



Exploring the Triadic Relationship: Diet, Sleep, and Postpartum Depression in Breastfeeding Women

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ABSTRACT

Background: Postpartum depression (PPD) is a critical public health concern affecting maternal mental health globally, particularly among lactating mothers. Emerging research indicates that dietary habits and sleep quality interact closely with depressive symptoms during the postpartum period.

Objective: To evaluate the association between dietary habits, sleep quality, and postpartum depression among lactating women aged 18–40 years in Lahore, Pakistan.

Methodology: A cross-sectional survey was conducted over three months at Farooq Group of Hospitals, Lahore. A total of 157 breastfeeding mothers were selected via convenience sampling. Dietary practices were evaluated using a Food Frequency Questionnaire (FFQ), depression severity was measured with the Edinburgh Postnatal Depression Scale (EPDS), and sleep quality was assessed using the Pittsburgh Sleep Quality Index (PSQI). Statistical analyses were performed using SPSS Version 22 using descriptive statistics and Chi-square tests of association.

Results: Participants had a mean age of 27.69 $\pm$ 5.52 years. A highly statistically significant association was observed between depression severity and sleep disturbances ($p < 0.001$), with severe depression linked to severe sleep problems. Statistically significant associations were also found between depression levels and consumption frequencies of cereals, rice, vegetables, fruits, eggs, chicken, meat, legumes, nuts, oils, seafood, sweets, fried foods, soft drinks, processed foods, junk food, and spreads ($p < 0.05$). Milk intake showed no statistically significant association ($p = 0.065$). Higher depression severity was characterized by greater consumption of energy-dense/processed foods and irregular or lower intake of nutrient-dense foods.

Conclusion: Postpartum depression is significantly associated with poor sleep quality and processed, energy-dense dietary patterns. Incorporating sleep management and dietary strategies into routine postpartum care may help alleviate PPD symptoms and enhance maternal well-being.

Introduction

Breastfeeding is universally acknowledged as the most beneficial form of early infant nutrition, supporting critical neurodevelopmental, physiological, and immunological pathways (Chiu, 2024; World Health Organization, 2024; Khichi et al., 2026). The World Health Organization (WHO) recommends exclusive breastfeeding for the first six months of an infant's life, followed by continued breastfeeding alongside nutritionally adequate complementary foods for up to two years or beyond (World Health Organization, 2023, 2024; Afzal et al., 2025). Despite these biological and clinical benefits, the transition into motherhood introduces profound physical, psychological, and physiological stressors. Among these, postpartum depression (PPD) stands out as a major global public health concern. PPD is a clinical mood disorder following childbirth, characterized by persistent sadness, cognitive impairment, severe fatigue, heightened anxiety, sleep disturbances, impaired maternal-infant bonding, and, in severe instances, suicidal ideation (Mazi, 2025; Naz & Fatima, 2025).

The underlying etiology of PPD is complex and multifactorial, involving profound biological transitions immediately following delivery. During pregnancy, maternal circulatory levels of estrogen and progesterone rise exponentially to sustain gestation; however, the rapid clearance of the placenta causes an abrupt drop in these neuroactive hormones within hours of birth (Zou et al., 2022). This sudden hormonal withdrawal disrupts central nervous system neurotransmitters, particularly gamma-aminobutyric acid (GABA) and serotonin signaling, predisposing vulnerable women to mood dysregulation (Zou et al., 2022). Furthermore, lactating mothers experience increased metabolic and nutritional demands required to sustain breast milk production, making them particularly vulnerable to biological stressors (Khamidullina, 2025).

In recent years, the biological interplay between nutrition, sleep architecture, and neurological health has gained significant attention. Emerging evidence emphasizes that maternal dietary habits directly influence central nervous system chemistry, systemic inflammation, and gut-brain axis signaling (Fish-Williamson & Hahn-Holbrook, 2023; Sun et al., 2023). Essential nutrients—such as omega-3 polyunsaturated fatty acids, B-complex vitamins, vitamin D, magnesium, zinc, and iron—serve as mandatory precursors and cofactors for neurotransmitter synthesis (including serotonin and dopamine) and synaptic plasticity (Islam et al., 2025; Rupanagunta, 2023). Diets lacking these vital micronutrients can impair neurochemical synthesis, elevate neuroinflammation, and disrupt cellular repair (Islam et al., 2025; Sun et al., 2023). Conversely, highly processed dietary patterns rich in refined carbohydrates, saturated fats, and synthetic additives promote systemic oxidative stress and pro-inflammatory cytokine production, which are strongly implicated in the pathogenesis of clinical depression (Dehghan-Banadaki et al., 2023; Yuan et al., 2025; Zou et al., 2022).

