother and her child is likely to have limited efficacy (Contractor and DeChurch, 2014; Kumar et al., 2015). This was illustrated in a recent study of online breastfeeding information provided to Aboriginal women in Australia, which found that only 4 of 31 of the reviewed sites provided information and advice in a culturally appropriate manner (Hopkins et al., 2021).

The manner in which this information is conveyed to mothers and their families, as well as the source providing this information, can both influence health outcomes. Educational interventions aimed at improving breastfeeding outcomes can positively impact a mother's self-efficacy, but these should be delivered in a manner that is adapted to local cultural values (Chipojola et al., 2020). Similar considerations apply to individual or group counseling approaches. For example, in a collectivist society, the involvement of extended family members or older women in a local community as "peer educators" may favorably affect health-related outcomes (Martin et al., 2015). On the other hand, in a society with individualistic values, such a method may be seen as interfering with a mother's self-efficacy and autonomy. In such a setting, the provision of "responsive support" by a woman's husband or partner, intended to promote her sense of self-efficacy in breastfeeding, may be a more appropriate strategy (Davidson and Ollerton, 2020), as would. individual or group interventions aimed at improving breastfeeding self-efficacy (Leahy-Warren et al., 2017; Galipeau et al., 2018; Leeming et al., 2022). In collectivist societies, individual and family attitudes toward breastfeeding may be shaped by traditional beliefs and practices, and it is important that healthcare workers address these in a non-confrontational manner, even when these appear to be in opposition with scientific evidence (Bandyopadhyay, 2009; Newbrander et al., 2014). At the same time, these beliefs should not be accepted unquestioningly, and mothers should be involved in the decision-making process regarding their own feeding plans and practices (Sharma and Byrne, 2016). Those involved in providing breastfeeding support should ensure that unsupportive or hostile attitudes and beliefs are discarded, whether these arise from family members or from healthcare workers unfamiliar with the sensitive nature of this work (Sharma and Byrne, 2016; Pezley et al., 2022). Finally, it is essential that those seeking to provide help to breastfeeding mothers familiarize themselves with the unique social, cultural and economic contexts of women from specific communities, particularly if they face other forms of discrimination or marginalization (Gyamfi et al., 2021).

Similar considerations arise when considering the masculinity-femininity dimension, which was also found to be associated with breastfeeding rates in this study. Countries with masculine values place a strong emphasis on competitiveness and achievement; in such settings, communicating the benefits of breastfeeding for a child's cognitive and educational achievement may be beneficial when advising mothers (LeWinn et al., 2020; Plunkett et al., 2021). Cultural masculinity is also associated with a stricter segregation of gender roles in the family, in which "fathers deal with facts, and mothers deal with feelings" (Hofstede et al., 2010). In such settings, attempting to leverage emotional support from a husband or partner may be unsuccessful; instead, peer groups involving mothers facing common challenges, who are able to support each other emotionally, may be more beneficial (Leahy-Warren et al., 2017). On the other hand, countries with feminine values place a greater emphasis on social bonds, cooperation and nurturing, and parental responsibilities are more equally shared in households. In such cultures, involving a husband or partner in efforts to support breastfeeding may be more effective (Grandahl et al., 2020), and communicating the benefits of breastfeeding in terms of mother-child bonds (Linde et al., 2020; Roth et al., 2021) and child social behavior (Reynolds et al., 2014) may be a more optimal strategy.

In developed countries, a special problem is posed by migrant women who experience a clash between the values of their country or culture of origin, and those of their "new" country, when initiating or continuing breastfeeding (Gallegos et al., 2015; Hohl et al., 2016). In such cases, those involved in providing maternal and health care should be aware of the beliefs and practices associated with breastfeeding in both cultures, and provide advice and guidance in a culturally sensitive manner.

Recognition and management of maternal anxiety and depression

Anxiety disorders and depression are common and occur at roughly equal rates both during pregnancy and in the postpartum period. Evidence from studies in general population samples suggests that these disorders co-occur frequently (Saha et al., 2021), and a meta-analysis of studies involving pregnant and post-natal women found that ~9% of women qualified for both diagnoses during pregnancy, and 4% in the post-partum period (Falah-Hassani et al., 2017). In addition to diagnosed or "syndromal" disorders, many mothers experience "sub-threshold" symptoms of anxiety or depression, which cause significant distress but do not fulfill the criteria for a psychiatric diagnosis (Andersson et al., 2006; Meaney, 2018; Rizzo et al., 2022). The impact of peripartum mental health on breastfeeding practices appears to remain significant even after correcting for demographic factors (Wouk et al., 2017).

Effective screening tools for the diagnosis of these conditions exist, and they can be managed effectively through individual or group psychological interventions, as well as through integrated interventions aimed at improving physical health and nutritional status (Kroska and Stowe, 2020; Yahya et al., 2021). However, diagnostic tools require adaptation to be understandable in non-Western cultural contexts (Green et al., 2018), and significant barriers in terms of budgetary allocation, infrastructure and manpower may compromise the provision of maternal mental health care in low- and middle-income countries (Hanlon et al., 2016). The acceptability of specific forms of treatment, particularly pharmacological therapies, may be low in certain cultures (Azale et al., 2016; Simhi et al., 2019). Cultural values can also influence the stigma associated with mental illness: in collectivist cultures, having a family member with a mental illness may be associated with shame a loss of "face," leading to social stigma. On the other hand, in individualist cultures, a depressed or anxious individual's inability to achieve certain goals or perform certain tasks may lead to a sense of guilt and self-stigma. In both cases,

the result is reduced help-seeking, though the causal mechanisms differ (Abdullah and Brown, 2011; Ran et al., 2021).

