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Stress and its associated factors in mothers with preterm infants in a private tertiary care hospital of Karachi, Pakistan: An analytical cross sectional study

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Title Page

Article Title: Stress and its associated factors in mothers with preterm infants in a private tertiary care hospital of Karachi, Pakistan: An analytical cross sectional study

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Abstract

Objectives This research’s goal is to present a thorough method for evaluating stress and the elements that contribute to it in mothers of premature babies.

Design Analytical cross sectional study

Setting Data was collected from inpatient service for preterm infants including neonatal intensive care unit (NICU), and neonatal step-down units of The Aga Khan University Hospital (AKUH) a private tertiary care hospital in Karachi Pakistan.

Participants Mothers aged 18 years and above who delivered preterm infants (gestational age of preterm below 37 weeks) in a private tertiary care hospital in Karachi, Pakistan.

Primary Outcome Stress in mother with preterm infants

Results 200 participants with a mean age of 30.12 years ($SD \pm 5.21$) were assessed. The level of stress identified using the perceived stress scale (PSS) among mothers who had delivered preterm infants was significantly higher as compared to other countries around the world. Based on the criteria of PSS scoring, the majority of the participants i.e., 92% (n=184) of the mothers, were categorized as having high perceived stress and 8% (n=16) of the mothers fell into the category of moderate stress.

Conclusions The study findings suggest high levels of perceived stress among mothers with preterm infants. The factors associated with the stress among mothers with preterm infants included immunization of newborn, education and occupation status of mothers, substance abuse by mother, gender preference from family, planning for further children, consumption of balance diet, education status of husband, mode of socialization, years in marriage, and hours of sleep.

Keywords Obstetrics, maternal medicine, psychological stress, stress

Intervention None

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Competing Interests None

Patient and Public Involvement Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Author's Disclaimer We guarantee that the manuscript has not been published or is being considered for publication elsewhere.

Author Contributions

The study was conceptualized and designed by Yasmin Parpio and Tazeen Ali. Salima Akbar was involved in data collection, writing of the manuscript's initial draft, revision and proofreading of the manuscript. Afshan Akber critically reviewed and proof read the manuscript multiple times. Yasmin Parpio also critically reviewed the manuscript. Yasmin Parpio and Sumia Andleeb Abbasi was involved in data analysis. The final draft of the manuscript was read and approved by all authors (SA, YP, AA, TA and SAA).

Data Availability Statement

All data relevant to the study are included in the article.

Acknowledgment

I would like to thank His Highness Prince Karim Aga Khan for providing me the opportunity to fulfill my dreams in his prestigious university.

Article Summary

Strengths and Limitation of this Study

Following are the strengths of the research study:

- To the researcher’s best knowledge, this is the first study that assessed the level of stress among mothers with preterm infants in Karachi, Pakistan.
- The questionnaire used for the study was a self-developed tool that was approved by the experts in the required fields and content validity index (CVI) was run for the tool resulting in a satisfactory rating.
- The PSS tool used in the study has been validated nationally and internationally, in various languages, and has also been administered to similar groups of participants as in the current study, i.e., mothers with preterm infants, in different parts of the world.
- This study has provided a base for future studies in the concerned field, in the Pakistani context and a reference for future studies in low and middle income countries (LMIC) and high income countries (HIC).

The limitations of the research study are as follows:

- This study was conducted in a private hospital; therefore, its findings cannot be generalized to the mothers who delivered preterm infants in government settings.

Introduction

In the context of obstetrics, 'preterm' refers to delivery of an infant prior to the completion of 37 weeks of pregnancy (1). Compared to term newborns, preterm infants have different needs. Preterm babies are more likely to experience infections, hypothermia, poor suck reflex, difficulty feeding, effort to gain weight, and impaired lung maturation (2).

Preterm births are escalating, globally. Each year, approximately 15 million newborns are delivered preterm globally (3). One of the reasons for the substantial neonatal deaths prevalence is preterm births which account for 28% of all neonatal deaths worldwide (4). Almost 45% of the children who die below the age of five are newborns; amongst these 60–80% are those born prematurely (2).

Pakistan is determined to work on this challenging issue, as Pakistan is ranked third in the world for neonatal mortality and accounts for about 7% of the universal neonatal death (5). Moreover, the high burden of neonatal morbidity and mortality rates in the nation can be attributed to preterm births. The prevalence of neonatal mortality in Pakistan is that for every 1000 live births, there are 42 neonatal deaths (6). Furthermore, to achieve sustainable development goal 3.2, which states to reduce neonatal and below 5 mortalities, the matter of preterm births needs to be addressed. Amongst the four provinces of Pakistan, Balochistan has the highest prevalence of neonatal mortality at, 63 deaths per 1000 live births (6).

Stress can be described as an innate response of an individual to undesirable circumstances that disturbs body equilibrium and stability (7). Stress upon the birth of preterm infants produces physical and psychological stressors for both the newborn and the mothers. The need for intensive care treatments, feeding difficulties, and low birth weight (LBW) are among

the physical challenges for preterm infants. These physical problems for the newborn often lead to psychological impacts on the health of the mothers as well. Preterm infants may have enduring effects of prematurity, preoccupation with the survival of the newborn leading to the development of stress, depression, and post-traumatic stress disorders in mothers (8). The mother-child bond is at risk when a preterm infant is born because of the early detachment of the infant from the mother, due to the aggressive treatment requisites for the newborn. A mother's stress stemming from a particular course of treatment for her preterm infant hinders the development of a stable parent-child bond (9).

The incidence of postpartum depression in Pakistan is 63.3% (10). Preterm births potentially create disturbing effects on the newborn, while simultaneously initiating distressing challenges for the mothers. These difficult challenges account for the advancement of stress resulting in high levels of depression in some mothers (11). Furthermore, this challenging issue makes the mother of a preterm more prone to mental instabilities, in contrast to mothers of term babies. The incidence of stress in mothers with preterm infants is as elevated as 30-40% in contrast to 6-12% in mothers with infants born at the completion of the gestational period (12). In the initial postnatal period, mothers of preterm infants have been found to have more stress and depression than mothers of term babies (10).

A multitude of factors contribute to the upsurge in stress experienced by mothers of preterm newborns. According to a research conducted in India, hospitalization of the child in the critical care setting, socio-economic status, and environmental support in the hospital setting for the mothers and the newborn are frequently associated with stress in mothers with preterm infants (13).

This study is important because the identification of stressors can lead to careful planning for the interventions and prevention programs for mothers with premature babies, in the future. This research potentially facilitates the accomplishment of the Sustainable Development Goal 3, by reducing maternal and infant mortalities and morbidities.

Methodology

The analytical cross-sectional study design was incorporated into the study to identify stress and its associated factors among mothers with preterm infants. The analytical cross-sectional study design is beneficial when the plan of the study is to identify the prevalence of a problem, its associated factors, and the association between exposure and outcome (14). To ascertain an association between the level of stress, and its associated factors, an analytical cross-sectional study design was considered relevant for this study.

Sampling Method

A consecutive sampling method was used for selecting participants. Consecutive sampling involves enlisting a group of people from the available population that meets the eligibility criteria over a particular period. Consecutive sampling is an enhanced approach as it minimizes bias in the study, as compared to the convenience sampling method (14).

Sample Size

The sample size of the study must be pre-planned, systematically considered, and adequately large to depict the population (15). The sample size was calculated using the Open Epi software.

Sample Size for the Prevalence of Stress among Mothers with Preterm Infants

The sample size was calculated through Open Epi software. The prevalence of stress

among mothers with preterm infants was reported to be 75% (16). The reported prevalence of stress was used to calculate the sample size, with a 95% confidence interval, 10% room for error, and a non-response rate of 10% was also adjusted. To achieve the study objective, the final sample size was determined as 73+7 i.e. 80.

Sample Size for Determining the Associated Factors of Stress among Mothers with Preterm Infants

The sample size was also calculated for associated factors by considering the prevalence of co-morbidities in mothers with preterm infants. The prevalence of co-morbidities among mothers with preterm infants was 38.41% and for mothers with term infants were 20.76% (17). Considering the proportions, taking power of the study as 80, the confidence level of 95%, two-sided hypotheses, taking 1:1 ratio for unexposed and exposed for the sample, and the estimated prevalence ratio of 1.8; the approximate sample size came out to be 213. Adding the non-response rate of 10% i.e. 21 the final sample size was 234.

Since the sample size is higher for associated factors of stress among mothers with preterm infants (i.e., 234), the sample size of 234 was required for the study. However, during the process of data collection, due to the non-availability of mothers in the NICU, a sample size of 200 was achieved.

Recruitment Process of Participants

The selection of relevant participants is fundamental for the correct interpretation of the population in a study (18). Firstly, permission for the research was taken from the chief medical officer (CMO) of the hospital. Moreover, approval from the ethical review committee (ERC) of AKUH was taken.

After getting the required permissions, the recruitment process of participants was

started. The researcher approached the participants in the NICU and neonatal step-down units. In addition, the researcher evaluated the participants based on eligibility criteria with the help of the patient's medical record numbers. After screening the relevant participants, the researcher shared the aim of the study with the participants. Moreover, the benefits of the study were also explained. Upon willing agreement from the participants, written informed consent was taken from them and the data collection process was then initiated.

Study Variables

Stress level among mothers with preterm infants was the dependent variable of the study. The stress among mothers was assessed through the PSS. This scale measures the overall level of stress by encompassing the control over self and the conditions in life, personal confidence, and ability to control important aspects in life. The scores for the scale were examined in the research study.

The factors associated with the stress among mothers with preterm infants were taken as the independent variables in the study. The following were the independent variables of the study:

- Mother's demographic data
- Pregnancy-related variables
- Family information
- Coping mechanisms
- Newborn's information

Data Sources

Demographic data were obtained through the medical records, which were accessed

from confidential files and the electronic system of the hospital, taking into consideration both the mother and the newborn. Moreover, a study specific self-developed questionnaire, which included components of demographic data for mothers and newborns, was added. Moreover, pregnancy, family, and coping-related variables were also included. Furthermore, the PSS was applied with regards to mothers for the data collection.

Eligibility Criteria

Defining the inclusion and exclusion criteria for the study participants improves the possibility of generating reliable results and diminishes the possibility of recruiting inappropriate participants (19). The participants for the study were selected based on the below mentioned inclusion and exclusion criteria.

Inclusion Criteria

The inclusion criteria of a study indicate the main features that the potential participants of the study must have; these criteria include demographics and the pertinent characteristics related to the study (19).The inclusion criteria of this study included:

- Mothers of age 18 years and above
- Gestational age of preterm below 37 weeks.
- Mothers who were willing to participate and give consent.

Exclusion Criterion

The exclusion criteria of the study specify the subjects who meet the inclusion criteria but possess other features that are not favorable for the study and that need to be excluded (19).The exclusion criterion of the study included:

- Mothers who could not communicate in Urdu or the English language.

Data Collection Tool

Data collection tools must be validated by the researcher prior to their use to check for appropriateness in a particular context to minimize any bias (15). An internally developed questionnaire was used for the data collection. This tool included components regarding demographic data for mothers and newborns. Moreover, pregnancy, family, and coping-related variables were also included. Furthermore, the PSS was also integrated into the questionnaire.

The study specific tool was run through a CVI where four experts in the concerned field were approached. All experts gave their marks out of 4 for each question in the questionnaire, for relevance and clarity, simultaneously. Each item was marked from 1 to 4 from 1 being not relevant and not clear, to 4 being very relevant and very clear. Upon their marking, the results were combined, the relevance came out to be 0.86 and clarity came out to be 0.92 which is considered satisfactory.

The PSS is a widely used functional tool for assessing stress among people going through difficult circumstances. This tool has been validated in the Pakistani context for assessing the level of stress among individuals (20). This tool consists of 10 items, in which participants give a rating with regard to their emotions and mindset related to the events and circumstances that happened in the last month. Each item is rated on a 5-point Likert scale, from 0 never to 4 very often. Six items are negative (1, 2, 3, 6, 9, 10) and the other four are positive (4, 5, 7, 8). To create the score, the four positive items are scored in a reversed manner and then all the items are added, ranging from 0 to 40. This scoring included three levels, 0 - 13 low stress, 14 - 26 moderate stress and 27 - 40 is considered high perceived stress (21). To confirm, a higher score represents an elevated level of stress.

Internal Consistency

The internal consistency of the measuring tool is determined by the association of all items developed for measurement in the tool (22). The internal consistency of the tool is measured with Cronbach's alpha. The Cronbach's alpha value is 0.87 for the total perceived stress score. This value shows that the internal consistency of the tool is acceptable (23). The calculated Cronbach's alpha for the PSS tool in the current study is 70% which is considered satisfactory.

Construct Validity

Validity reflects that the assessing tool measures the attributes it is projected to measure (21). The construct validity of the tool was measured, and the factor structure was assessed to observe whether the association between different variables in the tool was measuring a particular construct in the tool or not. The test-retest reliability score (r) is 0.86 for the total perceived stress score (23). This value depicts a satisfactory construct validity of the tool.

Data Analysis Plan

Analysis of the data was conducted on the statistical package for social sciences (SPSS). Descriptive analysis and inferential analysis of the data were considered in the study.

Descriptive Analysis

Descriptive analysis is a method used for portraying the data in a comprehensive manner, such that it examines the styles and connections between the data in the research study (14). Demographic variables of the study, including categorical data, frequencies, and proportions, were analyzed using descriptive analysis. Data that were continuous in nature were computed by measuring the mean and standard deviation. The level of stress among mothers with preterm infants, assessed through the questionnaire, was categorical in nature, and was reported through frequencies and percentage.

Inferential Analysis

The inferential analysis is utilized to determine the consistency of outcomes regarding a population, based on the data collected from the sample in the research study (14). Inferential analysis of the study findings was carried out firstly by differentiating categorical variables and continuous variables. Analysis was further continued by using the chi-square test for the categorical variables and T-test for two independent samples for continuous variables in the study. During the analysis, the confidence interval of 95% and p-value of less than 0.05 was considered as significant.

Ethical Considerations

Ethical considerations are important throughout the research process. The study was started after obtaining approvals from the CMO, and ERC of AKUH. Written informed consent of the participants was obtained, after thoroughly explaining the study's purpose, and benefits. Moreover, participants were informed about their autonomy to back out from the study at any time, before the data coding is complete. The participants were also assured that their withdrawal from the study would not affect their treatment process. In addition, the informed consent form was given in both English and Urdu languages, so that the participants could easily understand the process. Furthermore, it was explained to the participants that participation in the study was voluntary, and no incentives will be given for participating in the study.

The privacy and confidentiality of the study participants were considered important, and the survey was conducted in separate rooms. The data was accessible to the primary investigator, supervisor, and committee members of the research study. It was in both soft and hard formats. The hard copies were with the primary investigator and were kept under lock and

key. The soft copies were saved with the help of passwords. For publication of the research study, the data will be portrayed in a deidentified manner. In addition, participants were assigned codes in the data entry system, to protect their individualities.

Results

Descriptive Analysis

A total of two hundred (n=200) mothers who delivered preterm infants were recruited for the study.

Socio demographic characteristics of the mothers with preterm infants. The socio-demographic characteristics of the mothers who delivered preterm infants are illustrated in Table 1. The mean age of these mothers was 30.12 years (SD $\pm$ 5.21), with ages ranging from 18-44 years. The majority of the participants were Urdu speaking 82.5% (n=165).

Most of the mothers, i.e., around 97% (n=195), had completed their education, ranging from matriculation to postgraduate and above. The use of substances such as betel nuts and other forms of substance was reported by 9% (n=18) of the mothers. The mothers who were employed accounted for approximately 16.5% (n=33) of the participants, whereas nearly 83.5% (n=167) were housewives. The household income was taken as continuous data, with a mean of 109,250.00 PKR (SD $\pm$ 21027.32), with the income ranging from 50,000 to 160,000. Most of the mothers, i.e., around 89.5% (n=179), were satisfied with their financial status.

Obstetric and gynecological characteristics of mothers with preterm infants. Among the mothers who delivered preterm infants, the participants' average gestational age was 33.26 weeks (SD $\pm$ 2.86). Nearly 70.5% (n=141) of the mothers had had multiple pregnancies and 38.5% (n=77) had one child. More than half of the study participants i.e., 59.5% (n=119) reported that during their pregnancy their other children were taken care of by their family

members. Almost 73% (n=146) of the mothers reported that their current pregnancy was planned. More than half of the participants, i.e., 53% (n=106) of the mothers reported that they planned to have more children. Gender preference in the family was reported by almost 45.5% (n=91) of the participants, 42.5% (n=85) reported a preference for male and only 3% (n=6) reported preference for female.

About 12% (n=24) of the mothers had fertility and gynecological issues, including, polycystic ovary syndrome (PCOS), uterine fibroids, bicornuate uterus and, anovulatory infertility. All of the study participants had experienced a complication in their current pregnancy; most of them i.e., 30.5% (n=61) of the mothers had had preterm labor pains. The mode of delivery seemed to be inclined towards cesarean section; 81% (n=162) of the mothers had gone through cesarean section as the mode of delivery. Previous history was also noteworthy with miscarriage in 33% (n=66) of the participants, preterm deliveries in 13.5% (n=27), intrauterine deaths (IUD) in 6.5% (n=13), and abortion among 2.5% (n=5) of mothers. More than half of the study participants, i.e., 62.5% (n=125) of the mothers, started their antenatal visits during the initial weeks of pregnancy.

Nearly 64% (n=128) of the participants reported that they had completed their immunization. Nearly all the study participants, i.e., 96% (n=192) of the mothers, had conceived naturally. More than half of the study population, i.e., 76% (n=152) used artificial methods for family planning. Consuming a well-balanced diet during their pregnancy was reported by 92% (n=184) of the mothers. Most of the study participants, i.e., 79.5% (n=159) of the mothers, reported that they slept for 5-6 hours per day. The obstetric and gynecological characteristics of the mothers with preterm infants are illustrated in Table 1.

Table 1 *Socio-demographic, Obstetrics and Gynecological Characteristics of Mothers with Preterm Infants (n=200)*

Variables	Frequency (n)	Percentage (%)
Age (in years)	30.12	5.21
Monthly income in PKR	109,250.00	21027.32
Language spoken		
Urdu	165	82.5%
Sindhi	19	9.5%
Other languages	16	8%
Educational status		
Below matriculation	5	2%
Matriculation	48	24%
Intermediate	47	23.5%
Graduate	80	40%
Post graduate and above	20	10%
Substance abuse		
Yes	18	9%
No	182	91%
Occupation status		
House wife	167	83.5%
Working	33	16.5%
Satisfaction with financial status		
Yes	179	89.5%
No	21	10.5%
Gravid		
Primigravida	59	29.5%
Two pregnancies	51	25.5%
Three pregnancies	24	12%
Four pregnancies	26	13%
More than four pregnancies	40	20%
Children alive		
1	77	38.5%
2	52	26%
3	44	22%
More than 3	27	13.5%
Children deceased		
None	185	92.5%
Yes	15	7.5%
Comorbidities in children		
Yes	16	8%
No comorbidities	184	92%
Care of children during pregnancy		

Family member	119	59.5%
NA for primigravida	81	40.5%
Planned pregnancy		
Yes	146	73%
No	54	27%
Plan to have more children		
Yes	106	53%
No	33	16.5%
Will decide later	61	30.5%
Gender preference		
Boy	85	42.5%
Girl	6	3%
No	109	54.5%
Gynecological or fertility issues		
Yes	24	12%
No	176	88%
Mode of delivery		
Spontaneous vaginal delivery without episiotomy	16	8%
Spontaneous vaginal delivery with episiotomy	22	11%
Cesarean section	162	81%
History of miscarriage		
Yes	66	33%
No	134	67%
History of abortion		
Yes	5	2.5%
No	195	97.5%
History of preterm deliveries		
Yes	27	13.5%
No	173	86.5%
History of IUD		
Yes	13	6.5%
No	187	93.5%
Antenatal visits during pregnancy		
Initial weeks	125	62.5%
First trimester	67	33.5%
Second trimester and third trimester	8	4%
Immunization status		
Complete	128	64%
Incomplete	72	36%
Mode of conception		
Natural	192	96%
Artificial	8	4%

Family planning method		
Natural	48	24%
Artificial	152	76%
Balanced diet		
Yes	184	92%
No	16	8%
Hours of sleep		
Less than 3 hours	2	1%
3 – 4 hours	20	10%
5 – 6 hours	159	79.5%
7 – 8 hours	19	9.5%
Gestational age in weeks	33.26	2.86

Marital and familial characteristics. Among the study participants, 75% (n=150) lived in extended families. Nearly all the study participants, i.e., 96.5% (n=193), had co-morbidities in their families. Among them, 83.5% (n=167) had endocrine disorders. Almost all the families had earning members, out of which, 53.5% (n=107) had two earning members in the family. The average age of the husbands was 35.08 years (SD±5.43). The educational status of the husbands was high; most of the husbands, i.e., 65% (n=130), had studied up to graduation. All the husbands were employed; 53% (n=106) of them were doing business. There was a wide range of substance abuse among the husbands, which included 32% (n=64) smoking a cigarette, and 29.5% (n=59) using betel nut, pan, gutka and naswar.