Concurrently, sleep disruption during the postpartum period acts as both a primary biological trigger and an exacerbating factor for psychological distress (Li et al., 2023; Okun, 2023). Lactating mothers face frequent nocturnal awakenings to feed their infants, leading to continuous sleep fragmentation, altered circadian rhythms, and reduced rapid eye movement (REM) and slow-wave sleep stages (Pan, 2025; Yang et al., 2025). Chronic sleep deprivation impairs prefrontal cortex function, blunts stress adaptation mechanisms, and overactivates the hypothalamic-pituitary-adrenal (HPA) axis, resulting in elevated cortisol output and heightened vulnerability to depressive pathology (Okun, 2023; Wang et al., 2022). Poor sleep quality also influences appetite-regulating hormones, such as ghrelin and leptin, often driving cravings toward energy-dense, highly processed foods (Garmabi et al., 2024; Shahzadi et al., 2025; Tan, 2022).

Globally, PPD affects an estimated 10% to 20% of new mothers, with prevalence rates escalating up to 60% in low- and middle-income countries (LMICs) where healthcare resources, socioeconomic support, and nutritional security are limited (Journal of Affective Disorders, 2023). In Pakistan, community-based studies report staggering PPD prevalence rates as high as 77%, making maternal depression a significant yet under-addressed health crisis (Naz & Fatima, 2025). Socioeconomic disparities, cultural expectations surrounding motherhood, informal work settings, financial strain, and lack of spousal support further compound maternal psychological distress in this population (Al Nasr et al., 2020; Cooke, 2025).

Despite the widespread prevalence of PPD in South Asia, empirical data examining the direct interplay between nutrition, sleep disruption, and depression severity in lactating mothers remain sparse. Understanding this triadic relationship is crucial for developing non-pharmacological, preventative, and holistic interventions tailored to postpartum care. Therefore, this study aims to evaluate the association between dietary habits, sleep quality, and postpartum depression among lactating women aged 18–40 years in Lahore, Pakistan.

Methodology

This cross-sectional study was carried out over a period of 90 days (3 months) at Farooq Group of Hospitals in Lahore, Pakistan, to investigate the associations between dietary patterns, sleep quality, and postpartum depression severity. The target population comprised lactating mothers aged 18 to 40 years. A non-probability convenience sampling technique was utilized to recruit 157 eligible breastfeeding mothers attending post-natal follow-up visits or pediatric clinics. The required sample size of 157 was computed based on a 95% confidence level, a 5% margin of error, a 5% level of significance, and an anticipated local PPD prevalence of 77% ($P = 0.77$) (Naz & Fatima, 2025) using the standard single-proportion sample size formula: $n = \frac{z^2 \cdot P(1-P)}{e^2}$. The inclusion criteria were strictly defined to include postpartum lactating women between 18 and 40 years of age who provided informed consent, while non-lactating women, mothers under 18 or over 40 years of age, and individuals unable to complete the assessment tools were excluded from the study. Dietary practices were evaluated using a comprehensive Food Frequency Questionnaire (FFQ) designed to record the weekly and daily intake frequencies of primary nutrient categories, including daily items (cereals, rice, vegetables, fruits, eggs, milk, chicken, meat, legumes, nuts, oils) and weekly items (seafood, sweets, fried snacks, soft drinks, processed foods, junk food, spreads/sauces). Sleep quality and disturbances over the preceding month were assessed using the Pittsburgh Sleep Quality Index (PSQI) (Buysse et al., 1989), categorized into mild, moderate, and severe sleep difficulties. Maternal depressive symptoms were measured using the Edinburgh Postnatal Depression Scale (EPDS) (Cox et al., 1987), categorizing subjects into mild, moderate, and severe depression severity levels based on established clinical cut-off scores. All collected data were cleaned, coded, and analyzed statistically using IBM SPSS Statistics Version 22.0. Inferential statistical analyses were performed using Chi-square (χ^2) tests of independence to evaluate the statistical significance of associations between dietary intake frequencies, sleep disturbance classifications, and postpartum depression severity levels. Statistical significance for all tests was set at a threshold of $p < 0.05$.

