



Original Article

Unveiling the Factors Behind Delayed Introduction of Complementary Feeding and its Impact on Infant Nutrition: A Case Study in Peshawar, Pakistan

Mir Shakir Ullah Jan¹ and Naimat Ullah¹¹Department of Human Nutrition, University of Agriculture Peshawar, Khyber Pakhtunkhwa, Pakistan

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*Corresponding Author:

Mir Shakir Ullah Jan
Department of Human Nutrition, University of Agriculture Peshawar, Khyber Pakhtunkhwa, Pakistan
mirshakirullahjan@gmail.comReceived Date: 8th February, 2024
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ABSTRACT

Timely introduction of complementary feeding (CF) is essential for the health and development of infants. However, delayed initiation of CF can lead to malnutrition and stunted growth. Despite the presence of global guidelines, adherence to recommended feeding practices, particularly in initiating CF late, remains prevalent in developing regions. **Objective:** To examine the reasons for delayed CF in Peshawar, as well as its impact on infant health. **Methods:** A Retrospective case-control study was conducted with 800 mothers at the Hyderabad Medical Complex (HMC) vaccination center in Peshawar between July and October, 2022. Infants aged 6-12 months were categorized based on timely or late CF introduction. Late initiation of CF defined as, introduction of CF beyond 30 weeks. Regression analysis was employed to scrutinize parental background and psychological elements in the study. **Results:** Results of Multivariate logistic regression revealed that house hold income, maternal education level, low Antenatal Care (ANC) visits, maternal belief about CF and maternal drug addiction were significant ($p < 0.05$) factors that responsible for late starting of CF. Particularly late initiation of CF poorly effects Infant nutrition status. **Conclusions:** This study highlights the requirements for targeted population to advance CF practices in Peshawar. Such intervention promises to improve child health in the region, emphasizing the importance of proactive measures to address this concern.

INTRODUCTION

The duration from conception to the child second birthday is considered 1000 golden days of nutrition according to the child wellness and growth [1]. Infants' nourishment makes a substantial role in primary development [2]. The World Health Organization (WHO) advices that exclusive breast feeding should be ongoing up to 6 months, then followed by CF along with breast feeding up to 2 years [3,4]. Various longitudinal studies supported WHO guidelines, to start CF at about 6 months. The timely starting of CF is important for infant optimal health and growth. Postponing CF from the recommended time can badly affects the infant healthiness and development. Ongoing exclusive breast feeding for a longer time without introduction of CF at six months makes child nutrients scarce, due to which the

child's nutritional status is severely damaged [7,8]. Studies shows that low level of maternal education, income level and social opinions, may impact the delayed starting of CF [9, 10, 11, 12]. According to WHO guidelines, late CF is still a major problem in developing nations [11]. A number of studies collected in Bangladesh, India and Pakistan have shown that problem of late CF beyond the recommended age still exists and adversely affects the infant nutritional status [12-15]. More ever, different regions have different factors influencing late CF, requiring further investigation [16]. Peshawar is the ninth largest city in Pakistan, having population of 1.97 million, there is insufficient information on breastfeeding and CF practices. Despite this CF plays a vital role in the health and development of infants.

Practicing of CF remain largely unexplored, hampering our understanding of factors that contribute to improper practices such as late initiation of CF. This research aims to fill this gap and identify the factors responsible for late starting of CF. Additionally, the findings of this research can be used at the community-level interventions to promote child health by practicing adequate CF. Cross-cultural assessments with researches from developed nations can improve the study's influence and applicability, possibly leading to successful approaches tailored to the local context.

The main objective of this study is identifying the factors responsible for late initiation of CF among infants and understanding the association between late initiation of CF and infant nutritional status. These results can deliver valued indication making policies to indorse timely CF in Peshawar. Given the need for custom interventions to suit different population's needs, there is no fixed set of constituents for effective CF interventions[17].

METHODS

This study was conducted in the vaccination Center of Hayatabad Medical Complex, Peshawar in a time setting of July to October 2022. This study received ethical approval from the University of Agriculture, Human Nutrition department on 18th April 2022. Present research collected data from mothers of infants', aged 6 to 12 months. Data collection was started when approval is accepted from hospital administration. Current study has retrospective case control design, collected information from 800 infants' mothers, divided into two groups on the base of CF initiation time. The determination of the sample size was achieved using Cochran's formula, a method that considers various factors to ascertain the necessary sample size for a desired level of accuracy. The formula utilized was: $n = (Z^2 * p * q) / (e^2)$, where 'n' represents the required sample size, 'p' signifies the expected prevalence of timely complementary feeding (assumed as 0.50), 'q' denotes the rate of late complementary feeding (also assumed as 0.50), 'e' represents the level of precision (set at 0.05), and 'Z' is the statistical value corresponding to a 95% confidence level (which is 1.96). With these inputs, the calculated sample size was determined to be 384. The study entailed a retrospective case-control analysis utilizing data collected from the mothers of 800 infants, categorized into two groups: the standard group (consisting of infants adhering to timely complementary feeding) and the target group (comprising infants practicing late complementary feeding). Data collection involved obtaining consent from the mothers and administering closed- ended questionnaires, which were developed based on existing literature with certain modifications.