Among the study participants, 65.5% (n=131) had non-consanguineous marriages. Almost half of the study participants, i.e., 40.5% (n=81) had been married for less than five years. Nearly all the participants, i.e., 97% (n=194) were satisfied to a greater extent in the relationship with their husbands. On the other hand, more than half, i.e., 84% (n=168) of the mothers, were satisfied to some extent or to a lesser extent in their relationship with their in-laws. Marital and familial characteristics of the mothers with preterm infants are illustrated in Table 2.

Coping related factors. Practicing coping in stressful situations was reported by almost every participant. Among these, 38.5% (n=77) talked to their husbands in stressful situations. Almost all the study participants, i.e., 99% (n=198) of the mothers, worked on finding a solution for the stressful situation. All the participants in the study had some reliable person with whom they could talk and share their feelings in stressful situations. Socialization was reported by every participant with 39% (n=78) linking family as a mode of socialization. Table 2 illustrates the coping-related factors of mothers with preterm infants.

Newborn characteristics. The average age of preterm neonates was 10.11 days (SD±13.98). The average weight and height of neonates was 1.97 kg (SD±0.65) and 43.75 cm (SD±5.46) respectively. More than half of the newborns, i.e., 62% (n=124) were males. The APGAR score of the neonates at the first minute of life was 7.66 (SD±1.04). Moreover, preterm neonates were admitted with a range of complaints; among them 31.5% (n=63), were suffering from the RDS. More than half of the newborns, i.e., 51% (n=102), did not receive their immunization. Most of the newborns, i.e., 43.5% (n=87) were transferred from the NICU to the step down unit. More than half, i.e., 65% (n=130) of the preterm infants, were on OG tube feeding and 59.5% (n=119) were on breast milk. Newborn characteristics are illustrated in Table 2.

Table 2 *Marital and Familial Characteristics, Coping related Factors and Newborns*

Characteristics of the Mothers with Preterm Infants (n=200)

Variables	Frequency (n)	Percentage (%)
Type of family		
Nuclear	50	25%
Extended	150	75%
Co-morbidities in family		
Endocrine disorder	167	83.5%

Heart diseases	17	8.5%
Cancers, neurological and respiratory problems	9	4.5%
No comorbidities	7	3.5%
Educational status of husband		
Matriculation	6	3%
Intermediate	42	21%
Graduate	134	67%
Post graduate and above	18	9%
Occupation of husband		
Job	94	47%
Business	106	53%
Substance abuse by husband		
No substance abuse	77	38.5%
Pan, betel nut, gutka and naswar	59	29.5%
Cigarette	64	32%
Earning members in family		
1	55	27.5%
2	107	53.5%
3	30	15%
More than 3	8	4%
Type of marriage		
Consanguinity	69	34.5%
Non consanguinity	131	65.5%
Years in marriage		
Less than 5 years	81	40.5%
5 – 10 years	75	37.5%
11 – 15 years	40	20%
Above 15 years	4	2%
Satisfaction in relationship with husband		
To greater extent	194	97%
To some extent and to lesser extent	6	3%
Satisfaction in relationship with in-laws		
To greater extent	32	16%
To some extent and to lesser extent	168	84%
How do mothers cope in stressful situations		
Share with someone	70	35%
Talk to husband	77	38.5%
Analyze it	22	11%
Other	31	15.5%
Finding solutions in stressful		

situations	198	99%
Yes	2	1%
No		
Reliable person		
Husband	169	84.5%
Mother	27	13.5%
Other	4	2%
Mode of socialization		
Outing with family	78	39%
Outing with friends	45	22.5%
Social media	34	17%
Other	43	21.5%
Age in days	10.11	13.98
Weight in kg	1.97	0.65
Height in cm	43.75	5.46
APGAR score at 1 st minute of life	7.66	1.04
Gender		
Male	124	62%
Female	76	38%
Presenting complaints		
NNJ	50	25%
RDS	63	31.5%
IUGR and LBW	23	11.5%
TTN	24	12%
NEC, TNHI, sepsis, cardiac anomalies and others	40	20%
Immunization status		
Complete	98	49%
Incomplete	102	51%
Transferred from		
NICU	87	43.5%
B2 Nursery	35	17.5%
ER	37	18.5%
OR and Other	41	20.5%
Mode of feeding		
Direct breastfeeding	50	25%
Bottle feeding	20	10%
OG tube feeding	130	65%
Type of feed		
Breast feed	119	59.5%
Formula feed	81	40.5%

Outcome Variables

The PSS tool was used in the study to identify the level of stress among mothers with preterm infants. The level of stress that came out from the PSS tool among mothers is significantly higher based on the scoring of PSS scale. This scoring included three levels, 0 - 13 low stress, 14 - 26 moderate stress and 27 - 40 is considered high perceived stress (21). Based on the criteria of PSS scoring, a majority of the participants i.e., 92% (n=184) were falling under the category of high perceived stress, with the remainder falling into the category of moderate stress. Table 3 depicts the level of stress among mothers with preterm infants.

Table 3 *Perceived Stress Score of Mothers with Preterm Infants (n=200)*

Characteristics	Frequency	Percentage
Moderate stress	16	8%
High perceived stress	184	92%

Inferential Analysis

Categorical variables. Most of the mothers in the category of high perceived stress were having male child (62.5% n=115), with 31% (n=57) had RDS as the presenting complaints of the newborn. More than half of the mothers i.e., 53.3% (n=98) reported high perceived stress as their newborn’s immunization status was incomplete and 42.9% (n=79) had their babies transferred from NICU. On the other hand, mothers in moderate levels of stress had similar findings except three quarters (75% n=12) of mothers in this category had complete immunization status of their newborn.

Around half of the mothers in the category of high perceived stress had done graduation. However, three quarters i.e., 85.9% (n=158) were housewives, although the majority of mothers

i.e., 89.7% (n=165) were satisfied with their financial status. Most of the mothers i.e., 65.2% (n=120) were in non-consanguinity type of marriage and 7.6% (n=14) were abusing some form of substance. On the other hand, mothers in the category of moderate stress had similar findings except 37.5% (n=6) had done post graduate and above.

A small number of the mothers in high levels of stress i.e., 8.7% (n=16) reported that their children have co-morbidities including congenital heart diseases, metabolic disorders, seizures disorders and genetic disorders. In addition, more than half of the mothers i.e., 59.2% (n=109) had their family members for taking care of other children during pregnancy. Mothers in the category of moderate level of stress had similar findings except none of the mothers had any co-morbidity in their children.

Almost three fourth i.e., 74.5% (n=137) of the study participants in high levels of stress had planned their pregnancy and more than half i.e., 55.4% (n=102) will also plan for further children. However, 45.1% (n=83) had family preference for male child. The findings are similar in the category of moderate stress except that more than half i.e., 56.3% (n=9) of the mothers will decide later for planning more children.

A minimum number of mothers in the category of high perceived stress i.e., 12.5% (n=23) have gynecological issues. The complications that included in their pregnancies were 31% (n=57) had preterm labor pain, 23.4% (n=43) had GDM, and 21.7% (n=40) had preeclampsia. Most of the mothers i.e., 81.5% (n=150) had gone through cesarean section as a mode of delivery. A previous history of miscarriage, abortion, preterm deliveries and IUD was found in 32.6% (n=60), 2.2% (n=4), 13% (n=24), and 6.5% (n=12) of mothers respectively. On

the other hand, mothers in the category of moderate stress had similar findings except 37.5% (n=6) had PROM instead of pre-eclampsia.

Majority of mothers in high perceived stress i.e., 93.5% (n=172) had consumed a balanced diet during pregnancy. More than half of the mothers i.e., 64.7% (n=119) started the antenatal visits in initial weeks of pregnancy with 62.5% (n=115) had complete immunization status. The findings from the category of moderate level of stress are similar except the majority of the mothers 56.3% (n=9) started the antenatal visits in the first trimester of pregnancy.

Majority of the mothers in the category of high perceived stress 66.8% (n=123) had their babies' mode of feeding as OG tube feeding. Moreover, the majority of them 58.7% (n=108) were giving breast milk to their newborns. Three quarters of mothers i.e., 75% (n=138) were using artificial methods for family planning. However, there was no difference seen in the category of moderate level of stress for the above mentioned findings.

Majority of the mothers in the category of high perceived stress i.e., 76.1% (n=140) were living in extended families and 85.3% (n=157) had endocrine disorders in their families. Majority of the mothers i.e., 67.4% (n=124) had their husband education status of graduation, 52.7% (n=97) were running their business, 32.6% (n=60) smoked cigarette and 31% (n=57) chewed betel nut, pan, gutka and naswar. Approximately all the mothers i.e., 96.7% (n=178) were satisfied in their relationships with their husbands. However, most of the mothers i.e., 84.8% (n=156) were satisfied to some extent or to a lesser extent in the relationship with their in-laws. The finding of these elements are similar in the category of moderate level of stress except 43.8% (n=7) of mothers had their husband education status of post graduate and above.

Approximately half of the mothers i.e., 40.8% (n=75) were talking to their husband in time of stressful situation, all the mothers i.e., 99.5% (n=183) were finding a solution in times of stressful situation and almost half of the mothers i.e., 39.7% (n=73) had outing with family as a mode of socialization. The findings for the mothers in moderate levels of stress were similar except 50% (n=8) were sharing with someone else other than husband in time of stressful situation and had different modes of socialization rather than outing with family. The table 4 shows the inferential statistics for the categorical variables in the study.

Table 4 *Inferential Statistics for Categorical Variables of Stress among Mothers with Preterm Infants (n=200)*

Characteristics	Moderate stress 8% (n= 16)	High perceived stress 92% (n=184)	P – value
Neonate gender			
Male	56.3% (9)	62.5% (115)	0.60
Female	43.8% (7)	37.5% (69)	
Presenting complaints			
NNJ	37.5% (6)	23.9% (44)	0.501*
RDS	37.5% (6)	31% (57)	
IUGR and LBW	6.3% (1)	12% (22)	
TTN	12.5% (2)	12% (22)	
NEC, TNHI, sepsis, cardiac anomalies and others	6.3% (1)	21.2% (39)	
Immunization of newborn			
Complete	75% (12)	46.7% (86)	0.03
Incomplete	25% (4)	53.3% (98)	
Transferred from			
NICU	50% (8)	42.9% (79)	0.300*
B2 Nursery	12.5% (2)	17.9% (33)	
ER	31.3% (5)	17.4% (32)	
OR and Other	6.3% (1)	21.7% (40)	
Education status of mother			
Below matriculation	6.3% (1)	2.2%(4)	0.003*
Matriculation	18.8% (3)	24.5% (45)	
Intermediate	12.5% (2)	24.5% (45)	
Graduate	25% (4)	41.3% (76)	
Post graduate and above	37.5% (6)	7.6% (14)	

Language spoken			
Urdu	68.8% (11)	83.7% (154)	0.057*
Sindhi	12.5% (2)	9.2% (17)	
Balochi	12.5% (2)	1.6% (3)	
Other	6.3% (1)	5.4% (10)	
Mother's occupation			
House wife	56.3% (9)	85.9% (158)	0.007
Working	43.8% (7)	14.1% (26)	
Satisfaction with financial status			
Yes	87.5% (14)	89.7% (165)	0.678
No	12.5% (2)	10.3% (19)	
Substance abuse by mother			
No	75% (12)	92.4% (170)	0.042
Yes	25% (4)	7.6% (14)	
Marriage type			
Consanguinity	31.3% (5)	34.8% (64)	1.000
Non-consanguinity	68.8% (11)	65.2% (120)	
Comorbidities in children			
Yes	0% (0)	8.7% (16)	0.373
No	100% (16)	91.3% (168)	
Person taking care of other children during pregnancy			
Family members	62.5% (10)	59.2% (109)	1.000
NA for primi gravid mothers	37.5% (6)	40.8% (75)	
Planned pregnancy			
Yes	56.3% (9)	74.5% (137)	0.142
No	43.8% (7)	25.5% (47)	
Plan for more children			
Yes	25% (4)	55.4% (102)	0.041*
No	18.8% (3)	16.3% (30)	
Will decide later	56.3% (9)	28.3% (52)	
Gender preference from family			
Boy	12.5% (2)	45.1% (83)	0.037*
Girl	6.3% (1)	2.7% (5)	
No	81.3% (13)	52.2% (96)	
Gynecological issues			
Yes	6.3% (1)	12.5% (23)	0.699
No	93.8% (15)	87.5% (161)	
Complications in pregnancy			
GDM	18.8% (3)	23.4% (43)	0.086*
Pre-eclampsia	6.3% (1)	21.7% (40)	
PROM	37.5% (6)	11.4% (21)	
IUGR	6.3% (1)	4.3% (8)	
Preterm labor pain	25% (4)	31% (57)	
APH	6.3% (1)	8.2% (15)	
Mode of delivery			

SVD without episiotomy	12.5% (2)	7.6% (14)	0.758*
SVD with episiotomy	12.5% (2)	10.9% (20)	
Cesarean section	75% (12)	81.5% (150)	
History of miscarriage			
Yes	37.5% (6)	32.6% (60)	0.783
No	62.5% (10)	67.4% (124)	
History of abortion			
Yes	6.3% (1)	2.2% (4)	0.344
No	93.8% (15)	97.8% (180)	
History of preterm deliveries			
Yes	18.8% (3)	13% (24)	0.458
No	81.3% (13)	87% (160)	
History of IUD			
Yes	6.3% (1)	6.5% (12)	1.000
No	93.8% (15)	93.5% (172)	
Balance diet			
Yes	75% (12)	93.5% (172)	0.028
No	25% (4)	6.5% (12)	
Antenatal visits during pregnancy			
Initial weeks	37.5% (6)	64.7% (119)	0.098*
First trimester	56.3% (9)	31.5% (58)	
Second and third trimester	6.3% (1)	3.8% (7)	
Immunization status of mother			
Complete	81.3% (13)	62.5% (115)	0.178
Incomplete	18.8% (3)	37.5% (69)	
Mode of feeding baby			
DBF	31.3% (5)	24.5% (45)	0.067*
Bottle feeding	25% (4)	8.7% (16)	
OG feeding	43.8% (7)	66.8% (123)	
Type of feed for baby			
Breast feed	68.8% (11)	58.7% (108)	0.597
Formula feed	31.3% (5)	41.3% (76)	
Family planning method			
Natural	12.5% (2)	25% (46)	0.367
Artificial	87.5% (14)	75% (138)	
Type of family			
Nuclear	37.5% (8)	23.9% (44)	0.237
Extended	62.5% (10)	76.1% (140)	
Co-morbidities in family			
Endocrine disorders	62.5% (10)	85.3% (157)	0.072*
Heart diseases	25% (4)	7.1% (13)	
Cancers, neurological and respiratory problems	6.3% (1)	4.3% (8)	
No comorbidities	6.3% (1)	3.3% (6)	
Education status of husband			
Matriculation	12.5% (2)	2.2% (4)	<0.000*

Intermediate	6.3% (1)	22.3% (41)	
Graduate	37.5% (6)	67.4% (124)	
Post graduate and above	43.8% (7)	8.2% (15)	
Occupation of husband			
Job	43.8% (7)	47.3% (87)	1.000
Business	56.3% (9)	52.7% (97)	
Substance abuse by husband			
No	62.5% (10)	36.4% (67)	0.102*
Betelnut, pan, gutka and naswar	12.5%(2)	31% (57)	
Cigarette	25% (4)	32.6% (60)	
Satisfaction in relationship with husband			
To greater extent	100% (16)	96.7% (178)	1.000
To some extent and to lesser extent	0% (0)	3.3% (6)	
Satisfaction in relationship with in-laws			
To greater extent	25% (4)	15.2% (28)	0.294
To some extent and to lesser extent	75% (12)	84.8% (156)	
How do you cope with stressful situation			
Share with someone	50% (8)	33.7% (62)	0.156*
Talk to husband	12.5% (2)	40.8% (75)	
Analyze it	12.5% (2)	10.9% (20)	
Other	25% (4)	14.7% (27)	
Finding solution in stressful situation			
Yes	93.8% (15)	99.5% (183)	0.154
No	6.3% (1)	0.5% (1)	
Mode of socialization			
Outing with family	31.3% (5)	39.7% (73)	0.032*
Outing with friends	12.5% (2)	23.4% (43)	
Social media	6.3% (1)	17.9% (33)	
Others	50% (8)	19% (35)	

*Denotes pearson chi-square P-value

Continuous variables. The mean age, weight and length of newborns in mothers with high levels of perceived stress was 9.88 (SD +13.47), 1.97 (SD of +0.66) and 43.75 (+5.54) respectively. The mean APGAR score for neonates was 7.65 (SD +1.05) and the mean gestational age of mothers was 33.21 (SD +2.91). However, the scores of these elements for the

mothers in moderate levels of stress were comparatively higher as compared to mothers with the category of high perceived stress.

The mean age and monthly income of mothers with high levels of perceived stress were 30.27 (SD +5.16) and 110054.35 (SD +21051.51) which was higher as compared with the category of mothers in moderate levels of stress. The mean of years in marriage and number of earning members in a family of mothers with high levels of stress was 1.80 (SD +0.80) and 1.93 (SD +0.75) which was comparatively lower than for the mothers in moderate levels of stress. The mean gravid, hours of sleep and age of husbands of mothers with high levels of perceived stress were 2.78 (SD +1.65), 3.01 (SD +0.45) and 35.24 (SD +5.40) which was higher than for mothers in moderate levels of stress. The mean children alive and deceased of mothers with high levels of perceived stress were 2.17 (SD +1.21) and 1.09 (SD +0.35) which was much similar for the mothers with moderate levels of stress. The table 5 shows the inferential statistics for the continuous variables in the study.

Table 5 Inferential Statistics for Continuous Variables of Stress among Mothers with Preterm Infants (n=200)

Characteristics	Moderate stress		High perceived stress		P – value
	Mean	SD	Mean	SD	
Neonate age	12.75	+19.19	9.88	+13.47	0.43
Neonate weight	2.06	+0.57	1.97	+0.66	0.59
Neonate height	43.75	+4.53	43.75	+5.54	1.000
APGAR Score	7.69	+0.87	7.65	+1.05	0.89
Gestational age	33.75	+2.23	33.21	+2.91	0.47
Mother's age	28.44	+5.60	30.27	+5.16	0.17
Monthly income	100000	+18973.66	110054.35	+21051.51	0.06
Years in marriage	2.25	+0.85	1.80	+0.80	0.03*
Gravid	2.69	+1.74	2.78	+1.65	0.83
Children alive	2.13	+1.25	2.17	+1.21	0.87
Children deceased	1.31	+0.87	1.09	+0.35	0.33
Hours of sleep	2.63	+0.71	3.01	+0.45	0.05*

No of earning members	2.25	<u>+0.85</u>	1.93	<u>+0.75</u>	0.10
Age of husband	33.25	<u>+5.58</u>	35.24	<u>+5.40</u>	0.16

**Significant P-value*

Discussion

Level of Stress among Mothers with Preterm Infants

This study focused on the level of stress and its associated factors among mothers with preterm infants in Karachi, Pakistan. To assess the level of stress PSS tool was incorporated in a self-developed questionnaire. PSS has been used extensively around the globe to measure stress in various groups of people. Additionally, it is employed to gauge the level of stress experienced by mothers of preterm infants in Taiwan and Pakistan.

