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DETERMINANTS OF INFANTS FEEDING PRACTICES IN TANZANIA: A CROSS-SECTIONAL ANALYSIS AMONG BREASTFEEDING MOTHERS INMASASI DISTRICT, TANZANIA

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Abstract: With all the campaigns to promote, prevent, and protect exclusive breastfeeding, still many mothers across the globe and in Sub-Saharan Africa practice mixed-feeding. Cross-sectional data (quantitative and qualitative), were used to assess the determinants of infants' mixed-feeding practices, precisely the extent to which mixed-feeding is practiced, by identifying the common supplements introduced to infants before six months of age. Study participants aged 15-49 years were selected. Descriptive and inferential data analyses were done using IBM-SPSS 25. About 56% of the interviewed respondents were either married or lived with a partner. Close 55%had primary education. Slightly more than 90% initiated complementary foods to their infants before six months of the infant's age. Most mothers received advice from their mothers and friends, giving their infants mostly water, fruit juice, powdered/fresh animal milk, and porridge. The study further found out that insufficient breast milk (65.7%) was one of many other reasons why infants were introduced to mixed-feeding. The Chi-square test indicated that the amount of money spent on supplements $(\chi^2 = 12.8,\ P < 0.001)$; the age of the child in months $(\chi^2 = 26.2,\ P < 0.001)$; mode of delivery$(\chi^2 = 15.8,\ P < 0.001)$; age in months at which the infant was introduced into supplementary food$(\chi^2 = 10.3,\ P < 0.01)$; infant mother's marital status $(\chi^2 = 18.6,\ P < 0.001)$; place of birth$(\chi^2 = 7.8,\ P < 0.05)$; infant mother's age$(\chi^2 = 6.7,\ P < 0.05)$; and infant mother's ethnic group $(\chi^2 = 5.7,\ P < 0.05)$ had a significant association with whether mixed-feeding was practiced or not. Multiple logistic regression analysis showed that the amount of money spent on a child's food, age of the child above four months, place of delivery, mode of delivery, and marital status determine mixed-feeding practice in the study area. We conclude that mixed-feeding in the study area is higher. Thus, there is an urgent need to empower mothers with skills related to the side effects of mixed-feeding for increased survival of infants.

Keywords*: Infant feeding; Infant nutrition, complementary feeding, Tanzania*

1.0 Introduction

Nutrition during the first 1000 days, spanning from conception to age 24 months, has a critical influence on the immediate and long-term physical and cognitive development of infants. The period from birth through the first 12 months characterizes a different time when parents or

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caregivers make mostly all feeding decisions about what and how the infant is offered food (Spyreli *et al*., 2019). The definition of a modern family is changing (Wilson *et al*., 2015). Parents are currently described as the principal caregivers of children in the home, and infant feeding is a significant component of that care that encompasses the social, cultural, and economic structure of a parent's life (Black and Aboud, 2011).

Mixed-feeding practices started to attract the attention of many health practitioners around the 18th century (Apple, 1987;Fulminante, 2015). The primary influencers of mixed-feeding practices in developed nations include media advertisements of bottle feeding, peer-group pressure, and societal expectations such as fulfilling professional responsibilities (Apple, 1987). Development in medical practices, the growth of infant food manufacture, and scientific researches were mentioned making American mothers believe that medically-directed artificial infant feeding was equal to, if not better than, breastfeeding (Apple, 1987). In developing countries, mixed-feeding practices have been the norm in times unknown (King and Adam, 1987). However, factors such as the availability and promotion of milk-substitutes play a role. Others are urban growth, regimentation of breastfeeding, and female participation in the labor force (King and Adam, 1987).