Results

Demographic

Total number of respondents were 157. The age of respondents 14% were 20-30 years of age and 77.7% were 30-40 years of age. The level of education of respondents 17.8% education was Matriculation, 26.1% education was Grades 9–10 Intermediate, and 56.0% was Grades 11–12 Postgraduate.

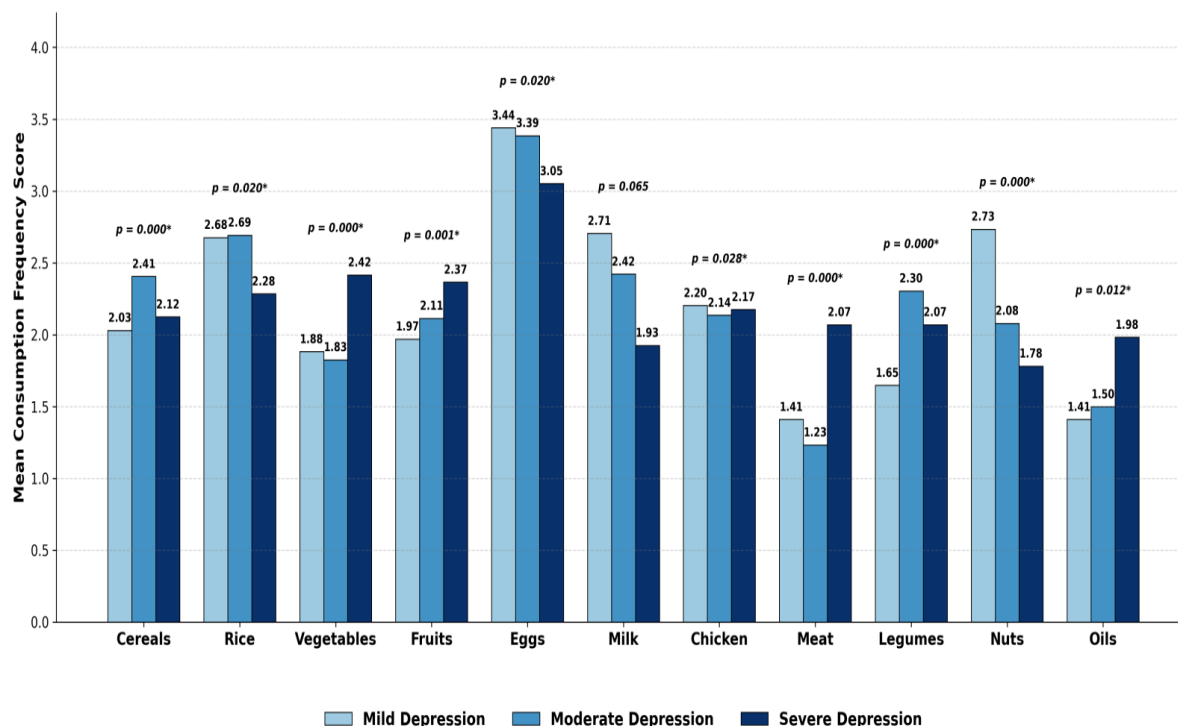
Table 1: Demographics

Variable	Total	Category	Percentage
Age	157	20-30 years	N= (22) 14.0%
		30-40 years	N=(122) 77.7%
Education Level	157	Matriculation, Grades 9–10	N= (28) 17.8%
		Intermediate, Grades 11–12	N= (41) 26.1%
		Postgraduate and above	N= (88) 56.0%

Dietary Intake Patterns of Staple and Nutrient-Rich Foods Across Depression Severity Levels

FFQ shows a statistically significant association was observed between the frequency of consumption of most food groups (cereals, rice, vegetables, fruits, eggs, chicken, meat, legumes, nuts, and oils) and depression levels ($p < 0.05$), indicating that 17 dietary intake patterns varied significantly across mild, moderate, and severe depression categories; however, milk consumption showed a non-significant association ($p = 0.065$).