In our study, 92% of the study participants fell under the category of high perceived stress, which is considerably higher. According to a comparator study conducted in Kenya on the prevalence of psychological distress among mothers with term and preterm infants, reported that 83.7% who delivered preterm infants were positive for stress (24). According to a systematic review conducted in high income countries (HIC) on post-traumatic stress symptoms in mothers of preterm infants, 77.8% of the mothers had stress and met the criteria for potential post-traumatic stress disorder after the birth of a preterm infant (25). These studies validate the findings of the current study as results are similar to a great extent.

On the contrary, according to a recent systematic review, conducted for urban HIC, on the prevalence of stress among mothers with preterm infants who were admitted in the NICU which reported the prevalence of stress was 39.9% (26). A study conducted in Malaysia, reported 56.5% of mothers with preterm infants admitted in the NICU had high levels of stress (27). However, these findings are relatively lower than the findings of the current study. The plausible

1
2
3 difference could be due to the diverse socio-cultural stressors related to the income levels of the
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5 two countries, as Malaysia is an upper middle income country (UMIC) while Pakistan comes
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7 under the category of LMIC (28).
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11 Another study conducted in the United States of America (USA), regarding the
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13 association between preterm birth and maternal mental health, concluded that 11.26% of the
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15 mothers who delivered preterm infants reported stress (29). A recent study conducted in the
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17 USA, on maternal mental health after their preterm infants were discharged from NICU, showed
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19 that 29% of the mothers had stress and depressive disorders (30). However, the level of stress
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21 mentioned in these studies is relatively lower as compared to the current Pakistani based study
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23 findings where the stress levels in mothers are significantly high. Comparing the findings of the
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25 studies conducted in the USA, which is considered a HIC, with Pakistan, a huge difference can
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27 be seen in the levels of stress being reported. This difference may be attributed to Pakistani
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29 women's cultural freedom to report stress, income status variance or the care approaches in the
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31 two settings.
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37 **Factors Affecting Level of Stress among Mothers with Preterm Infants**

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40 The literature has suggested that the social, cultural, and environmental aspects of a
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42 LMIC; like Pakistan, tend to create additional exposures to stressors, thereby adding to increased
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44 risk of stress and depression among mothers during pregnancy and childbirth (31). The literature
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46 has also suggested numerous factors that are associated with increased levels of stress among
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48 mothers with preterm infants. Amongst the determinants specific to culture, the main cause is
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50 unplanned pregnancy, along with preference of male child over female (31). Another study
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52 conducted in Pakistan has also suggested that decreased autonomy of mothers, in making
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decisions related to pregnancy and reproductive health, is also a major factor associated with increased levels of stress among mothers with preterm infants (32). In addition, Pakistani women are more susceptible to stress and depression due to overlapping socio-economic factors, which include, unemployment and lack of education. Obstetric factors include multiple and unplanned pregnancies. The psycho-social factors include verbal and physical abuse by husbands and mother-in-law (32).

This study has highlighted multiple factors that are associated with increased levels of stress among mothers with preterm infants. However, only the factors with a P-value of less than 0.05 were considered significant and were taken as important factors that are associated with increased levels of stress. The current study findings are consistent with the factors such as (hours of sleep, consumption of balance diet, immunization of newborn, mode of socialization, education and occupation status of mothers, substance abuse by mother, education status of husband, gender preference from family, planning for further children and years in marriage), mentioned in the literature that are associated with high levels of stress among mothers with preterm infants.

When comparing the results of the current study to previous research, it was found that 50% of the mothers had a higher education level still majority of mothers were housewives, this could be a contributing factor to the unemployment. Furthermore, two-third of mothers had planned their pregnancies while the majority of them were carrying multiple pregnancies which could be a potential reason for gender preference. This implies that these elements are in line with the literature.

Immunization of the newborn is another factor associated with the increased levels of stress among mothers with preterm infants. High perceived stress was reported in a significant number of mothers whose preterm infants had an incomplete immunization status. This finding is consistent with a systematic review about vaccination in preterm infants, which suggests that parents feel increased stress while vaccinating the preterm infants as compared to term infants (33). The plausible reasons included decreased weight of preterm infants, as compared to the term infants, and delay in the vaccination in order to allow for the correct gestation age to be achieved prior to the vaccination of the preterm infants (33).

The educational status of mothers was also a pivotal factor associated with the level of stress among mothers with preterm infants. In the current study, moderate and high levels of stress were reported in mothers who had graduated from high school. Contrary to this finding, the study conducted in Maichew, North Ethiopia, showed that no stress was reported in mothers with advanced levels of education; however, the level of stress was high in mothers with low level of education or no formal education (34). The reasons for the contradiction could have related to mothers having higher education, in the current study, wanting to work but at the same time had to take care of a preterm infant as a priority.

The current study showed that mothers who were not employed had high levels of stress as compared to working mothers. This finding was found to be similar to the findings of the study conducted in south east Ethiopia, that depicted high levels of stress in mothers who were housewives (35). A potential reason for low levels of stress in working mothers could be the advantage of regular social interaction with friends and co-workers, which changed the environment and probably enhanced the mental wellbeing of the mothers. Hence, the current

study highlighted the importance of employment in reducing the stress among mothers with preterm infants.

Substance abuse by mothers is yet another risk factor associated with stress among mothers with preterm stress. In the current study, the level of stress was reported in non-significant numbers of mothers among those who were abusing substances; however, these numbers depicted increased levels of stress among mothers with preterm infants. This finding is consistent with the findings of the study conducted in Maichew, North Ethiopia, where tobacco chewing was associated with increased levels of stress among mothers (34). Substance abuse has been associated with many health problems such as; to the impact of chewing the betel nut in the current study includes anemia during pregnancy and lactation. The current study has therefore identified the need to counsel the mothers to reduce substance abuse, in order to improve the high levels of stress among mothers with preterm infants.

Planning for further children was also associated with an increased level of stress among mothers with preterm infants. In the current study, more than half of the mothers in the category of high perceived stress will plan for further children. However, mothers with moderate levels of stress reported that they will decide later about planning for further children. According to a study conducted in China, on assessing mothers' parenting stress difference between having one and two children, mothers with two children showed significantly higher stress scores as compared to the mothers with one child (36). The finding is consistent to some extent, as planning for further children and parenting two children at a time, while including care of a preterm infant, is a challenging situation that can increase stress in mothers. One of the plausible reasons could be the minimum age gaps between the two children causing parenting stress in mothers who have delivered a preterm infant.

Gender preference of the child was also a major factor associated with the increased level of stress in mothers with preterm infants. In the current study, although a majority of mothers reported that there was no gender preference, a significant number of mothers reported male as the preferred gender. This finding is similar to another study conducted in Pakistan that showed that unplanned pregnancy was a factor associated with the increased level of stress among mothers, and the reason for unplanned pregnancies was preference of male child over female (31).

In the current study, it was identified that mothers with moderate and high levels of stress were consuming a balanced diet, yet they were experiencing increased levels of stress. However, this finding is in contradiction with the findings of a study conducted in Taiwan, where a low level of stress was associated with the consumption of a balanced diet (10).

The education status of the husband was also an important factor associated with the level of stress among mothers with preterm infants. In the current study increased levels of stress were reported among mothers whose husbands were educated up to the graduate level. This finding is contradictory with the findings of a study conducted in India that showed decreased levels of stress among mothers whose husbands had a higher level of education status (37). The core reason for the contradictory findings could possibly be the increased rate of unemployment in Pakistan, as being a graduate and not having employment of that level has been associated with triggering stress.

Socialization is yet another important factor associated with stress among mothers with preterm infants. In the current study, all the mothers had different modes of socialization, including, outing with family, friends, social media, and others, that decreased the level of stress

as it worked as mode of social support for them. This finding is also consistent with the study conducted in Taiwan that suggested social support, including family, friends, and social group work as mediators for the mothers; they boost their self-esteem and provide emotional stability to mothers with increased levels of stress following the birth of a preterm infant (10). The current study has identified support groups and socialization as the most important factors associated in reducing the levels of stress among mothers with preterm infants.

Years in marriage was another factor associated with the level of stress among mothers with preterm infants. The current study showed that fewer years of being married were proportional to the increased levels of stress among mothers. This finding is similar with another study conducted in Pakistan that showed, increase in the years of marriage gave a sense of satisfaction to mothers, and they could have shared decision making in planning further pregnancies, subsequently decreasing the level of stress, unplanned pregnancies, and gender preference (31).

In the current study, the decreased hours of sleep were found to increase the level of stress among the participants. Mothers who were under the category of high perceived stress had an average sleep duration of 3.01 hours ($SD\pm0.45$). This finding is consistent with the findings of the study conducted in Taiwan, which showed that 65% of the mothers with preterm infants showed insufficient and poor sleep as factors associated with the increased levels of stress (10). The possible reasons for disturbed sleep quality could be, frequent awakenings for feeding and handling the preterm infant.

The factors associated with stress among mothers with preterm infants are well supported by national and international literature. The overall results of the study in the context of Pakistan,

while focusing on the specific sample of mothers with preterm infants show many similarities with the existing literature.

Conclusion and Recommendations

Nursing practice. Thorough training of the health care professionals is necessary for the assessment of mental health in mothers with preterm infants, and for conducting interventions for them. In addition, a specialized clinical pathway for the infants born preterm can be initiated. This pathway can include the details of the child and the mother, the risk factors associated, and the scale that would be assessing the level of stress in mothers. It will also include the pertaining stress during pregnancy and the ongoing stress assessment of the mothers. Teaching related to coping strategies in stress and handling of newborns must be incorporated in the clinical pathway. A role of the nurse practitioner that incorporates the care of the newborns and mothers at the same time must be initiated. This role will help nurses identify the stress in the mothers undergoing the process of delivery, neonatal handling, and care. The study findings have identified high levels of perceived stress among mothers with preterm infants, hence, there is an immense need to emphasize on the psychological health screening program, that it is incorporated in antenatal and postnatal care. A support group must be formulated, consisting of mothers who deliver preterm infants. This support group will help decrease the level of stress and boost their coping by giving them an opportunity to express their feelings and concerns related to preterm handling and care. The administration of the hospitals should provide a separate area where the mothers with preterm infants can be individually assessed for the level of stress, and teaching for the same can be provided on an individual basis. At the policy level, it should be made compulsory while taking into consideration a multidisciplinary team approach,

that the team specifically includes a consultation by a psychologist for mothers who deliver preterm infants, in the postnatal period.

Nursing education. Nursing education must contain a separate course related to neonatal handling, care, feeding, teaching of the mothers with preterm infants, and basic assessment tools that assess the stress of the mothers with preterm infants. Nursing students must be introduced to the unique role and concept of nurse practitioner in the field. These nurse practitioners will serve as a liaison between both mothers and preterm infants. This will help students identify their area of interest and they can choose their careers in this field accordingly.

Nursing research. As the study findings identified an increased level of stress in mothers with preterm infants, there is a need for intervention studies, to identify ways for improving the mental health of mothers with preterm infants. A cross sectional study to identify the level of stress among mothers with term infants can be carried out. Since this study identified the level of stress and its associated factors among mothers with preterm infants, a similar study could be carried out to identify the level of stress and its associated factors among fathers with preterm infants. Future studies, with a multi-centered approach, consisting of large sample sizes, are required to validate the findings of this study.

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Title Page

Article Title: Stress and its associated factors in mothers with preterm infants in a private tertiary care hospital of Karachi, Pakistan: An analytical cross sectional study

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Abstract

Objectives This research's goal is to present a thorough method for evaluating stress and the elements that contribute to it in mothers of premature babies.

Design Analytical cross sectional study

Setting Data was collected from inpatient service for preterm infants including neonatal intensive care unit (NICU), and neonatal step-down units of The Aga Khan University Hospital (AKUH) a private tertiary care hospital in Karachi Pakistan.

Participants Mothers aged 18 years and above who delivered preterm infants (gestational age of preterm below 37 weeks) in a private tertiary care hospital in Karachi, Pakistan.

Primary Outcome Stress in mother with preterm infants

Results 200 participants with a mean age of 30.12 years ($SD \pm 5.21$) were assessed. The level of stress identified using the perceived stress scale (PSS) among mothers who had delivered preterm infants was significantly higher as compared to other countries around the world. Based on the criteria of PSS scoring, the majority of the participants i.e., 92% (n=184) of the mothers, were categorized as having high perceived stress and 8% (n=16) of the mothers fell into the category of moderate stress.

Conclusions The study findings suggest high levels of perceived stress among mothers with preterm infants. The factors associated with the stress among mothers with preterm infants included immunization of newborn, education and occupation status of mothers, substance abuse by mother, gender preference from family, planning for further children, consumption of balance diet, education status of husband, mode of socialization, years in marriage, and hours of sleep.

Keywords Premature, preterm infants, perceived stress scale, perceived stress, stress

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Author Contributions

The study was conceptualized and designed by Yasmin Parpio. Salima Akbar was involved in data collection, writing of the manuscript's initial draft, revision, proofreading of the manuscript and data analysis. Afshan Akber critically reviewed and proof read the manuscript multiple times. Yasmin Parpio and Afshan Akber were involved in data analysis. The final draft of the manuscript was read and approved by all authors (SA, AA and YP). Yasmin Parpio is the guarantor of the study.

Data Availability Statement

All data relevant to the study are included in the article.

Ethical Approval Statement

The study was started after obtaining approvals from the Chief Medical Officer, and Ethical Review Committee of Aga Khan University Hospital Reference Number: 2022-7808-

23288. Written informed consent of the participants was obtained, after thoroughly explaining the study's purpose, and benefits.

Acknowledgment

I would like to thank His Highness Prince Karim Aga Khan for providing me the opportunity to fulfill my dreams in his prestigious university.

Article Summary

Strengths and Limitation of this Study

Following are the strengths of the research study:

- This is the first study that assessed level of stress among mothers with preterm infants in Karachi, Pakistan.
- The self-developed questionnaire used in the study was approved by the experts after achieving satisfactory rating in content validity index (CVI).
- The PSS tool used in the study has been validated nationally and internationally, in various languages.
- The PSS tool has been administered to similar groups of participants as in the current study.

The limitations of the research study are as follows:

- This study was conducted in a private hospital; therefore, the sample size cannot be generalized for government settings.

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Introduction

In the context of obstetrics, ‘preterm’ refers to delivery of an infant prior to the completion of 37 weeks of pregnancy (1). Compared to term newborns, preterm infants have different needs. Preterm babies are more likely to experience infections, hypothermia, poor suck reflex, difficulty feeding, effort to gain weight, and impaired lung maturation (2).

Preterm births are escalating, globally. Each year, approximately 15 million newborns are delivered preterm globally (3). One of the reasons for the substantial neonatal deaths prevalence is preterm births which account for 28% of all neonatal deaths worldwide (4). Almost 45% of the children who die below the age of five are newborns; amongst these 60–80% are those born prematurely (2).

Pakistan is determined to work on this challenging issue, as Pakistan is ranked third in the world for neonatal mortality and accounts for about 7% of the universal neonatal death (5). Moreover, the high burden of neonatal morbidity and mortality rates in the nation can be attributed to preterm births. The prevalence of neonatal mortality in Pakistan is that for every 1000 live births, there are 42 neonatal deaths (6). Furthermore, to achieve sustainable development goal 3.2, which states to reduce neonatal and below 5 mortalities, the matter of preterm births needs to be addressed. Amongst the four provinces of Pakistan, Balochistan has the highest prevalence of neonatal mortality at, 63 deaths per 1000 live births (6).

Stress can be described as an innate response of an individual to undesirable circumstances that disturbs body equilibrium and stability (7). Stress upon the birth of preterm infants produces physical and psychological stressors for both the newborn and the mothers. The need for intensive care treatments, feeding difficulties, and low birth weight (LBW) are among

the physical challenges for preterm infants. These physical problems for the newborn often lead to psychological impacts on the health of the mothers as well. Preterm infants may have enduring effects of prematurity, preoccupation with the survival of the newborn leading to the development of stress, depression, and post-traumatic stress disorders in mothers (8). The mother-child bond is at risk when a preterm infant is born because of the early detachment of the infant from the mother, due to the aggressive treatment requisites for the newborn. A mother's stress stemming from a particular course of treatment for her preterm infant hinders the development of a stable parent-child bond (9).

The incidence of postpartum depression in Pakistan is 63.3% (10). Preterm births potentially create disturbing effects on the newborn, while simultaneously initiating distressing challenges for the mothers. These difficult challenges account for the advancement of stress resulting in high levels of depression in some mothers (11). Furthermore, this challenging issue makes the mother of a preterm more prone to mental instabilities, in contrast to mothers of term babies. The incidence of stress in mothers with preterm infants is as elevated as 30-40% in contrast to 6-12% in mothers with infants born at the completion of the gestational period (12). In the initial postnatal period, mothers of preterm infants have been found to have more stress and depression than mothers of term babies (10).

A multitude of factors contribute to the upsurge in stress experienced by mothers of preterm newborns. According to a research conducted in India, hospitalization of the child in the critical care setting, socio-economic status, and environmental support in the hospital setting for the mothers and the newborn are frequently associated with stress in mothers with preterm infants (13).

This study is important because the identification of stressors can lead to careful planning for the interventions and prevention programs for mothers with premature babies, in the future. This research potentially facilitates the accomplishment of the Sustainable Development Goal 3, by reducing maternal and infant mortalities and morbidities.

Methodology

Study Design

The analytical cross-sectional study design was incorporated into the study to identify stress and its associated factors among mothers with preterm infants. The analytical cross-sectional study design is beneficial when the plan of the study is to identify the prevalence of a problem, its associated factors, and the association between exposure and outcome (14). To ascertain an association between the level of stress, and its associated factors, an analytical cross-sectional study design was considered relevant for this study.

Sampling Method

A consecutive sampling method was used for selecting participants. Consecutive sampling involves enlisting a group of people from the available population that meets the eligibility criteria over a particular period. Consecutive sampling is an enhanced approach as it minimizes bias in the study, as compared to the convenience sampling method (14).

Sample Size

The sample size of the study must be pre-planned, systematically considered, and adequately large to depict the population (15). The sample size was calculated using the OpenEpi software.

Sample Size for the Prevalence of Stress among Mothers with Preterm Infants

The sample size was calculated through OpenEpi software. The prevalence of stress among mothers with preterm infants was reported to be 75% (16). The reported prevalence of stress was used to calculate the sample size, with a 95% confidence interval, 10% room for error, and a non-response rate of 10% was also adjusted. To achieve the study objective, the final sample size was determined as 73+7 i.e. 80.

Sample Size for Determining the Associated Factors of Stress among Mothers with Preterm Infants

The sample size was also calculated for associated factors by considering the prevalence of co-morbidities in mothers with preterm infants. The prevalence of co-morbidities among mothers with preterm infants was 38.41% and for mothers with term infants were 20.76% (17). Considering the proportions, taking power of the study as 80, the confidence level of 95%, two-sided hypotheses, taking 1:1 ratio for unexposed and exposed for the sample, and the estimated prevalence ratio of 1.8; the approximate sample size came out to be 213. Adding the non-response rate of 10% i.e. 21 the final sample size was 234.

Since the sample size is higher for associated factors of stress among mothers with preterm infants (i.e., 234), the sample size of 234 was required for the study. However, during the process of data collection, due to the non-availability of mothers in the NICU, a sample size of 200 was achieved.

Recruitment Process of Participants

The selection of relevant participants is fundamental for the correct interpretation of the population in a study (18). Firstly, permission for the research was taken from the chief medical officer (CMO) of the hospital. Moreover, approval from the ethical review committee (ERC) of

AKUH was taken.