These considerations suggest that the incorporation of a mental health component into programmes aimed at communicating the benefits of breastfeeding would be beneficial for both the mother and her child. In settings where formal visits to a health center are difficult, or where formal resources are limited, community-based psychological interventions, delivered at home by non-specialists, may be equally effective (Brock et al., 2017). Group-based approaches may also be helpful in reducing both perinatal anxiety and its endocrine correlates, and is cost-effective in low-income settings (Urizar et al., 2019). Components of these interventions could fruitfully be incorporated into broader programmes aimed at optimizing maternal and child health outcomes, and adapted to the needs of specific cultures (George et al., 2020). It is also essential to screen for the possibility of intimate partner violence in breastfeeding mothers with significant anxiety and depression, but this must be done with sensitivity and in a manner acceptable to them. In many non-Western cultures, women are reluctant to report IPV spontaneously, even when it has a significant impact on their physical and mental health (Ting and Panchanadeswaran, 2009; Sears, 2021). Given the existing evidence on the links between IPV, maternal mental health, and breastfeeding outcomes (Normann et al., 2020; Tran et al., 2020), it is crucial not to neglect this aspect of assessment when women present with difficulties in initiating or maintaining breastfeeding.

Limitations

This study is subject to certain important limitations. First, it is based on analyses of survey data and estimates of disease burden, which are subject to error related to the sampling strategies and statistical methods used. Second, as it is based on a cross-sectional analysis of data, the study findings cannot be used to draw any firm conclusions regarding causality (for example, the association between breastfeeding and mental health disorder may indicate a beneficial effect of the former on the latter, a deleterious effect of the latter on the former, or a combination of both). Third, as it is based on population-level data, the study findings cannot be directly extrapolated to individuals; population-level findings are subject to the "ecological fallacy" (Roumeliotis et al., 2021) and cannot be translated directly into individual-level recommendations. Fourth, it is highly likely that breastfeeding outcomes may be influenced by other variables that were not included in this study, but exert a significant effect at an individual level: these include maternal employment and workplace policies (Vilar-Compte et al., 2021), marital and family discord (Ahmed et al., 2022), intimate partner violence (Miller-Graff et al., 2018; Da Thi Tran et al., 2022), and health literacy, which is distinct from educational attainment (Haaland and Sitaraman, 2022). Fifth, the outcome variable used in this study was the rate of "ever having breastfed;" thus, this study cannot distinguish between factors associated with the initiation of breastfeeding and those associated with its maintenance over a period of 6 months. Sixth, caution must be exercised when interpreting findings related to culture. Though cultural dimensions are useful constructs when making country-level comparisons, they are abstract entities and should not be "reified" for the purpose of generalizations (such as "individualistic values are a barrier to breastfeeding" or "femininity

is better than masculinity in the context of breastfeeding"). Rather, the various beliefs and behaviors contained within each dimension should be examined in a more fine-grained manner, to obtain a more balanced view of the impact of culture on individual mother-infant dyads (Van Esterik, 1996). Seventh, certain other variables that could interfere with the initiation of breastfeeding, such as childhood adversity and traumatic birth experiences, could not be examined as there was no cross-national data available. Eighth, it was possible to carry out a confirmatory analysis only for individualism-collectivism, as there is no other larger or more recent data source for power distance or masculinity-femininity. Finally, increased industrialization, economic development and urbanization has led to cultural changes in several countries (Pelham et al., 2022). This should be taken into account when examining the effect of culture on breastfeeding practices and outcomes.

Conclusions

Despite certain limitations inherent in the methodology adopted, the current study is consistent with existing evidence on the relationships between culture, mental health and breastfeeding. This study also extends the results of prior studies by highlighting the potential contributions of specific cultural values (such as individualism-collectivism and masculinity-femininity) and the role of maternal anxiety as a barrier to successful breastfeeding. These findings provide valuable leads for further cross-national, individual-level research on the socio-cultural and psychological factors influencing the initiation and maintenance of breastfeeding, which could be extended through both quantitative and qualitative research across nations and cultures (Leeming et al., 2017). More importantly, these findings can also be used to improve existing information, education and communication strategies to improve breastfeeding outcomes, and to develop innovative approaches to addressing cultural concerns and maternal mental health in a sensitive and inclusive manner. The incorporation of cross-cultural and mental health components into such programmes, if done correctly, could lead to a "socially sensitive" approach to breastfeeding (Leeming et al., 2013) which would entail "listening to women's voices" across diverse cultures (Ting and Panchanadeswaran, 2009). Such an approach could lead to greater equity in breastfeeding practices at a global level (Gyamfi et al., 2021; Vilar-Compte et al., 2021; North et al., 2022), leading to better health outcomes for both mothers and their children.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the author, without undue reservation.

Author contributions

RR: design, data collection, data analysis, writing, and editing.

Conflict of interest

The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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