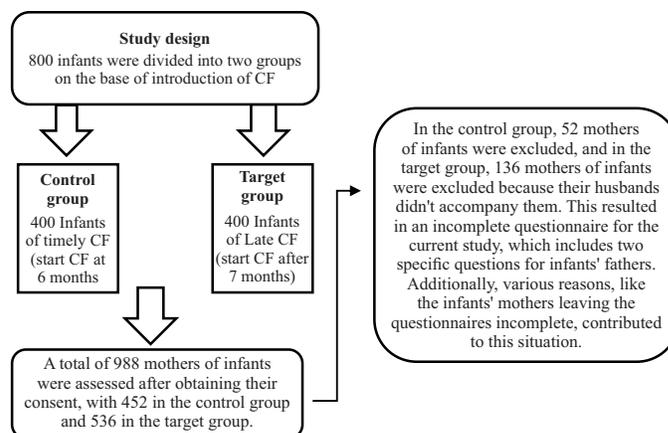


Figure 1: Flowchart of the Study

In this research, data were collected from a cohort of 800 mothers with infants. These mothers acted as the primary respondents during the data collection phase. Structured interviews were conducted using a questionnaire, initially crafted in English and later translated into Urdu. Upon obtaining consent, mothers were provided with hard copies of the questionnaire. Face-to-face interviews were employed in cases where mothers had limited education, ensuring comprehensive data collection. Data collection ceased upon reaching responses from all 800 participants, achieving a 100% response rate. Trained interviewers assisted mothers in completing the questionnaires, which aimed to capture details regarding the timing of introducing complementary foods. Additionally, fathers were asked two questions regarding the timing of complementary feeding and any history of drug addiction. Questionnaires were also administered to fathers, either self-completed or via face-to-face interviews for those with limited education. Following questionnaire completion, anthropometric data for infants were collected, measuring weight with a Salter scale and length with a recumbent scale, recorded in grams and centimeters, respectively. Z-scores were then calculated using Anthro-plus software, providing a standardized assessment of infants' nutritional status. The survey encompassed various inquiries into parental, infant, and familial dynamics, including demographic background, psychosocial factors affecting mothers, and maternal drug addiction beliefs. Prior to full-scale implementation, a pilot study with 15 mothers was conducted to refine the questionnaire design, revealing an average completion time of 20 minutes. It's worth noting that pilot study participants were excluded from the final sample. To streamline data analysis, SPSS version 21.0 software was utilized for conducting pertinent statistical tests. The data presented in tables 1 and 2 underwent chi-square analysis to facilitate their presentation, evaluation, and the observation of discrepancies among different variables.

Employing the multivariate logistic regression technique, the study established the relationship between the dependent variable (late introduction of CF) and independent variables. Variables with a p-value < 0.05 were considered significant factors contributing to the delayed introduction of CF. Previous research has already elucidated the links between various parental attributes, infant-related factors, and their association with CF introduction timing. Hence, this study aims to expand upon these associations. A structured questionnaire, drawing from existing literature and customized based on prior studies, was formulated [1, 9, 10, 13, 22]. Through an analysis of scholarly works, the study identified 11 specific factors that potentially influence the likelihood of initiating CF at a Late stage. Demographic variables considered included: Father's educational attainment (≤ 10 years versus > 10 years), Monthly household income (< 50000 versus ≥ 50000), Maternal educational attainment (< 8 years versus ≥ 8 years), Maternal age (< 25 years versus ≥ 25 years), Parity (1 child versus ≥ 2 children), Availability of counseling for breastfeeding (available versus not available), and Antenatal care (ANC) visits during the last pregnancy (< 4 visits versus ≥ 4 visits). Additionally, the study assessed maternal psychosocial beliefs regarding CF timing and drug addiction, using closed-ended response choices. Similarly, the father's beliefs regarding CF timing and drug use were confirmed using closed-ended response choices (addicted vs not addicted). To investigate associations between each potential explanatory variable and the delayed introduction of CF, the study employed multivariate logistic regressions.