After getting the required permissions, the recruitment process of participants was started. The researcher approached the participants in the NICU and neonatal step-down units. In addition, the researcher evaluated the participants based on eligibility criteria with the help of the patient's medical record numbers. After screening the relevant participants, the researcher shared the aim of the study with the participants. Moreover, the benefits of the study were also explained. Upon willing agreement from the participants, written informed consent was taken from them and the data collection process was then initiated.

Study Period

This quantitative analytical cross-sectional research study was completed in a five-month period, from December 2022 to April 2023. The study commenced after approvals from the CMO and ERC.

Study Variables

Stress level among mothers with preterm infants was the dependent variable of the study. The stress among mothers was assessed through the PSS. This scale measures the overall level of stress by encompassing the control over self and the conditions in life, personal confidence, and ability to control important aspects in life. The scores for the scale were examined in the research study.

The factors associated with the stress among mothers with preterm infants were taken as the independent variables in the study. The following were the independent variables of the study:

- Newborn's information

- Mother's demographic data
- Pregnancy-related variables
- Family information
- Coping mechanisms

Data Sources

Demographic data were obtained through the medical records, which were accessed from confidential files and the electronic system of the hospital, taking into consideration both the mother and the newborn. Moreover, a study specific self-developed questionnaire, which included components of demographic data for mothers and newborns, was added. Moreover, pregnancy, family, and coping-related variables were also included. Furthermore, the PSS was applied with regards to mothers for the data collection.

Eligibility Criteria

Defining the inclusion and exclusion criteria for the study participants improves the possibility of generating reliable results and diminishes the possibility of recruiting inappropriate participants (19). The participants for the study were selected based on the below mentioned inclusion and exclusion criteria.

Inclusion Criteria

The inclusion criteria of a study indicate the main features that the potential participants of the study must have; these criteria include demographics and the pertinent characteristics related to the study (19). The inclusion criteria of this study included:

- Mothers of age 18 years and above
- Gestational age of preterm below 37 weeks.

- Mothers who were willing to participate and give consent.

Exclusion Criterion

The exclusion criteria of the study specify the subjects who meet the inclusion criteria but possess other features that are not favorable for the study and that need to be excluded (19). The exclusion criterion of the study included:

- Mothers who could not communicate in Urdu or the English language.

Data Collection Tool

Data collection tools must be validated by the researcher prior to their use to check for appropriateness in a particular context to minimize any bias (15). An internally developed questionnaire was used for the data collection. This tool included components regarding demographic data for mothers and newborns. Moreover, pregnancy, family, and coping-related variables were also included. Furthermore, the PSS was also integrated into the questionnaire.

The study specific tool was run through a CVI where four experts in the concerned field were approached. All experts gave their marks out of 4 for each question in the questionnaire, for relevance and clarity, simultaneously. Each item was marked from 1 to 4 from 1 being not relevant and not clear, to 4 being very relevant and very clear. Upon their marking, the results were combined, the relevance came out to be 0.86 and clarity came out to be 0.92 which is considered satisfactory.

The PSS is a widely used functional tool for assessing stress among people going through difficult circumstances. This tool has been validated in the Pakistani context for assessing the level of stress among individuals (20). This tool consists of 10 items, in which participants give a rating with regard to their emotions and mindset related to the events and

circumstances that happened in the last month. Each item is rated on a 5-point Likert scale, from 0 never to 4 very often. Six items are negative (1, 2, 3, 6, 9, 10) and the other four are positive (4, 5, 7, 8). To create the score, the four positive items are scored in a reversed manner and then all the items are added, ranging from 0 to 40. This scoring included three levels, 0 - 13 low stress, 14 - 26 moderate stress and 27 - 40 is considered high perceived stress (21). To confirm, a higher score represents an elevated level of stress.

Internal Consistency

The internal consistency of the measuring tool is determined by the association of all items developed for measurement in the tool (22). The internal consistency of the tool is measured with Cronbach's alpha. The Cronbach's alpha value is 0.87 for the total perceived stress score. This value shows that the internal consistency of the tool is acceptable (23). The calculated Cronbach's alpha for the PSS tool in the current study is 70% which is considered satisfactory.

Construct Validity

Validity reflects that the assessing tool measures the attributes it is projected to measure (21). The construct validity of the tool was measured, and the factor structure was assessed to observe whether the association between different variables in the tool was measuring a particular construct in the tool or not. The test-retest reliability score (r) is 0.86 for the total perceived stress score (23). This value depicts a satisfactory construct validity of the tool.

Data Analysis Plan

Analysis of the data was conducted on the statistical package for social sciences (SPSS). Descriptive analysis and inferential analysis of the data were considered in the study.

Descriptive Analysis

Descriptive analysis is a method used for portraying the data in a comprehensive manner, such that it examines the styles and connections between the data in the research study (14). Demographic variables of the study, including categorical data, frequencies, and proportions, were analyzed using descriptive analysis. Data that were continuous in nature were computed by measuring the mean and standard deviation. The level of stress among mothers with preterm infants, assessed through the questionnaire, was categorical in nature, and was reported through frequencies and percentage.

Inferential Analysis

The inferential analysis is utilized to determine the consistency of outcomes regarding a population, based on the data collected from the sample in the research study (14). Inferential analysis of the study findings was carried out firstly by differentiating categorical variables and continuous variables. Analysis was further continued by using the chi-square test for the categorical variables and T-test for two independent samples for continuous variables in the study. During the analysis, the confidence interval of 95% and p-value of less than 0.05 was considered as significant.

Ethical Considerations

Ethical considerations are important throughout the research process. The study was started after obtaining approvals from the CMO, and ERC of AKUH. Written informed consent of the participants was obtained, after thoroughly explaining the study's purpose, and benefits. Moreover, participants were informed about their autonomy to back out from the study at any time, before the data coding is complete. The participants were also assured that their withdrawal from the study would not affect their treatment process. In addition, the informed

consent form was given in both English and Urdu languages, so that the participants could easily understand the process. Furthermore, it was explained to the participants that participation in the study was voluntary, and no incentives will be given for participating in the study.

The privacy and confidentiality of the study participants were considered important, and the survey was conducted in separate rooms. The data was accessible to the primary investigator, supervisor, and committee members of the research study. It was in both soft and hard formats. The hard copies were with the primary investigator and were kept under lock and key. The soft copies were saved with the help of passwords. For publication of the research study, the data will be portrayed in a deidentified manner. In addition, participants were assigned codes in the data entry system, to protect their individualities.

Patient and Public Involvement

Research question and outcome measures were not informed by patients' priorities, experiences, and preferences. Patients were not involved in the design and recruitment of this study. Moreover, results will be disseminated through publication of the research in a prestigious journal. Randomized controlled trials were not used in this study. Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Results

Descriptive Analysis

A total of two hundred (n=200) mothers who delivered preterm infants were recruited for the study. For descriptive analysis, continuous variables were summarized using mean and

standard deviation (SD). The categorical variables were reported through frequencies and percentages.

Socio demographic characteristics of the mothers with preterm infants. The socio-demographic characteristics of the mothers who delivered preterm infants are illustrated in Table 1. The mean age of these mothers was 30.12 years ($SD \pm 5.21$), with ages ranging from 18-44 years. The majority of the participants were Urdu speaking 82.5% (n=165).

Most of the mothers, i.e., around 97% (n=195), had completed their education, ranging from matriculation to postgraduate and above. The use of substances such as betel nuts and other forms of substance was reported by 9% (n=18) of the mothers. The mothers who were employed accounted for approximately 16.5% (n=33) of the participants, whereas nearly 83.5% (n=167) were housewives. The household income was taken as continuous data, with a mean of 109,250.00 PKR ($SD \pm 21027.32$), with the income ranging from 50,000 to 160,000. Most of the mothers, i.e., around 89.5% (n=179), were satisfied with their financial status.

Table 1 *Socio-demographic Characteristics of Mothers with Preterm Infants (n=200)*

Variables	Frequency (n)	Percentage (%)
Age (in years)	30.12	5.21
Monthly income in PKR	109,250.00	21027.32
Language spoken		
Urdu	165	82.5%
Sindhi	19	9.5%
Other languages	16	8%
Educational status		
Below matriculation	5	2%
Matriculation	48	24%
Intermediate	47	23.5%
Graduate	80	40%
Post graduate and above	20	10%
Substance abuse		
Yes	18	9%
No	182	91%
Occupation status		

House wife	167	83.5%
Working	33	16.5%
Satisfaction with financial status		
Yes	179	89.5%
No	21	10.5%

Obstetric and gynecological characteristics of mothers with preterm infants. Among the mothers who delivered preterm infants, the participants' average gestational age was 33.26 weeks (SD± 2.86). Nearly 70.5% (n=141) of the mothers had had multiple pregnancies and 38.5% (n=77) had one child. More than half of the study participants i.e., 59.5% (n=119) reported that during their pregnancy their other children were taken care of by their family members. Almost 73% (n=146) of the mothers reported that their current pregnancy was planned. More than half of the participants, i.e., 53% (n=106) of the mothers reported that they planned to have more children. Gender preference in the family was reported by almost 45.5% (n=91) of the participants, 42.5% (n=85) reported a preference for male and only 3% (n=6) reported preference for female.

About 12% (n=24) of the mothers had fertility and gynecological issues, including, polycystic ovary syndrome (PCOS), uterine fibroids, bicornuate uterus and, anovulatory infertility. All of the study participants had experienced a complication in their current pregnancy; most of them i.e., 30.5% (n=61) of the mothers had had preterm labor pains. The mode of delivery seemed to be inclined towards cesarean section; 81% (n=162) of the mothers had gone through cesarean section as the mode of delivery. Previous history was also noteworthy with miscarriage in 33% (n=66) of the participants, preterm deliveries in 13.5% (n=27), intrauterine deaths (IUD) in 6.5% (n=13), and abortion among 2.5% (n=5) of mothers. More than

half of the study participants, i.e., 62.5% (n=125) of the mothers, started their antenatal visits during the initial weeks of pregnancy.

Nearly 64% (n=128) of the participants reported that they had completed their immunization. Nearly all the study participants, i.e., 96% (n=192) of the mothers, had conceived naturally. More than half of the study population, i.e., 76% (n=152) used artificial methods for family planning. Consuming a well-balanced diet during their pregnancy was reported by 92% (n=184) of the mothers. Most of the study participants, i.e., 79.5% (n=159) of the mothers, reported that they slept for 5-6 hours per day. The obstetric and gynecological characteristics of the mothers with preterm infants are illustrated in Table 2.

Table 2 *Obstetrics and Gynecological Characteristics of the Mothers with Preterm Infants* (n=200)

Variables	Frequency (n)	Percentage (%)
Gravid		
Primigravida	59	29.5%
Two pregnancies	51	25.5%
Three pregnancies	24	12%
Four pregnancies	26	13%
More than four pregnancies	40	20%
Children alive		
1	77	38.5%
2	52	26%
3	44	22%
More than 3	27	13.5%
Children deceased		
None	185	92.5%
Yes	15	7.5%
Comorbidities in children		
Yes	16	8%
No comorbidities	184	92%
Care of children during pregnancy		
Family member	119	59.5%
NA for primigravida	81	40.5%
Planned pregnancy		

Yes	146	73%
No	54	27%
Plan to have more children		
Yes	106	53%
No	33	16.5%
Will decide later	61	30.5%
Gender preference		
Boy	85	42.5%
Girl	6	3%
No	109	54.5%
Gynecological or fertility issues		
Yes	24	12%
No	176	88%
Mode of delivery		
Spontaneous vaginal delivery without episiotomy	16	8%
Spontaneous vaginal delivery with episiotomy	22	11%
Cesarean section	162	81%
History of miscarriage		
Yes	66	33%
No	134	67%
History of abortion		
Yes	5	2.5%
No	195	97.5%
History of preterm deliveries		
Yes	27	13.5%
No	173	86.5%
History of IUD		
Yes	13	6.5%
No	187	93.5%
Antenatal visits during pregnancy		
Initial weeks	125	62.5%
First trimester	67	33.5%
Second trimester and third trimester	8	4%
Immunization status		
Complete	128	64%
Incomplete	72	36%
Mode of conception		
Natural	192	96%
Artificial	8	4%
Family planning method		
Natural	48	24%
Artificial	152	76%
Balanced diet		
Yes	184	92%

No	16	8%
Hours of sleep		
Less than 3 hours	2	1%
3 – 4 hours	20	10%
5 – 6 hours	159	79.5%
7 – 8 hours	19	9.5%
Gestational age in weeks	33.26	2.86

Marital and familial characteristics and coping related factors. Among the study participants, 75% (n=150) lived in extended families. Nearly all the study participants, i.e., 96.5% (n=193), had co-morbidities in their families. Among them, 83.5% (n=167) had endocrine disorders. Almost all the families had earning members, out of which, 53.5% (n=107) had two earning members in the family. The average age of the husbands was 35.08 years (SD±5.43). The educational status of the husbands was high; most of the husbands, i.e., 65% (n=130), had studied up to graduation. All the husbands were employed; 53% (n=106) of them were doing business. There was a wide range of substance abuse among the husbands, which included 32% (n=64) smoking a cigarette, and 29.5% (n=59) using betel nut, pan, gutka and naswar.

Among the study participants, 65.5% (n=131) had non-consanguineous marriages. Almost half of the study participants, i.e., 40.5% (n=81) had been married for less than five years. Nearly all the participants, i.e., 97% (n=194) were satisfied to a greater extent in the relationship with their husbands. On the other hand, more than half, i.e., 84% (n=168) of the mothers, were satisfied to some extent or to a lesser extent in their relationship with their in-laws.

Practicing coping in stressful situations was reported by almost every participant. Among these, 38.5% (n=77) talked to their husbands in stressful situations. Almost all the study participants, i.e., 99% (n=198) of the mothers, worked on finding a solution for the stressful situation. All the participants in the study had some reliable person with whom they could talk and share their feelings in stressful situations. Socialization was reported by every participant

with 39% (n=78) linking family as a mode of socialization. Marital and familial characteristics and coping related factors of the mothers with preterm infants are illustrated in Table 3.

Table 3 *Marital and Familial Characteristics and Coping Related Factors of the Mothers with Preterm Infants (n=200)*

Variables	Frequency (n)	Percentage (%)
Type of family		
Nuclear	50	25%
Extended	150	75%
Co-morbidities in family		
Endocrine disorder	167	83.5%
Heart diseases	17	8.5%
Cancers, neurological and respiratory problems	9	4.5%
No comorbidities	7	3.5%
Educational status of husband		
Matriculation	6	3%
Intermediate	42	21%
Graduate	134	67%
Post graduate and above	18	9%
Occupation of husband		
Job	94	47%
Business	106	53%
Substance abuse by husband		
No substance abuse	77	38.5%
Pan, betel nut, gutka and naswar	59	29.5%
Cigarette	64	32%
Earning members in family		
1	55	27.5%
2	107	53.5%
3	30	15%
More than 3	8	4%
Type of marriage		
Consanguinity	69	34.5%
Non consanguinity	131	65.5
Years in marriage		
Less than 5 years	81	40.5%
5 – 10 years	75	37.5%
11 – 15 years	40	20%
Above 15 years	4	2%
Satisfaction in relationship with husband		

To greater extent	194	97%
To some extent and to lesser extent	6	3%
Satisfaction in relationship with in-laws		
To greater extent	32	16%
To some extent and to lesser extent	168	84%
How do mothers cope in stressful situations		
Share with someone	70	35%
Talk to husband	77	38.5%
Analyze it	22	11%
Other	31	15.5%
Finding solutions in stressful situations		
Yes	198	99%
No	2	1%
Reliable person		
Husband	169	84.5%
Mother	27	13.5%
Other	4	2%
Mode of socialization		
Outing with family	78	39%
Outing with friends	45	22.5%
Social media	34	17%
Other	43	21.5%

Newborn characteristics. The average age of preterm neonates was 10.11 days (SD±13.98). The average weight and height of neonates was 1.97 kg (SD±0.65) and 43.75 cm (SD±5.46) respectively. More than half of the newborns, i.e., 62% (n=124) were males. The APGAR score of the neonates at the first minute of life was 7.66 (SD±1.04). Moreover, preterm neonates were admitted with a range of complaints; among them 31.5% (n=63), were suffering from the RDS. More than half of the newborns, i.e., 51% (n=102), did not receive their immunization. Most of the newborns, i.e., 43.5% (n=87) were transferred from the NICU to the step down unit. More than half, i.e., 65% (n=130) of the preterm infants, were on OG tube

feeding and 59.5% (n=119) were on breast milk. Newborn characteristics are illustrated in Table 4.

Table 4 *Newborns Characteristics (n=200)*

Variables	Frequency (n)	Percentage (%)
Age in days	10.11	13.98
Weight in kg	1.97	0.65
Height in cm	43.75	5.46
APGAR score at 1 st minute of life	7.66	1.04
Gender		
Male	124	62%
Female	76	38%
Presenting complaints		
NNJ	50	25%
RDS	63	31.5%
IUGR and LBW	23	11.5%
TTN	24	12%
NEC, TNHI, sepsis, cardiac anomalies and others	40	20%
Immunization status		
Complete	98	49%
Incomplete	102	51%
Transferred from		
NICU	87	43.5%
B2 Nursery	35	17.5%
ER	37	18.5%
OR and Other	41	20.5%
Mode of feeding		
Direct breastfeeding	50	25%
Bottle feeding	20	10%
OG tube feeding	130	65%
Type of feed		
Breast feed	119	59.5%
Formula feed	81	40.5%

Outcome Variables

The PSS tool was used in the study to identify the level of stress among mothers with preterm infants. The level of stress that came out from the PSS tool among mothers is

significantly higher based on the scoring of PSS scale. This scoring included three levels, 0 - 13 low stress, 14 - 26 moderate stress and 27 - 40 is considered high perceived stress (21). Based on the criteria of PSS scoring, a majority of the participants i.e., 92% (n=184) were falling under the category of high perceived stress, with the remainder falling into the category of moderate stress. Table 5 depicts the level of stress among mothers with preterm infants.

Table 5 *Perceived Stress Score of Mothers with Preterm Infants (n=200)*

Characteristics	Frequency	Percentage
Moderate stress	16	8%
High perceived stress	184	92%

Inferential Analysis

Inferential analysis of the study findings was carried out firstly by differentiating categorical variables and continuous variables. Analysis was further continued by using the chi-square test for the categorical variables and T-test for two independent samples for continuous variables in the study.

Categorical variables. Most of the mothers in the category of high perceived stress were having male child (62.5% n=115), with 31% (n=57) had RDS as the presenting complaints of the newborn. More than half of the mothers i.e., 53.3% (n=98) reported high perceived stress as their newborn’s immunization status was incomplete and 42.9% (n=79) had their babies transferred from NICU. On the other hand, mothers in moderate levels of stress had similar findings except three quarters (75% n=12) of mothers in this category had complete immunization status of their newborn.

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2
3 Around half of the mothers in the category of high perceived stress had done graduation.
4
5 However, three quarters i.e., 85.9% (n=158) were housewives, although the majority of mothers
6
7 i.e., 89.7% (n=165) were satisfied with their financial status. Most of the mothers i.e., 65.2%
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9 (n=120) were in non-consanguinity type of marriage and 7.6% (n=14) were abusing some form
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11 of substance. On the other hand, mothers in the category of moderate stress had similar findings
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13 except 37.5% (n=6) had done post graduate and above.
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18 A small number of the mothers in high levels of stress i.e., 8.7% (n=16) reported that
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20 their children have comorbidities including congenital heart diseases, metabolic disorders,
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22 seizures disorders and genetic disorders. In addition, more than half of the mothers i.e., 59.2%
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24 (n=109) had their family members for taking care of other children during pregnancy. Mothers in
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26 the category of moderate level of stress had similar findings except none of the mothers had any
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28 comorbidity in their children.
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30

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32
33 Almost three fourth i.e., 74.5% (n=137) of the study participants in high levels of stress
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35 had planned their pregnancy and more than half i.e., 55.4% (n=102) will also plan for further
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37 children. However, 45.1% (n=83) had family preference for male child. The findings are similar
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39 in the category of moderate stress except that more than half i.e., 56.3% (n=9) of the mothers
40
41 will decide later for planning more children.
42
43

44
45 A minimum number of mothers in the category of high perceived stress i.e., 12.5%
46
47 (n=23) have gynecological issues. The complications that included in their pregnancies were
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49 31% (n=57) had preterm labor pain, 23.4% (n=43) had GDM, and 21.7% (n=40) had
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51 preeclampsia. Most of the mothers i.e., 81.5% (n=150) had gone through cesarean section as a
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53 mode of delivery. A previous history of miscarriage, abortion, preterm deliveries and IUD was
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found in 32.6% (n=60), 2.2% (n=4), 13% (n=24), and 6.5% (n=12) of mothers respectively. On the other hand, mothers in the category of moderate stress had similar findings except 37.5% (n=6) had PROM instead of pre-eclampsia.