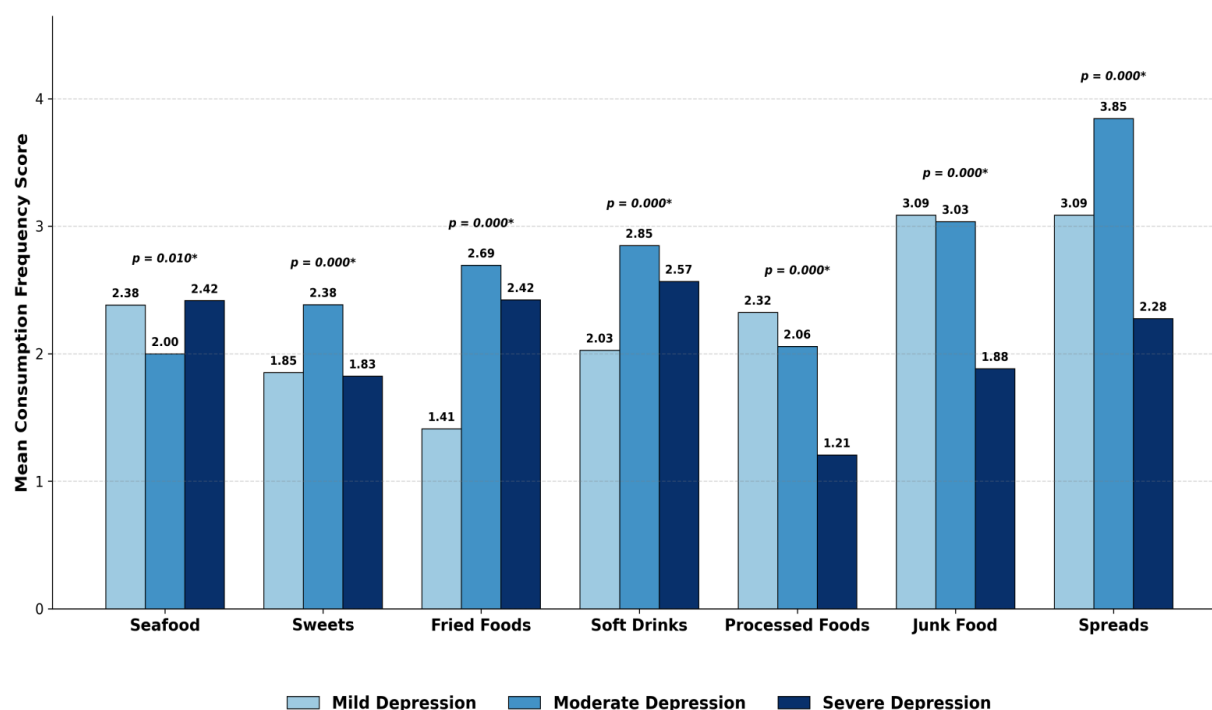
Comparison of Food Group Consumption Frequency by Depression Severity Level



Consumption Patterns of Processed and Unhealthy Foods Across Depression Severity Levels

FFQ shows a statistically significant association was found between depression levels and the consumption frequency of seafood, sweets, fried foods, soft drinks, processed foods, junk food, and spreads ($p < 0.05$), indicating that the intake of these food items varied significantly across mild, moderate, and severe depression categories.

Comparison of Unhealthy/Marine Food Consumption Frequency by Depression Severity Level



Association Between Sleep Quality And Postpartum Depression Severity

A highly statistically significant association was observed between depression severity and sleep difficulties ($p < 0.001$), indicating that individuals with severe depression reported a greater proportion of severe sleep problems, whereas those with moderate depression more frequently experienced mild sleep difficulties.

Table 2: Association Between Depression Severity and Sleep Score

Depression Score	Mild Sleep Difficulties	Moderate Sleep Disturbance	Severe Sleep Problems	Total (n)	p-value
Mild depression	18 (42.9%)	6 (14.3%)	18 (42.9%)	42	
Moderate depression	43 (68.3%)	15 (23.8%)	5 (7.9%)	63	
Severe depression	9 (17.3%)	12 (23.1%)	31 (59.6%)	52	
Total	70	33	54	157	0.001