Many mothers in Africa and beyond seem to breastfeed their babies for one year and even more, but Exclusive Breast Feeding (EBF) for up to six months is still not commonly practiced (Black 2013). Studies estimate that about 22% of the infants' deaths are associated with the early introduction of complementary feeding. Indeed, this practice is also known to escalate the risk of diarrhea, malnutrition, and other sicknesses (Mason, 2013; Joshi, 2014). Thus, subjecting infants to high morbidity and mortality rate around the globe. Also, mixed-feeding has a higher risk of the most common inflammatory bowel diseases, which include Crohn's disease, ulcerative colitis, higher incidence of Sudden Infant Death Syndrome (SIDS), and may have a higher risk of obesity (Chong, 2015).

Furthermore, a mixed-fed infant has a probability of suffering from gastrointestinal infections besides experiencing a deficit in growth (Morgan, 2018). Mixed-feeding hinders the infant's cognitive development (Chong, 2015). In addition, women who practice mixed-feeding are more likely to develop ovarian and premenopausal breast cancer, increased osteoporosis, increased risk of anemia by accelerating the early return of the menstrual cycle (Chong, 2015).

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Due to the increasing impacts associated with mixed-feeding practices and breastfeeding, various interventions have been established globally to enhance EBF. Today, commonly, it is known that EBF is referred to as the practice of feeding an infant with breast milk only for the first six months of life without the addition of other food or water (Horta and Victoria 2013). In the same line, World Health Organization (WHO) and United Nations International Children's Fund (UNICEF) recommend initiation of breastfeeding within the first hour after birth and mothers should continue feeding their infants with breast milk for at least the first six months (WHO and UN, 2008). WHO and UNICEF argue that taking oral rehydration solution, prescribed medication, vitamins, and minerals does not compromise EBF. Avoiding mixed-feeding before the age of six months has proven to lower the baby's risk of sickness for most infectious diseases. It has also proven to be a cost-effective intervention in reducing infant mortality and morbidity (UNICEF, 2009; Rajeshwari, 2010). Studies show that first-time mothers are more likely to seek health professional advice about their infant's health (Chouraqui *et al*., 2018). There are claims that most countries, especially developed countries, breastfeeding information is readily available and accessed in many health centers (Ware and Davies, 2015).

Tanzania is among the pioneer of implementing various programs in promoting optimal breastfeeding practices among mothers. The programs include Baby-Friendly Hospital Initiative (BFHI) adopted since 1992, prevention of mother to child transmission of HIV (PMCTC) adopted in 2004, and the national guidelines for Infant and Young Child Feeding (IYCF) since 2003. Nevertheless, only59% of infants under six months are exclusively breastfed (TDHS-MIS, 2016). Data from the National Bureau of Statistics (NBS) showed that exclusive breastfeeding in Tanzania declines rapidly with age; only 27% of infant's age 4-5 months are exclusively breastfed compared with 84% of infants age 0-1 month and 59% of infants age 2-3 months (TDHS-MIS, 2016). Contrary to recommendations, some infants under age six months consume other liquids and foods in addition to breast milk, which may be plain water (11%) and other milk (4%). More than one-fifth of infants under age six months are fed complementary foods in addition to breast milk, while the median duration of EBF is three months (TDHS-MIS, 2016).

Further, studies show that the effects of mixed-feeding practices are not limited to infant's health alone but also extend to mothers and the whole community. There is documentation of WHO and

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UNICEF recommendations on proper infant feeding. There are also guidelines of Tanzania ministry of health that require mothers to be guided and counseled during their antenatal and postnatal clinics on the issues related to infant health, including feeding practices. Masasi District is one of the areas claimed by the ministry of health to have a high prevalence of mixed-feeding practices. This paper aimed to explore the extent to which mixed-feeding is practiced, identify the common supplements introduced to infants before their six months of age, and identify determinants of mixed-feeding practices in the study area.

2.0 Methodology

2.1 Study area

This study was conducted at Mkomaindo ward in Masasi District in Mtwara region. The survey covered the whole area of Mkomaindo ward, which includes four streets, namely; Rest-camp, Maendeleo, Mkadaenda, and Matankini. The study scoped to common supplements introduced to infants before six months of age, the extent of the practice of infants' mixed-feeding among mothers, and the examination of determinants of mixed-feeding. The ward has two health facilities; the Masasi district hospital and Magereza dispensary.