Majority of mothers in high perceived stress i.e., 93.5% (n=172) had consumed a balanced diet during pregnancy. More than half of the mothers i.e., 64.7% (n=119) started the antenatal visits in initial weeks of pregnancy with 62.5% (n=115) had complete immunization status. The findings from the category of moderate level of stress are similar except the majority of the mothers 56.3% (n=9) started the antenatal visits in the first trimester of pregnancy.

Majority of the mothers in the category of high perceived stress 66.8% (n=123) had their babies' mode of feeding as OG tube feeding. Moreover, the majority of them 58.7% (n=108) were giving breast milk to their newborns. Three quarters of mothers i.e., 75% (n=138) were using artificial methods for family planning. However, there was no difference seen in the category of moderate level of stress for the above mentioned findings.

Majority of the mothers in the category of high perceived stress i.e., 76.1% (n=140) were living in extended families and 85.3% (n=157) had endocrine disorders in their families. Majority of the mothers i.e., 67.4% (n=124) had their husband education status of graduation, 52.7% (n=97) were running their business, 32.6% (n=60) smoked cigarette and 31% (n=57) chewed betel nut, pan, gutka and naswar. Approximately all the mothers i.e., 96.7% (n=178) were satisfied in their relationships with their husbands. However, most of the mothers i.e., 84.8% (n=156) were satisfied to some extent or to a lesser extent in the relationship with their in-laws. The finding of these elements are similar in the category of moderate level of stress except 43.8% (n=7) of mothers had their husband education status of post graduate and above.

Approximately half of the mothers i.e., 40.8% (n=75) were talking to their husband in time of stressful situation, all the mothers i.e., 99.5% (n=183) were finding a solution in times of stressful situation and almost half of the mothers i.e., 39.7% (n=73) had outing with family as a mode of socialization. The findings for the mothers in moderate levels of stress were similar except 50% (n=8) were sharing with someone else other than husband in time of stressful situation and had different modes of socialization rather than outing with family. The table 6.1 and 6.2 shows the inferential statistics for the categorical variables in the study.

Table 6.1 *Inferential Statistics for Categorical Variables of Stress among Mothers with Preterm Infants (n=200)*

Characteristics	Moderate stress 8% (n= 16)	High perceived stress 92% (n=184)	P – value
Neonate gender			
Male	56.3% (9)	62.5% (115)	0.60
Female	43.8% (7)	37.5% (69)	
Presenting complaints			
NNJ	37.5% (6)	23.9% (44)	0.501*
RDS	37.5% (6)	31% (57)	
IUGR and LBW	6.3% (1)	12% (22)	
TTN	12.5% (2)	12% (22)	
NEC, TNHI, sepsis, cardiac anomalies and others	6.3% (1)	21.2% (39)	
Immunization of newborn			
Complete	75% (12)	46.7% (86)	0.03
Incomplete	25% (4)	53.3% (98)	
Transferred from			
NICU	50% (8)	42.9% (79)	0.300*
B2 Nursery	12.5% (2)	17.9% (33)	
ER	31.3% (5)	17.4% (32)	
OR and Other	6.3% (1)	21.7% (40)	
Education status of mother			
Below matriculation	6.3% (1)	2.2%(4)	0.003*
Matriculation	18.8% (3)	24.5% (45)	
Intermediate	12.5% (2)	24.5% (45)	
Graduate	25% (4)	41.3% (76)	
Post graduate and above	37.5% (6)	7.6% (14)	

Language spoken			
Urdu	68.8% (11)	83.7% (154)	0.057*
Sindhi	12.5% (2)	9.2% (17)	
Balochi	12.5% (2)	1.6% (3)	
Other	6.3% (1)	5.4% (10)	
Mother's occupation			
House wife	56.3% (9)	85.9% (158)	0.007
Working	43.8% (7)	14.1% (26)	
Satisfaction with financial status			
Yes	87.5% (14)	89.7% (165)	0.678
No	12.5% (2)	10.3% (19)	
Substance abuse by mother			
No	75% (12)	92.4% (170)	0.042
Yes	25% (4)	7.6% (14)	
Marriage type			
Consanguinity	31.3% (5)	34.8% (64)	1.000
Non-consanguinity	68.8% (11)	65.2% (120)	
Comorbidities in children			
Yes	0% (0)	8.7% (16)	0.373
No	100% (16)	91.3% (168)	
Person taking care of other children during pregnancy			
Family members	62.5% (10)	59.2% (109)	1.000
NA for primi gavid mothers	37.5% (6)	40.8% (75)	
Planned pregnancy			
Yes	56.3% (9)	74.5% (137)	0.142
No	43.8% (7)	25.5% (47)	
Plan for more children			
Yes	25% (4)	55.4% (102)	0.041*
No	18.8% (3)	16.3% (30)	
Will decide later	56.3% (9)	28.3% (52)	
Gender preference from family			
Boy	12.5% (2)	45.1% (83)	0.037*
Girl	6.3% (1)	2.7% (5)	
No	81.3% (13)	52.2% (96)	
Gynecological issues			
Yes	6.3% (1)	12.5% (23)	0.699
No	93.8% (15)	87.5% (161)	
Complications in pregnancy			
GDM	18.8% (3)	23.4% (43)	0.086*
Pre-eclampsia	6.3% (1)	21.7% (40)	
PROM	37.5% (6)	11.4% (21)	
IUGR	6.3% (1)	4.3% (8)	
Preterm labor pain	25% (4)	31% (57)	
APH	6.3% (1)	8.2% (15)	
Mode of delivery			

SVD without episiotomy	12.5% (2)	7.6% (14)	0.758*
SVD with episiotomy	12.5% (2)	10.9% (20)	
Cesarean section	75% (12)	81.5% (150)	
History of miscarriage			
Yes	37.5% (6)	32.6% (60)	0.783
No	62.5% (10)	67.4% (124)	
History of abortion			
Yes	6.3% (1)	2.2% (4)	0.344
No	93.8% (15)	97.8% (180)	
History of preterm deliveries			
Yes	18.8% (3)	13% (24)	0.458
No	81.3% (13)	87% (160)	
History of IUD			
Yes	6.3% (1)	6.5% (12)	1.000
No	93.8% (15)	93.5% (172)	
Balance diet			
Yes	75% (12)	93.5% (172)	0.028
No	25% (4)	6.5% (12)	

*Denotes pearson chi-square P-value

Table 6.2 Inferential Statistics for Categorical Variables of Stress among Mothers with Preterm Infants (n=200)

Characteristics	Moderate stress 8% (n= 16)	High perceived stress 92% (n=184)	P – value
Antenatal visits during pregnancy			
Initial weeks	37.5% (6)	64.7% (119)	0.098*
First trimester	56.3% (9)	31.5% (58)	
Second and third trimester	6.3% (1)	3.8% (7)	
Immunization status of mother			
Complete	81.3% (13)	62.5% (115)	0.178
Incomplete	18.8% (3)	37.5% (69)	
Mode of feeding baby			
DBF	31.3% (5)	24.5% (45)	0.067*
Bottle feeding	25% (4)	8.7% (16)	
OG feeding	43.8% (7)	66.8% (123)	
Type of feed for baby			
Breast feed	68.8% (11)	58.7% (108)	0.597
Formula feed	31.3% (5)	41.3% (76)	
Family planning method			
Natural	12.5% (2)	25% (46)	0.367
Artificial	87.5% (14)	75% (138)	

Type of family			
Nuclear	37.5% (8)	23.9% (44)	0.237
Extended	62.5% (10)	76.1% (140)	
Co-morbidities in family			
Endocrine disorders	62.5% (10)	85.3% (157)	0.072*
Heart diseases	25% (4)	7.1% (13)	
Cancers, neurological and respiratory problems	6.3% (1)	4.3% (8)	
No comorbidities	6.3% (1)	3.3% (6)	
Education status of husband			
Matriculation	12.5% (2)	2.2% (4)	<0.000*
Intermediate	6.3% (1)	22.3% (41)	
Graduate	37.5% (6)	67.4% (124)	
Post graduate and above	43.8% (7)	8.2% (15)	
Occupation of husband			
Job	43.8% (7)	47.3% (87)	1.000
Business	56.3% (9)	52.7% (97)	
Substance abuse by husband			
No	62.5% (10)	36.4% (67)	0.102*
Betelnut, pan, gutka and naswar	12.5%(2)	31% (57)	
Cigarette	25% (4)	32.6% (60)	
Satisfaction in relationship with husband			
To greater extent	100% (16)	96.7% (178)	1.000
To some extent and to lesser extent	0% (0)	3.3% (6)	
Satisfaction in relationship with in-laws			
To greater extent	25% (4)	15.2% (28)	0.294
To some extent and to lesser extent	75% (12)	84.8% (156)	
How do you cope with stressful situation			
Share with someone	50% (8)	33.7% (62)	0.156*
Talk to husband	12.5% (2)	40.8% (75)	
Analyze it	12.5% (2)	10.9% (20)	
Other	25% (4)	14.7% (27)	
Finding solution in stressful situation			
Yes	93.8% (15)	99.5% (183)	0.154
No	6.3% (1)	0.5% (1)	
Mode of socialization			
Outing with family	31.3% (5)	39.7% (73)	0.032*
Outing with friends	12.5% (2)	23.4% (43)	
Social media	6.3% (1)	17.9% (33)	
Others	50% (8)	19% (35)	

**Denotes pearson chi-square P-value*

Continuous variables. The mean age, weight and length of newborns in mothers with high levels of perceived stress was 9.88 (SD +13.47), 1.97 (SD of +0.66) and 43.75 (+5.54) respectively. The mean APGAR score for neonates was 7.65 (SD +1.05) and the mean gestational age of mothers was 33.21 (SD +2.91). However, the scores of these elements for the mothers in moderate levels of stress were comparatively higher as compared to mothers with the category of high perceived stress.

The mean age and monthly income of mothers with high levels of perceived stress were 30.27 (SD +5.16) and 110054.35 (SD +21051.51) which was higher as compared with the category of mothers in moderate levels of stress. The mean of years in marriage and number of earning members in a family of mothers with high levels of stress was 1.80 (SD +0.80) and 1.93 (SD +0.75) which was comparatively lower than for the mothers in moderate levels of stress.

The mean gravid, hours of sleep and age of husbands of mothers with high levels of perceived stress were 2.78 (SD +1.65), 3.01 (SD +0.45) and 35.24 (SD +5.40) which was higher than for mothers in moderate levels of stress. The mean children alive and deceased of mothers with high levels of perceived stress were 2.17 (SD +1.21) and 1.09 (SD +0.35) which was much similar for the mothers with moderate levels of stress. The table 7 shows the inferential statistics for the continuous variables in the study.

Table 7 Inferential Statistics for Continuous Variables of Stress among Mothers with Preterm Infants (n=200)

Characteristics	Moderate stress		High perceived stress		P – value
	Mean	SD	Mean	SD	
Neonate age	12.75	+19.19	9.88	+13.47	0.43
Neonate weight	2.06	+ 0.57	1.97	+0.66	0.59
Neonate height	43.75	+4.53	43.75	+5.54	1.000
APGAR Score	7.69	+0.87	7.65	+1.05	0.89

Gestational age	33.75	+2.23	33.21	+2.91	0.47
Mother's age	28.44	+5.60	30.27	+5.16	0.17
Monthly income	100000	+18973.66	110054.35	+21051.51	0.06
Years in marriage	2.25	+0.85	1.80	+0.80	0.03*
Gravid	2.69	+1.74	2.78	+1.65	0.83
Children alive	2.13	+1.25	2.17	+1.21	0.87
Children deceased	1.31	+0.87	1.09	+0.35	0.33
Hours of sleep	2.63	+0.71	3.01	+0.45	0.05*
No of earning members	2.25	+0.85	1.93	+0.75	0.10
Age of husband	33.25	+5.58	35.24	+5.40	0.16

*Significant P-value

Discussion

Level of Stress among Mothers with Preterm Infants

This study focused on the level of stress and its associated factors among mothers with preterm infants in Karachi, Pakistan. To assess the level of stress PSS tool was incorporated in a self-developed questionnaire. PSS has been used extensively around the globe to measure stress in various groups of people. Additionally, it is employed to gauge the level of stress experienced by mothers of preterm infants in Taiwan and Pakistan.

In our study, 92% of the study participants fell under the category of high perceived stress, which is considerably higher. According to a comparator study conducted in Kenya on the prevalence of psychological distress among mothers with term and preterm infants, reported that 83.7% who delivered preterm infants were positive for stress (24). According to a systematic review conducted in high income countries (HIC) on post-traumatic stress symptoms in mothers of preterm infants, 77.8% of the mothers had stress and met the criteria for potential post-traumatic stress disorder after the birth of a preterm infant (25). These studies validate the findings of the current study as results are similar to a great extent.

On the contrary, according to a recent systematic review, conducted for urban HIC, on the prevalence of stress among mothers with preterm infants who were admitted in the NICU which reported the prevalence of stress was 39.9% (26). A study conducted in Malaysia, reported 56.5% of mothers with preterm infants admitted in the NICU had high levels of stress (27). However, these findings are relatively lower than the findings of the current study. The plausible difference could be due to the diverse socio-cultural stressors related to the income levels of the two countries, as Malaysia is an upper middle income country (UMIC) while Pakistan comes under the category of LMIC (28).

Another study conducted in the United States of America (USA), regarding the association between preterm birth and maternal mental health, concluded that 11.26% of the mothers who delivered preterm infants reported stress (29). A recent study conducted in the USA, on maternal mental health after their preterm infants were discharged from NICU, showed that 29% of the mothers had stress and depressive disorders (30). However, the level of stress mentioned in these studies is relatively lower as compared to the current Pakistani based study findings where the stress levels in mothers are significantly high. Comparing the findings of the studies conducted in the USA, which is considered a HIC, with Pakistan, a huge difference can be seen in the levels of stress being reported. This difference may be attributed to Pakistani women's cultural freedom to report stress, income status variance or the care approaches in the two settings.

Factors Affecting Level of Stress among Mothers with Preterm Infants

The literature has suggested that the social, cultural, and environmental aspects of a LMIC; like Pakistan, tend to create additional exposures to stressors, thereby adding to increased

1
2
3 risk of stress and depression among mothers during pregnancy and childbirth (31). The literature
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5 has also suggested numerous factors that are associated with increased levels of stress among
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7 mothers with preterm infants. Amongst the determinants specific to culture, the main cause is
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9 unplanned pregnancy, along with preference of male child over female (31). Another study
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11 conducted in Pakistan has also suggested that decreased autonomy of mothers, in making
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13 decisions related to pregnancy and reproductive health, is also a major factor associated with
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15 increased levels of stress among mothers with preterm infants (32). In addition, Pakistani women
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17 are more susceptible to stress and depression due to overlapping socio-economic factors, which
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19 include, unemployment and lack of education. Obstetric factors, which include, multiple and
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21 unplanned pregnancies. The psycho-social factors, which include, verbal and physical abuse by
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23 husbands and mother-in-law (32). When comparing the results of the current study to previous
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25 research, it was found that 50% of the mothers had a higher education level still majority of
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27 mothers were housewives, this could be a contributing factor to the unemployment in Pakistan.
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29 Furthermore, two-third of mothers had planned their pregnancies while majority of them were
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31 carrying multiple pregnancies which could be a potential reason for gender preference. This
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33 implies that these elements are in line with the literature.
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41 This study has highlighted multiple factors that are associated with increased levels of
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43 stress among mothers with preterm infants. However, only the factors with a P-value of less than
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45 0.05 were considered significant and were taken as important factors that are associated with
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47 increased levels of stress. The current study findings are consistent with the factors such as
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49 (hours of sleep, consumption of balance diet, immunization of newborn, mode of socialization,
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51 education and occupation status of mothers, substance abuse by mother, education status of
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53 husband, gender preference from family, planning for further children and years in marriage),
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mentioned in the literature that are associated with high levels of stress among mothers with preterm infants.

When comparing the results of the current study to previous research, it was found that 50% of the mothers had a higher education level still majority of mothers were housewives, this could be a contributing factor to the unemployment. Furthermore, two-third of mothers had planned their pregnancies while the majority of them were carrying multiple pregnancies which could be a potential reason for gender preference. This implies that these elements are in line with the literature.

Immunization of the newborn is another factor associated with the increased levels of stress among mothers with preterm infants. High perceived stress was reported in a significant number of mothers whose preterm infants had an incomplete immunization status. This finding is consistent with a systematic review about vaccination in preterm infants, which suggests that parents feel increased stress while vaccinating the preterm infants as compared to term infants (33). The plausible reasons included decreased weight of preterm infants, as compared to the term infants, and delay in the vaccination in order to allow for the correct gestation age to be achieved prior to the vaccination of the preterm infants (33).

The educational status of mothers was also a pivotal factor associated with the level of stress among mothers with preterm infants. In the current study, moderate and high levels of stress were reported in mothers who had graduated from high school. Contrary to this finding, the study conducted in Maichew, North Ethiopia, showed that no stress was reported in mothers with advanced levels of education; however, the level of stress was high in mothers with low level of education or no formal education (34). The reasons for the contradiction could have

related to mothers having higher education, in the current study, wanting to work but at the same time had to take care of a preterm infant as a priority.

The current study showed that mothers who were not employed had high levels of stress as compared to working mothers. This finding was found to be similar to the findings of the study conducted in south east Ethiopia, that depicted high levels of stress in mothers who were housewives (35). A potential reason for low levels of stress in working mothers could be the advantage of regular social interaction with friends and co-workers, which changed the environment and probably enhanced the mental wellbeing of the mothers. Hence, the current study highlighted the importance of employment in reducing the stress among mothers with preterm infants.

Substance abuse by mothers is yet another risk factor associated with stress among mothers with preterm stress. In the current study, the level of stress was reported in non-significant numbers of mothers among those who were abusing substances; however, these numbers depicted increased levels of stress among mothers with preterm infants. This finding is consistent with the findings of the study conducted in Maichew, North Ethiopia, where tobacco chewing was associated with increased levels of stress among mothers (34). Substance abuse has been associated with many health problems such as; to the impact of chewing the betel nut in the current study includes anemia during pregnancy and lactation. The current study has therefore identified the need to counsel the mothers to reduce substance abuse, in order to improve the high levels of stress among mothers with preterm infants.

Planning for further children was also associated with an increased level of stress among mothers with preterm infants. In the current study, more than half of the mothers in the category

of high perceived stress will plan for further children. However, mothers with moderate levels of stress reported that they will decide later about planning for further children. According to a study conducted in China, on assessing mothers' parenting stress difference between having one and two children, mothers with two children showed significantly higher stress scores as compared to the mothers with one child (36). The finding is consistent to some extent, as planning for further children and parenting two children at a time, while including care of a preterm infant, is a challenging situation that can increase stress in mothers. One of the plausible reasons could be the minimum age gaps between the two children causing parenting stress in mothers who have delivered a preterm infant.

Gender preference of the child was also a major factor associated with the increased level of stress in mothers with preterm infants. In the current study, although a majority of mothers reported that there was no gender preference, a significant number of mothers reported male as the preferred gender. This finding is similar to another study conducted in Pakistan that showed that unplanned pregnancy was a factor associated with the increased level of stress among mothers, and the reason for unplanned pregnancies was preference of male child over female (31).