RESULTS

Table 1 displays the demographic factors of the interviewed infants' parents. Chi-square analysis was employed to assess the association between various factors of the timely and late complementary feeding groups. Seven factors were evaluated, namely father's education, income level, maternal education, maternal age, parity, availability of counselling facility for complementary feeding, and antenatal care (ANC) visits during the last pregnancy. All factors, except parity, exhibited significant differences between the timely and late complementary feeding groups.

Table 1: Parent's Demographic Factors (N=1600)

Factors	Groups			p-value
	Timely N (%)	Late N (%)		
Father Education	≤ 10	87 (21.75)	288 (72)	0.03
	> 10	313 (78.25)	112 (285)	
Household Income Per Month	< 50000	68 (17)	268 (67)	< 0.01
	≥ 50000	332 (83)	132 (33)	

Maternal Education	< 8	120 (30)	349 (87.25)	< 0.01
	≥ 8	280 (70)	52.3 (13.75)	
Maternal Age	< 25	24 (6)	59 (80)	0.04
	25-42	376 (94)	341 (20)	
Parity	1	139 (34.75)	196 (49)	.160
	≥ 2	241 (60.25)	204 (51)	
Counselling Facility of BF	Yes	268 (67)	108 (27)	< 0.01
	No	132 (33)	292 (73)	
ANC Visits During Last Pregnancy	< 4	60 (15)	335 (83.75%)	< 0.01
	≥ 4	340 (85)	65 (16.25%)	

Table 2 presents the psychosocial beliefs of the interviewed infants' parents. Chi-square analysis was employed to determine the significant differences between timely and late introduction of complementary feeding groups across various factors. Significant associations were found between timely and late complementary feeding groups concerning two factors related to mothers' beliefs about complementary feeding: the appropriate timing and drug addiction. Regarding factors related to fathers of infants, assessed through chi-square analysis, questions included the appropriate age for complementary feeding and drug addiction. Only one factor, namely the appropriate timing of complementary feeding, exhibited a significant difference between the timely and late complementary feeding groups.

Table 2: Parental Psychosocial Beliefs

Factors	Groups			p-value
	Timely N (%)	Late N (%)		
Maternal Psychological Belief				
CF should be start at the age of six months	Yes	372 (93)	68 (17)	< 0.01
	No	28 (7)	332 (83)	
Does the mother have any drug addiction	Yes	40 (10)	108 (27)	< 0.01
	No	360 (90)	292 (73)	
Fathers' Psychosocial Belief				
CF should be start at the age of six months	Yes	362 (91)	57 (14.25)	0.03
	No	38 (9)	343 (84.75)	
Does the father have any drug addiction	Yes	160 (40)	172 (43)	.198
	No	240 (60)	228 (57)	

Table 3 shows the effect of complementary feeding timing on the nutritional status of the infants. children in the late group, who have a z-score below -2, mostly commenced complementary feeding after 34 weeks.

Table 3: Impact of Timing of Complementary Feeding on Nutritional Status of Infants (N=800)

Z. Score (Weight for Length)	Timely	Late
< -2	12	132
≤ 2	368	236
> 2	16	32

Table 4 shows Pearson correlation analysis that reveals a clear trend: as the age of complementary feeding increases, the nutritional status of children decreases,

potentially leading to malnutrition.

Table 4: Correlation between Complementary Age and Current Nutritional Status

Pearson Correlation	Z-Score	Sig.
	Current Nutritional	
Complementary Age	-.427	.000

Table 5 contains outcomes of multi-variate logistic regression. The present study identified six significant ($p < 0.05$) factors associated with late initiation of complementary feeding as shown as in table 4. These factors included household income (OR: 3.913, 95% CI: 4.182-6.896), maternal education (OR: 5.615, 95% CI: 6.366-9.034), absence of breast-feeding counselling (OR: 3.723, 95% CI: 4.343-7.453), fewer than four ANC visits (OR: 2.213, 95% CI: 3.232-5.432), maternal belief of not knowing the exact time of complementary feeding (OR: 5.587, 95% CI: 2.677-11.663), and maternal drug addiction (OR: 2.645, 95% CI: 3.234-6.654). These findings underscore the substantial impact of these factors on the timing of complementary feeding initiation and provide a range of values within which the true odds ratio is likely to fall with 95% confidence.