Discussion

Postpartum depression is a complex and multifactorial mental health condition that affects a substantial proportion of women during the first year after childbirth. It is clinically distinguished from normal postpartum emotional adjustments by its persistence, severity, and functional impairment. (Mazi, 2025). The present study included 157 postpartum women, with ages ranging from 20 to 40 years. The mean age was 27.69 ± 5.52 years, indicating that the majority of participants were in their late twenties. The relatively moderate standard deviation (5.52 years) suggests a reasonably dispersed sample across early adulthood to mature reproductive age. In this study, education was coded from 1 to 4, where 1 represented Secondary (Matriculation), 2 Higher Secondary (Intermediate), 3 Graduate (bachelor's degree), and 4 Postgraduate and above. The mean education score (2.36 ± 0.89) indicates that most participants had education between higher secondary and graduate level. Total number of respondents were 157. The age of respondents 14% were 20-30 years of age and 77.7% were 30-40 years of age. The level of education of respondents 17.8% education was Matriculation, 26.1% education was Grades 9–10 Intermediate, and 56.0% was Grades 11–12 Postgraduate. A study among postpartum women in China found that higher Dietary Inflammatory Index scores, particularly due to increased intake of refined carbohydrates, were significantly associated with a greater risk of postpartum depression (Zhang et al., 2025). Similarly, our findings showed a significant association between cereal intake frequency and depression severity. Most mildly depressed participants consumed cereals 1–2 times daily (58.8%), whereas participants with severe depression reported higher intake frequencies, with 35% consuming cereals 2–3 times and 15% consuming them 4–5 times daily. Research from the United States using National Health and Nutrition Examination Survey data reported that high-glycemic dietary patterns, particularly refined carbohydrates, were associated with increased depressive symptoms (al., 2025). Similarly, our findings showed higher rice intake with increasing depression severity, a severe depression participants more frequently consumed rice 2–3 times (48.3%) and 4–5 times daily (16.7%). Research in Nutritional Psychiatry suggests that vegetable preparation methods may influence maternal mental health outcomes (Sun, 2023). Similarly, our findings showed higher vegetable intake frequencies among participants with severe depression compared to those with mild and moderate depression, who mainly consumed vegetables 1–2 times daily. Emerging evidence in Nutritional Psychiatry links low fruit intake with increased depressive symptoms among postpartum women (Matison, 2024). Similarly, our findings showed more irregular fruit consumption with increasing depression severity, as severely depressed participants reported both higher no intake and higher frequent intake compared to mildly depressed participant. Earlier epidemiological research suggests that higher egg consumption may be associated with depressive symptoms, although findings remain inconsistent (Fudong Li, 2023). Similarly, our study found significant variations in egg intake across depression severity levels, with frequent consumption common among all groups but differently distributed in severe depression. A cross-sectional study reported no significant association between postpartum milk intake and postpartum depression after adjusting for confounders (Almasaudi, 2023). Similarly, our findings showed no significant relationship between milk consumption and depression severity, despite minor variations in intake frequencies across groups. Studies on unhealthy dietary patterns suggest that higher consumption of processed foods, including poultry products, is associated with greater depressive symptoms (Fish-Williamson, 2023). Similarly, our findings showed more