In the current study, it was identified that mothers with moderate and high levels of stress were consuming a balanced diet, yet they were experiencing increased levels of stress. However, this finding is in contradiction with the findings of a study conducted in Taiwan, where a low level of stress was associated with the consumption of a balanced diet (10).

The education status of the husband was also an important factor associated with the level of stress among mothers with preterm infants. In the current study increased levels of stress were

reported among mothers whose husbands were educated up to the graduate level. This finding is contradictory with the findings of a study conducted in India, that showed decreased levels of stress among mothers whose husbands had a higher level of education status (37). The core reason for the contradictory findings could possibly be the increased rate of unemployment in Pakistan, as being a graduate and not having employment of that level has been associated with triggering stress.

Socialization is yet another important factor associated with stress among mothers with preterm infants. In the current study, all the mothers had different modes of socialization, including, outing with family, friends, social media, and others, that decreased the level of stress as it worked as mode of social support for them. This finding is also consistent with the study conducted in Taiwan, that suggested social support, including family, friends, and social group work as mediators for the mothers; they boost their self-esteem and provide emotional stability to mothers with increased levels of stress following the birth of a preterm infant (10). The current study has identified support groups and socialization as the most important factors associated in reducing the levels of stress among mothers with preterm infants.

Years in marriage was another factor associated with the level of stress among mothers with preterm infants. The current study showed that fewer years of being married was proportional to the increased levels of stress among mothers. This finding is similar with another study conducted in Pakistan that showed, increase in the years of marriage gave a sense of satisfaction to mothers, and they could have shared decision making in planning further pregnancies, subsequently decreasing the level of stress, unplanned pregnancies, and gender preference (31).

In the current study, the decreased hours of sleep were found to increase the level of stress among the participants. Mothers who were under the category of high perceived stress had an average sleep duration of 3.01 hours ($SD \pm 0.45$). This finding is consistent with the findings of the study conducted in Taiwan, which showed that 65% of the mothers with preterm infants showed insufficient and poor sleep as factors associated with the increased levels of stress (10). The possible reasons for disturbed sleep quality could be, frequent awakenings for feeding and handling the preterm infant.

The factors associated with stress among mothers with preterm infants are well supported by national and international literature. The overall results of the study in the context of Pakistan, while focusing on the specific sample of mothers with preterm infants show many similarities with the existing literature.

Limitations of the Study

The limitations of the research study are as follows:

- An analytical cross-sectional study design was used in the study. However, to find the association between outcomes of the study and the factors associated, longitudinal or prospective cohort studies can provide better results.
- The study has limited generalizability, as the sample of the study included only mothers who delivered preterm infants.
- This study was conducted in a private hospital; therefore, the sample size cannot be generalized for public and government settings.

Conclusion and Recommendations

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Education and counseling of the mothers regarding status of their neonate and ways of involving mothers in the care of their newborn is very crucial. Kangaroo mother care is significant in reducing the separation time and improving the bond between mother and the newborn. Teaching nurse’s therapeutic communication techniques in order to provide emotional support to the mothers.

Nursing practice. Thorough training of the health care professionals is necessary for the assessment of mental health in mothers with preterm infants, and for conducting interventions for them. In addition, a specialized clinical pathway for the infants born preterm can be initiated. This pathway can include the details of the child and the mother, the risk factors associated, and the scale that would be assessing the level of stress in mothers. It will also include the pertaining stress during pregnancy and the ongoing stress assessment of the mothers. Teaching related to coping strategies in stress and handling of newborns must be incorporated in the clinical pathway. A role of the nurse practitioner that incorporates the care of the newborns and mothers at the same time must be initiated. This role will help nurses identify the stress in the mothers undergoing the process of delivery, neonatal handling, and care. The study findings have identified high levels of perceived stress among mothers with preterm infants, hence, there is an immense need to emphasize on the psychological health screening program, that it is incorporated in antenatal and postnatal care. A support group must be formulated, consisting of mothers who deliver preterm infants. This support group will help decrease the level of stress and boost their coping by giving them an opportunity to express their feelings and concerns related to preterm handling and care. The administration of the hospitals should provide a separate area where the mothers with preterm infants can be individually assessed for the level of stress, and teaching for the same can be provided on an individual basis. At the policy level, it

should be made compulsory while taking into consideration a multidisciplinary team approach, that the team specifically includes a consultation by a psychologist for mothers who deliver preterm infants, in the postnatal period.

Nursing education. Nursing education must contain a separate course related to neonatal handling, care, feeding, teaching of the mothers with preterm infants, and basic assessment tools that assess the stress of the mothers with preterm infants. Nursing students must be introduced to the unique role and concept of nurse practitioner in the field. These nurse practitioners will serve as a liaison between both mothers and preterm infants. This will help students identify their area of interest and they can choose their careers in this field accordingly.

Nursing research. As the study findings identified an increased level of stress in mothers with preterm infants, there is a need for intervention studies, to identify ways for improving the mental health of mothers with preterm infants. A cross sectional study to identify the level of stress among mothers with term infants can be carried out. Since this study identified the level of stress and its associated factors among mothers with preterm infants, a similar study could be carried out to identify the level of stress and its associated factors among fathers with preterm infants. Future studies, with a multi-centered approach, consisting of large sample sizes, are required to validate the findings of this study. Further research studies are required that include public hospitals so it could provide a diverse range of healthcare setting which will improve the generalizability of the study findings. A longitudinal follow-up study is required to provide deeper insights on the long term effects of stress over time on mothers.

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Title Page

Article Title: Stress and its associated factors in mothers with preterm infants in a private tertiary care hospital of Karachi, Pakistan: An analytical cross sectional study

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Abstract

Objectives This research's goal is to present a thorough method for evaluating stress and the elements that contribute to it in mothers of premature babies.

Design Analytical cross sectional study

Setting Data was collected from inpatient service for preterm infants including neonatal intensive care unit (NICU), and neonatal step-down units of The Aga Khan University Hospital (AKUH) a private tertiary care hospital in Karachi Pakistan.

Participants Mothers aged 18 years and above who delivered preterm infants (gestational age of preterm below 37 weeks) in a private tertiary care hospital in Karachi, Pakistan.

Primary Outcome Stress in mother with preterm infants

Results 200 participants with a mean age of 30.12 years ($SD \pm 5.21$) were assessed. The level of stress identified using the perceived stress scale (PSS) among mothers who had delivered preterm infants was significantly higher as compared to other countries around the world. Based on the criteria of PSS scoring, the majority of the participants i.e., 92% (n=184) of the mothers, were categorized as having high perceived stress and 8% (n=16) of the mothers fell into the category of moderate stress.

Conclusions The study findings suggest high levels of perceived stress among mothers with preterm infants. The factors associated with the stress among mothers with preterm infants included immunization of newborn, education and occupation status of mothers, substance abuse by mother, gender preference from family, planning for further children, consumption of balance diet, education status of husband, mode of socialization, years in marriage, and hours of sleep.

Keywords Premature, preterm infants, perceived stress scale, perceived stress, stress

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Author’s Disclaimer We guarantee that the manuscript has not been published or is being considered for publication elsewhere.

Author Contributions

The study was conceptualized and designed by Yasmin Parpio. Salima Akbar was involved in data collection, writing of the manuscript's initial draft, revision, proofreading of the manuscript and data analysis. Afshan Akber critically reviewed and proof read the manuscript multiple times. Yasmin Parpio and Afshan Akber were involved in data analysis. The final draft of the manuscript was read and approved by all authors (SA, AA and YP). Yasmin Parpio is the guarantor of the study.

Data Availability Statement

All data relevant to the study are included in the article.

Ethical Approval Statement

This study involves human participants and was approved by Ethics Review Committee of Aga Khan University Hospital. The study was started after obtaining approvals from the Chief

Medical Officer, and Ethical Review Committee of Aga Khan University Hospital Reference Number: 2022-7808-23288. Written informed consent of the participants was obtained, after thoroughly explaining the study's purpose, and benefits.

Acknowledgment

I would like to thank His Highness Prince Karim Aga Khan for providing me the opportunity to fulfill my dreams in his prestigious university.

Article Summary

Strengths and Limitation of this Study

Following are the strengths of the research study:

- This is the first study that assessed level of stress among mothers with preterm infants in Karachi, Pakistan.
- The self-developed questionnaire used in the study was approved by the experts after achieving satisfactory rating in content validity index (CVI).
- The PSS tool used in the study has been validated nationally and internationally, in various languages.
- The PSS tool has been administered to similar groups of participants as in the current study.

The limitations of the research study are as follows:

- This study was conducted in a private hospital; therefore, the sample size cannot be generalized for government settings.

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Introduction

In the context of obstetrics, ‘preterm’ refers to delivery of an infant prior to the completion of 37 weeks of pregnancy [23]. Compared to term newborns, preterm infants have different needs. Preterm babies are more likely to experience infections, hypothermia, poor suck reflex, difficulty feeding, effort to gain weight, and impaired lung maturation [37].

Preterm births are escalating, globally. Each year, approximately 15 million newborns are delivered preterm globally [15]. One of the reasons for the substantial neonatal deaths prevalence is preterm births which account for 28% of all neonatal deaths worldwide [26]. Almost 45% of the children who die below the age of five are newborns; amongst these 60–80% are those born prematurely [37].

Pakistan is determined to work on this challenging issue, as Pakistan is ranked third in the world for neonatal mortality and accounts for about 7% of the universal neonatal death [8]. Moreover, the high burden of neonatal morbidity and mortality rates in the nation can be attributed to preterm births. The prevalence of neonatal mortality in Pakistan is that for every 1000 live births, there are 42 neonatal deaths [19]. Furthermore, to achieve sustainable development goal 3.2, which states to reduce neonatal and below 5 mortalities, the matter of preterm births needs to be addressed. Amongst the four provinces of Pakistan, Balochistan has the highest prevalence of neonatal mortality at, 63 deaths per 1000 live births [19].

Stress can be described as an innate response of an individual to undesirable circumstances that disturbs body equilibrium and stability [2]. Stress upon the birth of preterm infants produces physical and psychological stressors for both the newborn and the mothers. The need for intensive care treatments, feeding difficulties, and low birth weight (LBW) are among

the physical challenges for preterm infants. These physical problems for the newborn often lead to psychological impacts on the health of the mothers as well. Preterm infants may have enduring effects of prematurity, preoccupation with the survival of the newborn leading to the development of stress, depression, and post-traumatic stress disorders in mothers [28]. The mother-child bond is at risk when a preterm infant is born because of the early detachment of the infant from the mother, due to the aggressive treatment requisites for the newborn. A mother's stress stemming from a particular course of treatment for her preterm infant hinders the development of a stable parent-child bond [22].

The incidence of postpartum depression in Pakistan is 63.3% [5]. Preterm births potentially create disturbing effects on the newborn, while simultaneously initiating distressing challenges for the mothers. These difficult challenges account for the advancement of stress resulting in high levels of depression in some mothers [17]. Furthermore, this challenging issue makes the mother of a preterm more prone to mental instabilities, in contrast to mothers of term babies. The incidence of stress in mothers with preterm infants is as elevated as 30-40% in contrast to 6-12% in mothers with infants born at the completion of the gestational period [12]. In the initial postnatal period, mothers of preterm infants have been found to have more stress and depression than mothers of term babies [5].

A multitude of factors contribute to the upsurge in stress experienced by mothers of preterm newborns. According to a research conducted in India, hospitalization of the child in the critical care setting, socio-economic status, and environmental support in the hospital setting for the mothers and the newborn are frequently associated with stress in mothers with preterm infants [3].

This study is important because the identification of stressors can lead to careful planning for the interventions and prevention programs for mothers with premature babies, in the future. This research potentially facilitates the accomplishment of the Sustainable Development Goal 3, by reducing maternal and infant mortalities and morbidities.

Methodology

Study Design

The analytical cross-sectional study design was incorporated into the study to identify stress and its associated factors among mothers with preterm infants. The analytical cross-sectional study design is beneficial when the plan of the study is to identify the prevalence of a problem, its associated factors, and the association between exposure and outcome [31]. To ascertain an association between the level of stress, and its associated factors, an analytical cross-sectional study design was considered relevant for this study.

Sampling Method

A consecutive sampling method was used for selecting participants. Consecutive sampling involves enlisting a group of people from the available population that meets the eligibility criteria over a particular period. Consecutive sampling is an enhanced approach as it minimizes bias in the study, as compared to the convenience sampling method [31].

Sample Size

The sample size of the study must be pre-planned, systematically considered, and adequately large to depict the population [13]. The sample size was calculated using the OpenEpi software.

Sample Size for the Prevalence of Stress among Mothers with Preterm Infants

The sample size was calculated through OpenEpi software. The prevalence of stress among mothers with preterm infants was reported to be 75% [12]. The reported prevalence of stress was used to calculate the sample size, with a 95% confidence interval, 10% room for error, and a non-response rate of 10% was also adjusted. To achieve the study objective, the final sample size was determined as 73+7 i.e. 80.

Sample Size for Determining the Associated Factors of Stress among Mothers with Preterm Infants

The sample size was also calculated for associated factors by considering the prevalence of co-morbidities in mothers with preterm infants. The prevalence of co-morbidities among mothers with preterm infants was 38.41% and for mothers with term infants were 20.76% [1]. Considering the proportions, taking power of the study as 80, the confidence level of 95%, two-sided hypotheses, taking 1:1 ratio for unexposed and exposed for the sample, and the estimated prevalence ratio of 1.8; the approximate sample size came out to be 213. Adding the non-response rate of 10% i.e. 21 the final sample size was 234.

Since the sample size is higher for associated factors of stress among mothers with preterm infants (i.e., 234), the sample size of 234 was required for the study. However, during the process of data collection, due to the non-availability of mothers in the NICU, a sample size of 200 was achieved.

Recruitment Process of Participants

The selection of relevant participants is fundamental for the correct interpretation of the population in a study [26]. Firstly, permission for the research was taken from the chief medical officer (CMO) of the hospital. Moreover, approval from the ethical review committee (ERC) of

AKUH was taken.

After getting the required permissions, the recruitment process of participants was started. The researcher approached the participants in the NICU and neonatal step-down units. In addition, the researcher evaluated the participants based on eligibility criteria with the help of the patient’s medical record numbers. After screening the relevant participants, the researcher shared the aim of the study with the participants. Moreover, the benefits of the study were also explained. Upon willing agreement from the participants, written informed consent was taken from them and the data collection process was then initiated.

Study Period

This quantitative analytical cross-sectional research study was completed in a five-month period, from December 2022 to April 2023. The study commenced after approvals from the CMO and ERC.

Study Variables

Stress level among mothers with preterm infants was the dependent variable of the study. The stress among mothers was assessed through the PSS. This scale measures the overall level of stress by encompassing the control over self and the conditions in life, personal confidence, and ability to control important aspects in life. The scores for the scale were examined in the research study.

The factors associated with the stress among mothers with preterm infants were taken as the independent variables in the study. The following were the independent variables of the study:

- Newborn’s information

- Mother's demographic data
- Pregnancy-related variables
- Family information
- Coping mechanisms

Data Sources

Demographic data were obtained through the medical records, which were accessed from confidential files and the electronic system of the hospital, taking into consideration both the mother and the newborn. Moreover, a study specific self-developed questionnaire, which included components of demographic data for mothers and newborns, was added. Moreover, pregnancy, family, and coping-related variables were also included. Furthermore, the PSS was applied with regards to mothers for the data collection.

Eligibility Criteria

Defining the inclusion and exclusion criteria for the study participants improves the possibility of generating reliable results and diminishes the possibility of recruiting inappropriate participants [6]. The participants for the study were selected based on the below mentioned inclusion and exclusion criteria.

Inclusion Criteria

The inclusion criteria of a study indicate the main features that the potential participants of the study must have; these criteria include demographics and the pertinent characteristics related to the study [16]. The inclusion criteria of this study included:

- Mothers of age 18 years and above
- Gestational age of preterm below 37 weeks.

- Mothers who were willing to participate and give consent.

Exclusion Criterion

The exclusion criteria of the study specify the subjects who meet the inclusion criteria but possess other features that are not favorable for the study and that need to be excluded [16]. The exclusion criterion of the study included:

- Mothers who could not communicate in Urdu or the English language.

Data Collection Tool

Data collection tools must be validated by the researcher prior to their use to check for appropriateness in a particular context to minimize any bias [13]. An internally developed questionnaire was used for the data collection. This tool included components regarding demographic data for mothers and newborns. Moreover, pregnancy, family, and coping-related variables were also included. Furthermore, the PSS was also integrated into the questionnaire.

The study specific tool was run through a CVI where four experts in the concerned field were approached. All experts gave their marks out of 4 for each question in the questionnaire, for relevance and clarity, simultaneously. Each item was marked from 1 to 4 from 1 being not relevant and not clear, to 4 being very relevant and very clear. Upon their marking, the results were combined, the relevance came out to be 0.86 and clarity came out to be 0.92 which is considered satisfactory.

The PSS is a widely used functional tool for assessing stress among people going through difficult circumstances. This tool has been validated in the Pakistani context for assessing the level of stress among individuals [13]. This tool consists of 10 items, in which participants give a rating with regard to their emotions and mindset related to the events and

circumstances that happened in the last month. Each item is rated on a 5-point Likert scale, from 0 never to 4 very often. Six items are negative (1, 2, 3, 6, 9, 10) and the other four are positive (4, 5, 7, 8). To create the score, the four positive items are scored in a reversed manner and then all the items are added, ranging from 0 to 40. This scoring included three levels, 0 - 13 low stress, 14 - 26 moderate stress and 27 - 40 is considered high perceived stress [7]. To confirm, a higher score represents an elevated level of stress.

Internal Consistency

The internal consistency of the measuring tool is determined by the association of all items developed for measurement in the tool [34]. The internal consistency of the tool is measured with Cronbach's alpha. The Cronbach's alpha value is 0.87 for the total perceived stress score. This value shows that the internal consistency of the tool is acceptable [35]. The calculated Cronbach's alpha for the PSS tool in the current study is 70% which is considered satisfactory.

Construct Validity

Validity reflects that the assessing tool measures the attributes it is projected to measure [7]. The construct validity of the tool was measured, and the factor structure was assessed to observe whether the association between different variables in the tool was measuring a particular construct in the tool or not. The test-retest reliability score (r) is 0.86 for the total perceived stress score [35]. This value depicts a satisfactory construct validity of the tool.

Data Analysis Plan

Analysis of the data was conducted on the statistical package for social sciences (SPSS). Descriptive analysis and inferential analysis of the data were considered in the study.

Descriptive Analysis

Descriptive analysis is a method used for portraying the data in a comprehensive manner, such that it examines the styles and connections between the data in the research study [14]. Demographic variables of the study, including categorical data, frequencies, and proportions, were analyzed using descriptive analysis. Data that were continuous in nature were computed by measuring the mean and standard deviation. The level of stress among mothers with preterm infants, assessed through the questionnaire, was categorical in nature, and was reported through frequencies and percentage.

Inferential Analysis

The inferential analysis is utilized to determine the consistency of outcomes regarding a population, based on the data collected from the sample in the research study [14]. Inferential analysis of the study findings was carried out firstly by differentiating categorical variables and continuous variables. Analysis was further continued by using the chi-square test for the categorical variables and T-test for two independent samples for continuous variables in the study. During the analysis, the confidence interval of 95% and p-value of less than 0.05 was considered as significant.

Ethical Considerations

Ethical considerations are important throughout the research process. The study was started after obtaining approvals from the CMO, and ERC of AKUH. Written informed consent of the participants was obtained, after thoroughly explaining the study’s purpose, and benefits. Moreover, participants were informed about their autonomy to back out from the study at any time, before the data coding is complete. The participants were also assured that their withdrawal from the study would not affect their treatment process. In addition, the informed

consent form was given in both English and Urdu languages, so that the participants could easily understand the process. Furthermore, it was explained to the participants that participation in the study was voluntary, and no incentives will be given for participating in the study.