2.2 Study design and Sample

The study used a community based cross-sectional study design in which quantitative and qualitative data were collected. The qualitative data (with synonymous names throughout), provided an in-depth understanding of participants' perspectives, and helped to explain quantitative data findings. The data for this study were collected from July 2019 to October 2019. Participants were mothers/women of reproductive age of 15-49 years with infants under the age of six months. A consecutive sampling technique was used to select respondents among mothers with infants. Consecutive sampling technique involves selecting all subjects (in this case, breastfeeding mothers) who agree to participate, provided they meet pre-established criteria until the number of desired sample size is achieved. The sample size of 204 mothers was determined using the unknown population formula by Cochran (1963);

$n = Z^2pq/e^2$where Z = 1.96 (C.L = 95%), e = Marginal error (6.8%), p = probability that a mother practices mixed feeding = 0.5, q=(1-p). Thus, the estimated sample size was 204mothers. The study also involved key informants for qualitative information.

Received July 2019
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Available online 03 May 2021

2.3 Data Collection

We used questionnaires as survey instruments, data on socio-demographic characteristics, the extent to which mixed-feeding was practiced, common supplements introduced to infants before their six months of age, and determinants of mixed-feeding practices were collected. These results informed the development of specific questions that were asked during subsequent structured questionnaire-based interviews. A pretested, structured questionnaire was administered in Kiswahili, the national language.

2.4 Data Analysis

Data were edited for accuracy, consistency, and completeness; after that, it was coded and entered into IBM SPSS Statistics version 25 for analysis. First, univariate analysis, mainly descriptive statistics, was conducted to determine various proportions. Such proportions include mixed-feeding practices and mothers' socio-demographic characteristics.Second, we did a multiple binary logistic regression to capture the relationship among variables determining the infants' mixed-feeding practices. The last category for each independent variable served as a reference category. We present below the model used for analysis:

$$\ln\left(\frac{P(Y_i=1)}{1-P(Y_i=1)}\right)=\alpha+\beta_1 x_{1i}+\beta_2 x_{2i}+\cdots+\beta_{13} x_{13i}$$

Whereby;

$P(Y_i=1)$ *The probability that a mother is practicing mixed-feeding (1=Yes, 0=No)*

$x_1 =$ *Age of the mother*

$x_2 = Average\ household\ income\ per\ month$

$x_3 = Number\ of\ biological\ children$

$x_4 = Sex\ of\ the\ current\ child$

$x_5 = Mode\ of\ delivery$

$x_6 = Age\ (in\ months)\ of\ the\ current\ child$

$x_7 = Marital\ status$

$x_8 = Place\ of\ delivery$

$x_9 = Occupationa\ of\ mother$

$x_{10} = Ethnic\ group$

$x_{11} = Mother's\ education$

$x_{12} = Partner's\ education$

$x_{13} = Amount\ of\ money\ spent\ for\ the\ child's\ food$

$\alpha = Regression\ constant$

$\beta = Regression\ coefficien$

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Available online 03 May 2021

2.5 Ethical consideration

The academic research clearance was granted by the Institute of Rural Development Planning (IRDP) research committee. Regional, district, and community authorities in the study area were contacted and issued a written approval of the study. Before participation, each infant-mother visited, verbal consent was sought.

3.0 Results and Discussion

Mothers' socio-demographic characteristics are known to play a role in determining mixed-feeding practices in many developing countries, as discussed in the background information of this paper. The mean age of the 204 interviewed mothers was 29.25 ± 6.87 years. While the youngest respondents were aged 16 years, the eldest was 47 years. Many (27.0%) of mothers were aged between 25-29 years, while few (8.8%) were 40 years and above. The majority of the mothers had primary school education (54.9%), were self-employed (38.2%), and married/living with their partner (56.4%). The findings also show that 37.7% of mothers had one child while the rest had more than one child except for 0.5 % who had seven children. It was revealed that more than two-thirds (61.8%) of mothers delivered in health facilities while only 1.0 % delivered on their way to health facilities, and 51.0 % of the delivered babies were of females (Table 1).