frequent chicken intake among participants with severe depression compared to those with mild depression. A recent study among women in Iran found that high consumption of processed and red meat was associated with increased postpartum depressive symptoms (Dehghan- Banadaki, 2023). Similarly, our findings showed higher meat intake frequencies among participants with severe depression compared to those with mild depression. A large cross-sectional study reported that higher legume consumption was associated with lower odds of depression (Zhang Y, 2022). Similarly, our findings showed more irregular legume intake patterns among participants with severe depression compared to mild and moderate groups. A recent study found that higher nut intake (≥ 3 times/week) was associated with a lower risk of depressive symptoms (Kim, 2025). Similarly, our findings showed lower frequent nut consumption among participants with severe depression compared to those with mild depression. A cross-sectional study among U.S. pregnant and postpartum women found that pro-inflammatory diets, including high fat/oil intake, were associated with increased perinatal depression risk (Jian Qiao, 2025). Similarly, our findings showed higher oil consumption frequency in severe depression cases compared to mild and moderate groups. A 2025 meta-analysis found that higher fish consumption is associated with lower depressive symptoms (Afzal et al., 2026; Kim, 2025). Similarly, our results showed more irregular seafood intake among participants with severe depression compared to those with mild depression. Observational and meta-analytic evidence links high intake of sugary foods and beverages with increased depressive symptoms and postpartum depression risk (Adi, 2023; Afzal et al., 2025). Similarly, our findings showed higher sweet consumption with increasing depression severity. Frequent fried food intake has been linked to higher risk of depressive symptoms (Anli Wang et al., 2024). Similarly, our findings showed higher fried food consumption among participants with severe depression compared to mild cases. Prospective studies show that higher intake of sugar-sweetened beverages is linked to increased risk of depressive symptoms, with a dose-response relationship (Park et al., 2023). Similarly, our findings showed greater soft drink consumption with increasing depression severity. A U.S. study found that pro-inflammatory, high-fat diets were associated with increased perinatal depression risk (Q. et al., 2025). Similarly, our findings showed significant variation in oily food intake across depression severity levels. A 2024 meta-analysis found that higher junk food intake is associated with increased risk of depression (Ejtahed H-S, 2024). In contrast, our findings showed differing patterns, with higher frequent intake in mild and moderate depression, while severe cases were mainly in the 1-2 times category. A 2025 review found that higher ultra-processed food intake is associated with increased risk of depression (Karim S., 2025). Similarly, our findings showed significant differences in processed food consumption across depression severity levels. Recent evidence shows a strong association between sleep disturbances and postpartum depression, with poor sleep quality and insomnia increasing depressive symptoms after childbirth (Okun, 2023). A 2024 study found a strong association between higher PHQ-9 depression scores and sleep disturbances ($p < .0001$). Similarly, our results showed a significant relationship between depression severity and sleep problems ($p = 0.000$), with worsening depression linked to greater sleep disturbances. A 2025 study found that even mild depressive symptoms are associated with poorer sleep quality (Shnaimer, 2025). Similarly, among participants with mild depression, a large proportion reported both mild and severe sleep disturbances, indicating notable sleep issues even at low depression levels. A cross-sectional study in Iran found that depression severity was significantly associated with poor sleep quality, including in moderate depression (Garmabi, 2024). Similarly, most participants with moderate depression reported mild sleep difficulties, though some still experienced moderate to severe disturbances. A population-based study found that higher depression severity is strongly associated with sleep disorders ($OR = 3.95$, $p < .0001$) (Tu, 2024). Similarly, our findings showed that severe depression was linked with a higher proportion of severe sleep problems, with more than half of participants in this group affected. Overall, out of 157 participants, 70 had mild sleep difficulties, 33 had moderate sleep disturbance, and 54 experienced severe sleep problems. The highly significant p-value (0.001) confirms that the association between depression severity and sleep disturbance is not due to chance.

Conclusion

The present study investigated the association between dietary habits, sleep quality, and postpartum depression (PPD) among women aged 18-40 years. The findings confirm that PPD remains a significant mental health concern among postpartum women. The study demonstrated clear variations in depression severity within the sample population, highlighting the substantial psychological burden experienced during the postpartum period. These findings reinforce the understanding that PPD is a multifactorial condition influenced by behavioral and lifestyle-related factors. With regard to dietary quality, significant differences in dietary intake patterns were observed across varying levels of depression severity. Women with higher depressive symptoms tended to consume greater amounts of energy-dense and pro-inflammatory foods, including refined carbohydrates, fried foods, and sugar-sweetened beverages. In contrast, lower or irregular consumption of nutrient-dense foods such as fruits, legumes, nuts, and seafood was more common among those experiencing moderate to severe depressive symptoms. Sleep quality demonstrated a strong and statistically significant association with PPD. The prevalence of severe sleep disturbances increased

progressively with rising depression severity. Women experiencing moderate to severe depressive symptoms reported markedly poorer sleep quality compared to those with minimal or mild symptoms. These findings support existing evidence that sleep disturbances are closely related to the development and exacerbation of depressive symptomatology in the postpartum period. In summary, the study highlights the interconnected relationship between PPD, dietary quality, and sleep disturbances. The findings emphasize the importance of integrating mental health screening, nutritional counseling, and sleep management strategies into routine postpartum care. Early identification of unhealthy dietary patterns and sleep disturbances may serve as important preventive measures to reduce the severity and burden of PPD. Future longitudinal studies are recommended to further explore causal relationships and to develop targeted intervention strategies aimed at improving maternal well-being.

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