The privacy and confidentiality of the study participants were considered important, and the survey was conducted in separate rooms. The data was accessible to the primary investigator, supervisor, and committee members of the research study. It was in both soft and hard formats. The hard copies were with the primary investigator and were kept under lock and key. The soft copies were saved with the help of passwords. For publication of the research study, the data will be portrayed in a deidentified manner. In addition, participants were assigned codes in the data entry system, to protect their individualities.

Patient and Public Involvement

Patients or the public were not involved in the design, or conduct, or reporting, or dissemination plans of our research. Research question and outcome measures were not informed by patients' priorities, experiences, and preferences. Patients were not involved in the design and recruitment of this study. Moreover, results will be disseminated through publication of the research in a prestigious journal. Randomized controlled trials were not used in this study.

Results

Descriptive Analysis

A total of two hundred (n=200) mothers who delivered preterm infants were recruited for the study. For descriptive analysis, continuous variables were summarized using mean and

standard deviation (SD). The categorical variables were reported through frequencies and percentages.

Socio demographic characteristics of the mothers with preterm infants. The socio-demographic characteristics of the mothers who delivered preterm infants are illustrated in Table 1. The mean age of these mothers was 30.12 years ($SD \pm 5.21$), with ages ranging from 18-44 years. The majority of the participants were Urdu speaking 82.5% (n=165).

Most of the mothers, i.e., around 97% (n=195), had completed their education, ranging from matriculation to postgraduate and above. The use of substances such as betel nuts and other forms of substance was reported by 9% (n=18) of the mothers. The mothers who were employed accounted for approximately 16.5% (n=33) of the participants, whereas nearly 83.5% (n=167) were housewives. The household income was taken as continuous data, with a mean of 109,250.00 PKR ($SD \pm 21027.32$), with the income ranging from 50,000 to 160,000. Most of the mothers, i.e., around 89.5% (n=179), were satisfied with their financial status.

Table 1 *Socio-demographic Characteristics of Mothers with Preterm Infants (n=200)*

Variables	Frequency (n)	Percentage (%)
Age (in years)	30.12	5.21
Monthly income in PKR	109,250.00	21027.32
Language spoken		
Urdu	165	82.5%
Sindhi	19	9.5%
Other languages	16	8%
Educational status		
Below matriculation	5	2%
Matriculation	48	24%
Intermediate	47	23.5%
Graduate	80	40%
Post graduate and above	20	10%
Substance abuse		
Yes	18	9%
No	182	91%
Occupation status		

House wife	167	83.5%
Working	33	16.5%
Satisfaction with financial status		
Yes	179	89.5%
No	21	10.5%

Obstetric and gynecological characteristics of mothers with preterm infants. Among the mothers who delivered preterm infants, the participants' average gestational age was 33.26 weeks (SD± 2.86). Nearly 70.5% (n=141) of the mothers had had multiple pregnancies and 38.5% (n=77) had one child. More than half of the study participants i.e., 59.5% (n=119) reported that during their pregnancy their other children were taken care of by their family members. Almost 73% (n=146) of the mothers reported that their current pregnancy was planned. More than half of the participants, i.e., 53% (n=106) of the mothers reported that they planned to have more children. Gender preference in the family was reported by almost 45.5% (n=91) of the participants, 42.5% (n=85) reported a preference for male and only 3% (n=6) reported preference for female.

About 12% (n=24) of the mothers had fertility and gynecological issues, including, polycystic ovary syndrome (PCOS), uterine fibroids, bicornuate uterus and, anovulatory infertility. All of the study participants had experienced a complication in their current pregnancy; most of them i.e., 30.5% (n=61) of the mothers had had preterm labor pains. The mode of delivery seemed to be inclined towards cesarean section; 81% (n=162) of the mothers had gone through cesarean section as the mode of delivery. Previous history was also noteworthy with miscarriage in 33% (n=66) of the participants, preterm deliveries in 13.5% (n=27), intrauterine deaths (IUD) in 6.5% (n=13), and abortion among 2.5% (n=5) of mothers. More than

half of the study participants, i.e., 62.5% (n=125) of the mothers, started their antenatal visits during the initial weeks of pregnancy.

Nearly 64% (n=128) of the participants reported that they had completed their immunization. Nearly all the study participants, i.e., 96% (n=192) of the mothers, had conceived naturally. More than half of the study population, i.e., 76% (n=152) used artificial methods for family planning. Consuming a well-balanced diet during their pregnancy was reported by 92% (n=184) of the mothers. Most of the study participants, i.e., 79.5% (n=159) of the mothers, reported that they slept for 5-6 hours per day. The obstetric and gynecological characteristics of the mothers with preterm infants are illustrated in Table 2.

Table 2 *Obstetrics and Gynecological Characteristics of the Mothers with Preterm Infants* (n=200)

Variables	Frequency (n)	Percentage (%)
Gravid		
Primigravida	59	29.5%
Two pregnancies	51	25.5%
Three pregnancies	24	12%
Four pregnancies	26	13%
More than four pregnancies	40	20%
Children alive		
1	77	38.5%
2	52	26%
3	44	22%
More than 3	27	13.5%
Children deceased		
None	185	92.5%
Yes	15	7.5%
Comorbidities in children		
Yes	16	8%
No comorbidities	184	92%
Care of children during pregnancy		
Family member	119	59.5%
NA for primigravida	81	40.5%
Planned pregnancy		

Yes	146	73%
No	54	27%
Plan to have more children		
Yes	106	53%
No	33	16.5%
Will decide later	61	30.5%
Gender preference		
Boy	85	42.5%
Girl	6	3%
No	109	54.5%
Gynecological or fertility issues		
Yes	24	12%
No	176	88%
Mode of delivery		
Spontaneous vaginal delivery without episiotomy	16	8%
Spontaneous vaginal delivery with episiotomy	22	11%
Cesarean section	162	81%
History of miscarriage		
Yes	66	33%
No	134	67%
History of abortion		
Yes	5	2.5%
No	195	97.5%
History of preterm deliveries		
Yes	27	13.5%
No	173	86.5%
History of IUD		
Yes	13	6.5%
No	187	93.5%
Antenatal visits during pregnancy		
Initial weeks	125	62.5%
First trimester	67	33.5%
Second trimester and third trimester	8	4%
Immunization status		
Complete	128	64%
Incomplete	72	36%
Mode of conception		
Natural	192	96%
Artificial	8	4%
Family planning method		
Natural	48	24%
Artificial	152	76%
Balanced diet		
Yes	184	92%

No	16	8%
Hours of sleep		
Less than 3 hours	2	1%
3 – 4 hours	20	10%
5 – 6 hours	159	79.5%
7 – 8 hours	19	9.5%
Gestational age in weeks	33.26	2.86

Marital and familial characteristics and coping related factors. Among the study participants, 75% (n=150) lived in extended families. Nearly all the study participants, i.e., 96.5% (n=193), had co-morbidities in their families. Among them, 83.5% (n=167) had endocrine disorders. Almost all the families had earning members, out of which, 53.5% (n=107) had two earning members in the family. The average age of the husbands was 35.08 years (SD±5.43). The educational status of the husbands was high; most of the husbands, i.e., 65% (n=130), had studied up to graduation. All the husbands were employed; 53% (n=106) of them were doing business. There was a wide range of substance abuse among the husbands, which included 32% (n=64) smoking a cigarette, and 29.5% (n=59) using betel nut, pan, gutka and naswar.

Among the study participants, 65.5% (n=131) had non-consanguineous marriages. Almost half of the study participants, i.e., 40.5% (n=81) had been married for less than five years. Nearly all the participants, i.e., 97% (n=194) were satisfied to a greater extent in the relationship with their husbands. On the other hand, more than half, i.e., 84% (n=168) of the mothers, were satisfied to some extent or to a lesser extent in their relationship with their in-laws.

Practicing coping in stressful situations was reported by almost every participant. Among these, 38.5% (n=77) talked to their husbands in stressful situations. Almost all the study participants, i.e., 99% (n=198) of the mothers, worked on finding a solution for the stressful situation. All the participants in the study had some reliable person with whom they could talk and share their feelings in stressful situations. Socialization was reported by every participant

with 39% (n=78) linking family as a mode of socialization. Marital and familial characteristics and coping related factors of the mothers with preterm infants are illustrated in Table 3.

Table 3 *Marital and Familial Characteristics and Coping Related Factors of the Mothers with Preterm Infants (n=200)*

Variables	Frequency (n)	Percentage (%)
Type of family		
Nuclear	50	25%
Extended	150	75%
Co-morbidities in family		
Endocrine disorder	167	83.5%
Heart diseases	17	8.5%
Cancers, neurological and respiratory problems	9	4.5%
No comorbidities	7	3.5%
Educational status of husband		
Matriculation	6	3%
Intermediate	42	21%
Graduate	134	67%
Post graduate and above	18	9%
Occupation of husband		
Job	94	47%
Business	106	53%
Substance abuse by husband		
No substance abuse	77	38.5%
Pan, betel nut, gutka and naswar	59	29.5%
Cigarette	64	32%
Earning members in family		
1	55	27.5%
2	107	53.5%
3	30	15%
More than 3	8	4%
Type of marriage		
Consanguinity	69	34.5%
Non consanguinity	131	65.5
Years in marriage		
Less than 5 years	81	40.5%
5 – 10 years	75	37.5%
11 – 15 years	40	20%
Above 15 years	4	2%
Satisfaction in relationship with husband		

To greater extent	194	97%
To some extent and to lesser extent	6	3%
Satisfaction in relationship with in-laws		
To greater extent	32	16%
To some extent and to lesser extent	168	84%
How do mothers cope in stressful situations		
Share with someone	70	35%
Talk to husband	77	38.5%
Analyze it	22	11%
Other	31	15.5%
Finding solutions in stressful situations		
Yes	198	99%
No	2	1%
Reliable person		
Husband	169	84.5%
Mother	27	13.5%
Other	4	2%
Mode of socialization		
Outing with family	78	39%
Outing with friends	45	22.5%
Social media	34	17%
Other	43	21.5%

Newborn characteristics. The average age of preterm neonates was 10.11 days (SD±13.98). The average weight and height of neonates was 1.97 kg (SD±0.65) and 43.75 cm (SD±5.46) respectively. More than half of the newborns, i.e., 62% (n=124) were males. The APGAR score of the neonates at the first minute of life was 7.66 (SD±1.04). Moreover, preterm neonates were admitted with a range of complaints; among them 31.5% (n=63), were suffering from the RDS. More than half of the newborns, i.e., 51% (n=102), did not receive their immunization. Most of the newborns, i.e., 43.5% (n=87) were transferred from the NICU to the step down unit. More than half, i.e., 65% (n=130) of the preterm infants, were on OG tube

feeding and 59.5% (n=119) were on breast milk. Newborn characteristics are illustrated in Table 4.

Table 4 *Newborns Characteristics (n=200)*

Variables	Frequency (n)	Percentage (%)
Age in days	10.11	13.98
Weight in kg	1.97	0.65
Height in cm	43.75	5.46
APGAR score at 1 st minute of life	7.66	1.04
Gender		
Male	124	62%
Female	76	38%
Presenting complaints		
NNJ	50	25%
RDS	63	31.5%
IUGR and LBW	23	11.5%
TTN	24	12%
NEC, TNHI, sepsis, cardiac anomalies and others	40	20%
Immunization status		
Complete	98	49%
Incomplete	102	51%
Transferred from		
NICU	87	43.5%
B2 Nursery	35	17.5%
ER	37	18.5%
OR and Other	41	20.5%
Mode of feeding		
Direct breastfeeding	50	25%
Bottle feeding	20	10%
OG tube feeding	130	65%
Type of feed		
Breast feed	119	59.5%
Formula feed	81	40.5%

Outcome Variables

The PSS tool was used in the study to identify the level of stress among mothers with preterm infants. The level of stress that came out from the PSS tool among mothers is

significantly higher based on the scoring of PSS scale. This scoring included three levels, 0 - 13 low stress, 14 - 26 moderate stress and 27 - 40 is considered high perceived stress [7]. Based on the criteria of PSS scoring, a majority of the participants i.e., 92% (n=184) were falling under the category of high perceived stress, with the remainder falling into the category of moderate stress. Table 5 depicts the level of stress among mothers with preterm infants.

Table 5 *Perceived Stress Score of Mothers with Preterm Infants (n=200)*

Characteristics	Frequency	Percentage
Moderate stress	16	8%
High perceived stress	184	92%

Inferential Analysis

Inferential analysis of the study findings was carried out firstly by differentiating categorical variables and continuous variables. Analysis was further continued by using the chi-square test for the categorical variables and T-test for two independent samples for continuous variables in the study.

Categorical variables. Most of the mothers in the category of high perceived stress were having male child (62.5% n=115), with 31% (n=57) had RDS as the presenting complaints of the newborn. More than half of the mothers i.e., 53.3% (n=98) reported high perceived stress as their newborn’s immunization status was incomplete and 42.9% (n=79) had their babies transferred from NICU. On the other hand, mothers in moderate levels of stress had similar findings except three quarters (75% n=12) of mothers in this category had complete immunization status of their newborn.

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3 Around half of the mothers in the category of high perceived stress had done graduation.
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5 However, three quarters i.e., 85.9% (n=158) were housewives, although the majority of mothers
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7 i.e., 89.7% (n=165) were satisfied with their financial status. Most of the mothers i.e., 65.2%
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9 (n=120) were in non-consanguinity type of marriage and 7.6% (n=14) were abusing some form
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11 of substance. On the other hand, mothers in the category of moderate stress had similar findings
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13 except 37.5% (n=6) had done post graduate and above.
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18 A small number of the mothers in high levels of stress i.e., 8.7% (n=16) reported that
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20 their children have comorbidities including congenital heart diseases, metabolic disorders,
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22 seizures disorders and genetic disorders. In addition, more than half of the mothers i.e., 59.2%
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24 (n=109) had their family members for taking care of other children during pregnancy. Mothers in
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26 the category of moderate level of stress had similar findings except none of the mothers had any
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28 comorbidity in their children.
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33 Almost three fourth i.e., 74.5% (n=137) of the study participants in high levels of stress
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35 had planned their pregnancy and more than half i.e., 55.4% (n=102) will also plan for further
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37 children. However, 45.1% (n=83) had family preference for male child. The findings are similar
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39 in the category of moderate stress except that more than half i.e., 56.3% (n=9) of the mothers
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41 will decide later for planning more children.
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45 A minimum number of mothers in the category of high perceived stress i.e., 12.5%
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47 (n=23) have gynecological issues. The complications that included in their pregnancies were
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49 31% (n=57) had preterm labor pain, 23.4% (n=43) had GDM, and 21.7% (n=40) had
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51 preeclampsia. Most of the mothers i.e., 81.5% (n=150) had gone through cesarean section as a
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53 mode of delivery. A previous history of miscarriage, abortion, preterm deliveries and IUD was
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found in 32.6% (n=60), 2.2% (n=4), 13% (n=24), and 6.5% (n=12) of mothers respectively. On the other hand, mothers in the category of moderate stress had similar findings except 37.5% (n=6) had PROM instead of pre-eclampsia.

Majority of mothers in high perceived stress i.e., 93.5% (n=172) had consumed a balanced diet during pregnancy. More than half of the mothers i.e., 64.7% (n=119) started the antenatal visits in initial weeks of pregnancy with 62.5% (n=115) had complete immunization status. The findings from the category of moderate level of stress are similar except the majority of the mothers 56.3% (n=9) started the antenatal visits in the first trimester of pregnancy.

Majority of the mothers in the category of high perceived stress 66.8% (n=123) had their babies' mode of feeding as OG tube feeding. Moreover, the majority of them 58.7% (n=108) were giving breast milk to their newborns. Three quarters of mothers i.e., 75% (n=138) were using artificial methods for family planning. However, there was no difference seen in the category of moderate level of stress for the above mentioned findings.

Majority of the mothers in the category of high perceived stress i.e., 76.1% (n=140) were living in extended families and 85.3% (n=157) had endocrine disorders in their families. Majority of the mothers i.e., 67.4% (n=124) had their husband education status of graduation, 52.7% (n=97) were running their business, 32.6% (n=60) smoked cigarette and 31% (n=57) chewed betel nut, pan, gutka and naswar. Approximately all the mothers i.e., 96.7% (n=178) were satisfied in their relationships with their husbands. However, most of the mothers i.e., 84.8% (n=156) were satisfied to some extent or to a lesser extent in the relationship with their in-laws. The finding of these elements are similar in the category of moderate level of stress except 43.8% (n=7) of mothers had their husband education status of post graduate and above.

Approximately half of the mothers i.e., 40.8% (n=75) were talking to their husband in time of stressful situation, all the mothers i.e., 99.5% (n=183) were finding a solution in times of stressful situation and almost half of the mothers i.e., 39.7% (n=73) had outing with family as a mode of socialization. The findings for the mothers in moderate levels of stress were similar except 50% (n=8) were sharing with someone else other than husband in time of stressful situation and had different modes of socialization rather than outing with family. The table 6.1 and 6.2 shows the inferential statistics for the categorical variables in the study.