Table 5: Factors Associated with the Late Initiation of Complementary Feeding

Factors	Multi-Variate Analysis	
	OR	95% CI
Demographic Factors		
Father Education	<10 years	.454 .075,2.736
	≥10 years	1 Ref 1
Household Income	<50000	3.913 4.182,6.896
	≥50000	1 Ref 1
Maternal Education Level	<8 years	5.615 6.366,9.034
	≥8 years	1 Ref 1
Maternal Age at Child Birth (years)	<25	.832 .186, 3.221
	≥25	1 Ref 1
Parity	<1	.813 .179,3.681
	≥2	1 Ref 1
Breast Feeding Counselling	Not available	3.723 4.343,7.453
	Available	1 Ref 1
ANC Visits	<4	2.213 3.232,5.432
	≥4	1 Ref 1
Maternal Psychosocial Belief		
Maternal Belief of CF	Don't know the exact time of CF	5.587 2.677,11.663
	Known the exact time of CF	1 Ref 1
Mother Drug Addiction	Addicted	2.645 3.234,6.654
	Not addicted	1 Ref 1
Fathers' Psychosocial Belief		
Father Belief of CF	Did not know the exact time of CF	.674 .295, 1.537
	Known the exact time of CF	1 Ref 1
Father Drug Addiction	Addicted	.638 .275, 1.528
	Not addicted	1 Ref 1

DISCUSSION

In this study, Table 3 was utilized to present the results of a correlation analysis conducted between the introduction of complementary feeding at various ages and the prevailing nutritional status of children. The analysis revealed a statistically significant negative correlation (Pearson Correlation = -0.427 , $p < 0.001$) between the delayed initiation of complementary feeding and the nutritional status of children. These findings are consistent with a prior study conducted in Nigeria, which similarly concluded that a delayed introduction of complementary feeding is a significant contributing factor to the development of poor nutritional status in children [19]. The data presented in Table 3 also elucidate the distribution of children across different Z-Score categories in relation to both timely and late complementary feeding practices. This study highlights the negative affect of late starting of CF on infant nutritional status, great ratio of infants falls into the < -2 Z-Score category, When CF is initiated than WHO suggested time frame.

Data shown in table 3 reveals that 22% of infants started CF at age of 7 months (30 weeks), 69% started at age of 31 and 38 weeks and 9% were introduced to CF between 39 and 48 weeks. This data illustrated that a large number of infants introduced to CF, deviated from WHO CF guidelines. Similar results are also identified in studies conducted across Asia, that identified that more than half of infants introduced to CF after recommended time across the regions [20-22]. Current study recognized six factors that are significantly ($p < 0.05$) associated with late introduction of CF. Particularly, income level and low maternal education level is interconnected factors manipulating the appropriate timing of CF, various studies in Pakistan and India supported these findings that infants in low-income families has more chances of introducing to CF in lateral stage [20, 21]. Similarly, studies in Nepal and Islamabad, Pakistan shows a negative association between low maternal education and trends of late initiation of CF [22, 20]. These findings parallel with previous studies in many circumstances, highlighting the critical need to report these factors to advance infants nutrition. Furthermore, this study identified a noteworthy correlation between breast feeding facility at health center and less than four ANC visits. The delay of CF beyond recommended time due to fewer ANC are also reported in the study conducted in India, that revealed, ANC visits is a contributing factor to start CF beyond the recommended time [21]. Similarly, studies in Ethiopia, additionally highlights the absence of breastfeeding counseling at health center is an important factor, play roles in initiating timely CF [23]. Educating mothers about breast feeding and endorsing ANC visits having essential role in minimizing late practices of CF.

Present research exposes that mothers who don't know the time of CF introducing, has a drug addictions history. These finding are parallel to the study conducted in Sindh Pakistan and India that reported, maternal nutritional awareness is a contributing factor to starting of CF after six months [21, 24]. While limited evidence is reported on relation between late introduction of CF and maternal drug addiction, but a study in Europe reveals that drug addicted mothers are socially inactive and inactive mothers' lifestyle has adverse effect on nutritional status of infants [25]. Educating mothers about appropriate time of CF has essential role in decreasing late CF practices and further studies are needed to explore the correlation between maternal drug addiction and late initiation of CF.

CONCLUSIONS

This study identified the correlation between delayed introduction of CF and infant nutritional status. Infants has low nutritional status, if introducing CF beyond the recommended time. Factors like income level and low maternal education contributing to delay introduction of CF. Maternal drug addiction and social inactivity also effect CF time in a negative way. Addressing late initiation of CF needs a wide-ranging approach that considers maternal knowledge, socio-economic aspects and social welfare. These findings are appropriate for policymakers, healthcare professionals, and communities, offering map to improve child nutrition and health.

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Authors Contribution

Conceptualization: NU, MSUJ

Methodology: MSUJ

Formal analysis: MSUJ

Writing-review and editing: MSUJ

All authors have read and agreed to the published version of the manuscript.

Conflicts of Interest

The authors declare no conflict of interest.

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