Table 6.1 *Inferential Statistics for Categorical Variables of Stress among Mothers with Preterm Infants (n=200)*

Characteristics	Moderate stress 8% (n= 16)	High perceived stress 92% (n=184)	P – value
Neonate gender			
Male	56.3% (9)	62.5% (115)	0.60
Female	43.8% (7)	37.5% (69)	
Presenting complaints			
NNJ	37.5% (6)	23.9% (44)	0.501*
RDS	37.5% (6)	31% (57)	
IUGR and LBW	6.3% (1)	12% (22)	
TTN	12.5% (2)	12% (22)	
NEC, TNHI, sepsis, cardiac anomalies and others	6.3% (1)	21.2% (39)	
Immunization of newborn			
Complete	75% (12)	46.7% (86)	0.03
Incomplete	25% (4)	53.3% (98)	
Transferred from			
NICU	50% (8)	42.9% (79)	0.300*
B2 Nursery	12.5% (2)	17.9% (33)	
ER	31.3% (5)	17.4% (32)	
OR and Other	6.3% (1)	21.7% (40)	
Education status of mother			
Below matriculation	6.3% (1)	2.2%(4)	0.003*
Matriculation	18.8% (3)	24.5% (45)	
Intermediate	12.5% (2)	24.5% (45)	
Graduate	25% (4)	41.3% (76)	
Post graduate and above	37.5% (6)	7.6% (14)	

Language spoken			
Urdu	68.8% (11)	83.7% (154)	0.057*
Sindhi	12.5% (2)	9.2% (17)	
Balochi	12.5% (2)	1.6% (3)	
Other	6.3% (1)	5.4% (10)	
Mother's occupation			
House wife	56.3% (9)	85.9% (158)	0.007
Working	43.8% (7)	14.1% (26)	
Satisfaction with financial status			
Yes	87.5% (14)	89.7% (165)	0.678
No	12.5% (2)	10.3% (19)	
Substance abuse by mother			
No	75% (12)	92.4% (170)	0.042
Yes	25% (4)	7.6% (14)	
Marriage type			
Consanguinity	31.3% (5)	34.8% (64)	1.000
Non-consanguinity	68.8% (11)	65.2% (120)	
Comorbidities in children			
Yes	0% (0)	8.7% (16)	0.373
No	100% (16)	91.3% (168)	
Person taking care of other children during pregnancy			
Family members	62.5% (10)	59.2% (109)	1.000
NA for primi gavid mothers	37.5% (6)	40.8% (75)	
Planned pregnancy			
Yes	56.3% (9)	74.5% (137)	0.142
No	43.8% (7)	25.5% (47)	
Plan for more children			
Yes	25% (4)	55.4% (102)	0.041*
No	18.8% (3)	16.3% (30)	
Will decide later	56.3% (9)	28.3% (52)	
Gender preference from family			
Boy	12.5% (2)	45.1% (83)	0.037*
Girl	6.3% (1)	2.7% (5)	
No	81.3% (13)	52.2% (96)	
Gynecological issues			
Yes	6.3% (1)	12.5% (23)	0.699
No	93.8% (15)	87.5% (161)	
Complications in pregnancy			
GDM	18.8% (3)	23.4% (43)	0.086*
Pre-eclampsia	6.3% (1)	21.7% (40)	
PROM	37.5% (6)	11.4% (21)	
IUGR	6.3% (1)	4.3% (8)	
Preterm labor pain	25% (4)	31% (57)	
APH	6.3% (1)	8.2% (15)	
Mode of delivery			

SVD without episiotomy	12.5% (2)	7.6% (14)	0.758*
SVD with episiotomy	12.5% (2)	10.9% (20)	
Cesarean section	75% (12)	81.5% (150)	
History of miscarriage			
Yes	37.5% (6)	32.6% (60)	0.783
No	62.5% (10)	67.4% (124)	
History of abortion			
Yes	6.3% (1)	2.2% (4)	0.344
No	93.8% (15)	97.8% (180)	
History of preterm deliveries			
Yes	18.8% (3)	13% (24)	0.458
No	81.3% (13)	87% (160)	
History of IUD			
Yes	6.3% (1)	6.5% (12)	1.000
No	93.8% (15)	93.5% (172)	
Balance diet			
Yes	75% (12)	93.5% (172)	0.028
No	25% (4)	6.5% (12)	

*Denotes pearson chi-square P-value

Table 6.2 Inferential Statistics for Categorical Variables of Stress among Mothers with Preterm Infants (n=200)

Characteristics	Moderate stress 8% (n= 16)	High perceived stress 92% (n=184)	P – value
Antenatal visits during pregnancy			
Initial weeks	37.5% (6)	64.7% (119)	0.098*
First trimester	56.3% (9)	31.5% (58)	
Second and third trimester	6.3% (1)	3.8% (7)	
Immunization status of mother			
Complete	81.3% (13)	62.5% (115)	0.178
Incomplete	18.8% (3)	37.5% (69)	
Mode of feeding baby			
DBF	31.3% (5)	24.5% (45)	0.067*
Bottle feeding	25% (4)	8.7% (16)	
OG feeding	43.8% (7)	66.8% (123)	
Type of feed for baby			
Breast feed	68.8% (11)	58.7% (108)	0.597
Formula feed	31.3% (5)	41.3% (76)	
Family planning method			
Natural	12.5% (2)	25% (46)	0.367
Artificial	87.5% (14)	75% (138)	

Type of family			
Nuclear	37.5% (8)	23.9% (44)	0.237
Extended	62.5% (10)	76.1% (140)	
Co-morbidities in family			
Endocrine disorders	62.5% (10)	85.3% (157)	0.072*
Heart diseases	25% (4)	7.1% (13)	
Cancers, neurological and respiratory problems	6.3% (1)	4.3% (8)	
No comorbidities	6.3% (1)	3.3% (6)	
Education status of husband			
Matriculation	12.5% (2)	2.2% (4)	<0.000*
Intermediate	6.3% (1)	22.3% (41)	
Graduate	37.5% (6)	67.4% (124)	
Post graduate and above	43.8% (7)	8.2% (15)	
Occupation of husband			
Job	43.8% (7)	47.3% (87)	1.000
Business	56.3% (9)	52.7% (97)	
Substance abuse by husband			
No	62.5% (10)	36.4% (67)	0.102*
Betelnut, pan, gutka and naswar	12.5%(2)	31% (57)	
Cigarette	25% (4)	32.6% (60)	
Satisfaction in relationship with husband			
To greater extent	100% (16)	96.7% (178)	1.000
To some extent and to lesser extent	0% (0)	3.3% (6)	
Satisfaction in relationship with in-laws			
To greater extent	25% (4)	15.2% (28)	0.294
To some extent and to lesser extent	75% (12)	84.8% (156)	
How do you cope with stressful situation			
Share with someone	50% (8)	33.7% (62)	0.156*
Talk to husband	12.5% (2)	40.8% (75)	
Analyze it	12.5% (2)	10.9% (20)	
Other	25% (4)	14.7% (27)	
Finding solution in stressful situation			
Yes	93.8% (15)	99.5% (183)	0.154
No	6.3% (1)	0.5% (1)	
Mode of socialization			
Outing with family	31.3% (5)	39.7% (73)	0.032*
Outing with friends	12.5% (2)	23.4% (43)	
Social media	6.3% (1)	17.9% (33)	
Others	50% (8)	19% (35)	

**Denotes pearson chi-square P-value*

Continuous variables. The mean age, weight and length of newborns in mothers with high levels of perceived stress was 9.88 (SD +13.47), 1.97 (SD of +0.66) and 43.75 (+5.54) respectively. The mean APGAR score for neonates was 7.65 (SD +1.05) and the mean gestational age of mothers was 33.21 (SD +2.91). However, the scores of these elements for the mothers in moderate levels of stress were comparatively higher as compared to mothers with the category of high perceived stress.

The mean age and monthly income of mothers with high levels of perceived stress were 30.27 (SD +5.16) and 110054.35 (SD +21051.51) which was higher as compared with the category of mothers in moderate levels of stress. The mean of years in marriage and number of earning members in a family of mothers with high levels of stress was 1.80 (SD +0.80) and 1.93 (SD +0.75) which was comparatively lower than for the mothers in moderate levels of stress.

The mean gravid, hours of sleep and age of husbands of mothers with high levels of perceived stress were 2.78 (SD +1.65), 3.01 (SD +0.45) and 35.24 (SD +5.40) which was higher than for mothers in moderate levels of stress. The mean children alive and deceased of mothers with high levels of perceived stress were 2.17 (SD +1.21) and 1.09 (SD +0.35) which was much similar for the mothers with moderate levels of stress. The table 7 shows the inferential statistics for the continuous variables in the study.

Table 7 Inferential Statistics for Continuous Variables of Stress among Mothers with Preterm Infants (n=200)

Characteristics	Moderate stress		High perceived stress		P – value
	Mean	SD	Mean	SD	
Neonate age	12.75	+19.19	9.88	+13.47	0.43
Neonate weight	2.06	+ 0.57	1.97	+0.66	0.59
Neonate height	43.75	+4.53	43.75	+5.54	1.000
APGAR Score	7.69	+0.87	7.65	+1.05	0.89

Gestational age	33.75	+2.23	33.21	+2.91	0.47
Mother's age	28.44	+5.60	30.27	+5.16	0.17
Monthly income	100000	+18973.66	110054.35	+21051.51	0.06
Years in marriage	2.25	+0.85	1.80	+0.80	0.03*
Gravid	2.69	+1.74	2.78	+1.65	0.83
Children alive	2.13	+1.25	2.17	+1.21	0.87
Children deceased	1.31	+0.87	1.09	+0.35	0.33
Hours of sleep	2.63	+0.71	3.01	+0.45	0.05*
No of earning members	2.25	+0.85	1.93	+0.75	0.10
Age of husband	33.25	+5.58	35.24	+5.40	0.16

*Significant P-value

Discussion

Level of Stress among Mothers with Preterm Infants

This study focused on the level of stress and its associated factors among mothers with preterm infants in Karachi, Pakistan. To assess the level of stress PSS tool was incorporated in a self-developed questionnaire. PSS has been used extensively around the globe to measure stress in various groups of people. Additionally, it is employed to gauge the level of stress experienced by mothers of preterm infants in Taiwan and Pakistan.

In our study, 92% of the study participants fell under the category of high perceived stress, which is considerably higher. According to a comparator study conducted in Kenya on the prevalence of psychological distress among mothers with term and preterm infants, reported that 83.7% who delivered preterm infants were positive for stress [28]. According to a systematic review conducted in high income countries (HIC) on post-traumatic stress symptoms in mothers of preterm infants, 77.8% of the mothers had stress and met the criteria for potential post-traumatic stress disorder after the birth of a preterm infant [14]. These studies validate the findings of the current study as results are similar to a great extent.

On the contrary, according to a recent systematic review, conducted for urban HIC, on the prevalence of stress among mothers with preterm infants who were admitted in the NICU which reported the prevalence of stress was 39.9% [25]. A study conducted in Malaysia, reported 56.5% of mothers with preterm infants admitted in the NICU had high levels of stress [29]. However, these findings are relatively lower than the findings of the current study. The plausible difference could be due to the diverse socio-cultural stressors related to the income levels of the two countries, as Malaysia is an upper middle income country (UMIC) while Pakistan comes under the category of LMIC [29].

Another study conducted in the United States of America (USA), regarding the association between preterm birth and maternal mental health, concluded that 11.26% of the mothers who delivered preterm infants reported stress [4]. A recent study conducted in the USA, on maternal mental health after their preterm infants were discharged from NICU, showed that 29% of the mothers had stress and depressive disorders [17]. However, the level of stress mentioned in these studies is relatively lower as compared to the current Pakistani based study findings where the stress levels in mothers are significantly high. Comparing the findings of the studies conducted in the USA, which is considered a HIC, with Pakistan, a huge difference can be seen in the levels of stress being reported. This difference may be attributed to Pakistani women's cultural freedom to report stress, income status variance or the care approaches in the two settings.

Factors Affecting Level of Stress among Mothers with Preterm Infants

The literature has suggested that the social, cultural, and environmental aspects of a LMIC; like Pakistan, tend to create additional exposures to stressors, thereby adding to increased

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3 risk of stress and depression among mothers during pregnancy and childbirth [20]. The literature
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5 has also suggested numerous factors that are associated with increased levels of stress among
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7 mothers with preterm infants. Amongst the determinants specific to culture, the main cause is
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9 unplanned pregnancy, along with preference of male child over female [20]. Another study
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11 conducted in Pakistan has also suggested that decreased autonomy of mothers, in making
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13 decisions related to pregnancy and reproductive health, is also a major factor associated with
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15 increased levels of stress among mothers with preterm infants [21]. In addition, Pakistani women
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17 are more susceptible to stress and depression due to overlapping socio-economic factors, which
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19 include, unemployment and lack of education. Obstetric factors, which include, multiple and
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21 unplanned pregnancies. The psycho-social factors, which include, verbal and physical abuse by
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23 husbands and mother-in-law [21].
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30 The current study has showed that almost half of the mothers in moderate stress and one
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32 quarter of mothers in high stress have unplanned pregnancies. The findings were consistent with
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34 the findings of the study conducted in Kenya, which also showed that unwanted and unplanned
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36 pregnancy, poor social support, marital discord and low socioeconomic status of mothers with
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38 preterm infants in Kenya were significant factors associated with the stress [28]. Kenya is also a
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40 LMIC with similar social, cultural, and environmental status like Pakistan. Therefore, this study
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42 validates the findings of the current study in similar context.
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47 The study conducted in Kenya also mentioned domestic violence as the factor associated
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49 with stress among mothers with preterm infants [28]. However, this finding is contradicting with
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51 the findings of the current study as majority of the mothers were satisfied to a great extent in
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53 relationship with their husband.
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When comparing the results of the current study to previous research, it was found that 50% of the mothers had a higher education level still majority of mothers were housewives, this could be a contributing factor to the unemployment in Pakistan. Furthermore, two-third of mothers had planned their pregnancies while majority of them were carrying multiple pregnancies which could be a potential reason for gender preference. This implies that these elements are in line with the literature.

This study has highlighted multiple factors that are associated with increased levels of stress among mothers with preterm infants. However, only the factors with a P-value of less than 0.05 were considered significant and were taken as important factors that are associated with increased levels of stress. The current study findings are consistent with the factors such as (hours of sleep, consumption of balance diet, immunization of newborn, mode of socialization, education and occupation status of mothers, substance abuse by mother, education status of husband, gender preference from family, planning for further children and years in marriage), mentioned in the literature that are associated with high levels of stress among mothers with preterm infants.

Immunization of the newborn is another factor associated with the increased levels of stress among mothers with preterm infants. High perceived stress was reported in a significant number of mothers whose preterm infants had an incomplete immunization status. This finding is consistent with a systematic review about vaccination in preterm infants, which suggests that parents feel increased stress while vaccinating the preterm infants as compared to term infants [6]. The plausible reasons included decreased weight of preterm infants, as compared to the term infants, and delay in the vaccination in order to allow for the correct gestation age to be achieved prior to the vaccination of the preterm infants [6].

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The educational status of mothers was also a pivotal factor associated with the level of stress among mothers with preterm infants. In the current study, moderate and high levels of stress were reported in mothers who had graduated from high school. Contrary to this finding, the study conducted in Maichew, North Ethiopia, showed that no stress was reported in mothers with advanced levels of education; however, the level of stress was high in mothers with low level of education or no formal education [10]. The reasons for the contradiction could have related to mothers having higher education, in the current study, wanting to work but at the same time had to take care of a preterm infant as a priority.

The current study showed that mothers who were not employed had high levels of stress as compared to working mothers. This finding was found to be similar to the findings of the study conducted in south east Ethiopia, that depicted high levels of stress in mothers who were housewives [10]. A potential reason for low levels of stress in working mothers could be the advantage of regular social interaction with friends and co-workers, which changed the environment and probably enhanced the mental wellbeing of the mothers. Hence, the current study highlighted the importance of employment in reducing the stress among mothers with preterm infants.

Substance abuse by mothers is yet another risk factor associated with stress among mothers with preterm stress. In the current study, the level of stress was reported in non-significant numbers of mothers among those who were abusing substances; however, these numbers depicted increased levels of stress among mothers with preterm infants. This finding is consistent with the findings of the study conducted in Maichew, North Ethiopia, where tobacco chewing was associated with increased levels of stress among mothers [10]. Substance abuse has been associated with many health problems such as; to the impact of chewing the betel nut in the

current study includes anemia during pregnancy and lactation. The current study has therefore identified the need to counsel the mothers to reduce substance abuse, in order to improve the high levels of stress among mothers with preterm infants.

Planning for further children was also associated with an increased level of stress among mothers with preterm infants. In the current study, more than half of the mothers in the category of high perceived stress will plan for further children. However, mothers with moderate levels of stress reported that they will decide later about planning for further children. According to a study conducted in China, on assessing mothers' parenting stress difference between having one and two children, mothers with two children showed significantly higher stress scores as compared to the mothers with one child [32]. The finding is consistent to some extent, as planning for further children and parenting two children at a time, while including care of a preterm infant, is a challenging situation that can increase stress in mothers. One of the plausible reasons could be the minimum age gaps between the two children causing parenting stress in mothers who have delivered a preterm infant.

Gender preference of the child was also a major factor associated with the increased level of stress in mothers with preterm infants. In the current study, although a majority of mothers reported that there was no gender preference, a significant number of mothers reported male as the preferred gender. This finding is similar to another study conducted in Pakistan that showed that unplanned pregnancy was a factor associated with the increased level of stress among mothers, and the reason for unplanned pregnancies was preference of male child over female [20].

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In the current study, it was identified that mothers with moderate and high levels of stress were consuming a balanced diet, yet they were experiencing increased levels of stress. However, this finding is in contradiction with the findings of a study conducted in Taiwan, where a low level of stress was associated with the consumption of a balanced diet [5].

The education status of the husband was also an important factor associated with the level of stress among mothers with preterm infants. In the current study increased levels of stress were reported among mothers whose husbands were educated up to the graduate level. This finding is contradictory with the findings of a study conducted in India, that showed decreased levels of stress among mothers whose husbands had a higher level of education status [9]. The core reason for the contradictory findings could possibly be the increased rate of unemployment in Pakistan, as being a graduate and not having employment of that level has been associated with triggering stress.

Socialization is yet another important factor associated with stress among mothers with preterm infants. In the current study, all the mothers had different modes of socialization, including, outing with family, friends, social media, and others, that decreased the level of stress as it worked as mode of social support for them. This finding is also consistent with the study conducted in Taiwan, that suggested social support, including family, friends, and social group work as mediators for the mothers; they boost their self-esteem and provide emotional stability to mothers with increased levels of stress following the birth of a preterm infant [5]. The current study has identified support groups and socialization as the most important factors associated in reducing the levels of stress among mothers with preterm infants.

Years in marriage was another factor associated with the level of stress among mothers with preterm infants. The current study showed that fewer years of being married was proportional to the increased levels of stress among mothers. This finding is similar with another study conducted in Pakistan that showed, increase in the years of marriage gave a sense of satisfaction to mothers, and they could have shared decision making in planning further pregnancies, subsequently decreasing the level of stress, unplanned pregnancies, and gender preference [20].

In the current study, the decreased hours of sleep were found to increase the level of stress among the participants. Mothers who were under the category of high perceived stress had an average sleep duration of 3.01 hours ($SD \pm 0.45$). This finding is consistent with the findings of the study conducted in Taiwan, which showed that 65% of the mothers with preterm infants showed insufficient and poor sleep as factors associated with the increased levels of stress [5]. The possible reasons for disturbed sleep quality could be, frequent awakenings for feeding and handling the preterm infant.

The factors associated with stress among mothers with preterm infants are well supported by national and international literature. The overall results of the study in the context of Pakistan, while focusing on the specific sample of mothers with preterm infants show many similarities with the existing literature.

Limitations of the Study

The limitations of the research study are as follows:

- An analytical cross-sectional study design was used in the study. However, to find the association between outcomes of the study and the factors associated, longitudinal or prospective cohort studies can provide better results.
- The study has limited generalizability, as the sample of the study included only mothers who delivered preterm infants.
- This study was conducted in a private hospital; therefore, the sample size cannot be generalized for public and government settings.

Conclusion and Recommendations

Education and counseling of the mothers regarding status of their neonate and ways of involving mothers in the care of their newborn is very crucial. Kangaroo mother care is significant in reducing the separation time and improving the bond between mother and the newborn. Teaching nurse's therapeutic communication techniques in order to provide emotional support to the mothers.

Nursing practice. Thorough training of the health care professionals is necessary for the assessment of mental health in mothers with preterm infants, and for conducting interventions for them. In addition, a specialized clinical pathway for the infants born preterm can be initiated. This pathway can include the details of the child and the mother, the risk factors associated, and the scale that would be assessing the level of stress in mothers. It will also include the pertaining stress during pregnancy and the ongoing stress assessment of the mothers. Teaching related to coping strategies in stress and handling of newborns must be incorporated in the clinical pathway. A role of the nurse practitioner that incorporates the care of the newborns and mothers at the same time must be initiated. This role will help nurses identify the stress in the mothers

undergoing the process of delivery, neonatal handling, and care. The study findings have identified high levels of perceived stress among mothers with preterm infants, hence, there is an immense need to emphasize on the psychological health screening program, that it is incorporated in antenatal and postnatal care. A support group must be formulated, consisting of mothers who deliver preterm infants. This support group will help decrease the level of stress and boost their coping by giving them an opportunity to express their feelings and concerns related to preterm handling and care. The administration of the hospitals should provide a separate area where the mothers with preterm infants can be individually assessed for the level of stress, and teaching for the same can be provided on an individual basis. At the policy level, it should be made compulsory while taking into consideration a multidisciplinary team approach, that the team specifically includes a consultation by a psychologist for mothers who deliver preterm infants, in the postnatal period.

Nursing education. Nursing education must contain a separate course related to neonatal handling, care, feeding, teaching of the mothers with preterm infants, and basic assessment tools that assess the stress of the mothers with preterm infants. Nursing students must be introduced to the unique role and concept of nurse practitioner in the field. These nurse practitioners will serve as a liaison between both mothers and preterm infants. This will help students identify their area of interest and they can choose their careers in this field accordingly.

Nursing research. As the study findings identified an increased level of stress in mothers with preterm infants, there is a need for intervention studies, to identify ways for improving the mental health of mothers with preterm infants. A cross sectional study to identify the level of stress among mothers with term infants can be carried out. Since this study identified the level of stress and its associated factors among mothers with preterm infants, a

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similar study could be carried out to identify the level of stress and its associated factors among fathers with preterm infants. Future studies, with a multi-centered approach, consisting of large sample sizes, are required to validate the findings of this study. Further research studies are required that include public hospitals so it could provide a diverse range of healthcare setting which will improve the generalizability of the study findings. A longitudinal follow-up study is required to provide deeper insights on the long term effects of stress over time on mothers.

For peer review only

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