Table 1: Socio-demographic characteristics of the respondents (n=204)

Characteristic	Frequency	Percent
Age of mothers		
15-19	14	6.9
20-24	42	20.6
25-29	55	27.0
30-34	45	22.1
35-39	30	14.7
40+	18	8.8
Marital status		
Single	49	24.0
Married/Living together	115	56.4
Divorced/ Separated	40	19.6
The educational level of the mother		
No formal education	11	5.4
Primary school education	112	54.9
Secondary school education	60	29.4
College education	17	8.3
University education	4	2.0
The main occupation of the mother		
Housemother	58	28.4

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Available online 03 May 2021

Characteristic	Frequency	Percent
Government employee	16	7.8
Employed in a private institution	10	4.9
Self-employed in business	78	38.2
Farmer	42	20.6
Number of biological children		
1	77	37.7
2+	127	62.3
Place of delivery		
Home	12	5.9
Health facility	190	93.1
On the way	2	1.0
Mode of delivery		
Normal vaginal delivery	126	82.8
Caesarean section	78	17.2
Sex of the current child		
Male	100	49.0
Female	104	51.0

3.1 The Extent of Mixed-feeding Practices

The extent of mixed-feeding practices is presented based on the percentage of mixed-feeding practices, the average amount of money spent in buying a child's supplements, and age (in months) at which infants are introduced to supplements. The mean age of all infants was 4.07 months, with the youngest being of 1-month-old and the oldest being six months. The mean age at which infants were introduced to other food different from their mother's milk was 2.99 months. The study further revealed that79.4%of all interviewed mothers gave their infants food other than breast milk at the age of <3months, and 93.1%gave their infants food at the age of <6months (Table 2). This implies that close to seven percent of the mothers practiced EBF. The mean amount of money used to buy an infant's supplement per day was TZS 712.50 (SD 546.96). This would mean that mixed-feeding practices are often at peak at three months of the infant's age. In FGD, mothers revealed that infants tend to eat more at the age of three months to the extent that breast milk becomes no longer enough for them. This situation dictates mothers to introduce breast milk substitutes.

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Table 2: Age of current Infant and Agewhen introduced to supplements (n=204)

Age in Months	Age of the current child (months)			Age when introduced to supplements		
	Frequency	Percent	Cumulative Percent	Frequency	Percent	Cumulative Percent
1	4	2	2	29	14.2	14.2
2	18	8.8	10.8	22	10.8	25
3	53	26	36.8	111	54.4	79.4
4	42	20.6	57.4	20	9.8	89.2
5	59	28.9	86.3	8	3.9	93.1
6	28	13.7	100	14	6.9	100
Total	**204**	**100**		**204**	**100**	

Our results are similar to findings from other studies such as Alzaheb (2016), who found for Saudi Arabia that about 63% of the studied infants received solid foods before reaching 17 weeks of age. Also, Inoue and Binns (2014)found that the mean age of introducing solid foods to infants in China (Hangzhou) was 3.8 months. However, studies in Japan and Maldives found that infants were introduced to other food supplements at the age of 5.6 months. Close to the WHO recommendation.

3.2 Common Supplements Introduced to Infants before Six Months of Age

Table 3 presents supplements that were reported, commonly given to infants before the age of six months. Findings showed 95.3%of mothers gave water to their babies before six months of age, while only 1.3%of mothers give their infants meat (e.g., beef, pork, lamb, goat, chicken, or duck).Some gave their infants water while others bought industrial water from the shop or used boiled water. Buying of industrial water and boiling is anticipated for promising safety and hygiene. However, those who opt for boiled water claim that industrial water contains chemicals that can harm infants. During FGD, participants claimed that water is often introduced to quench the baby's thirst as one of them explained:-

Sometimes you breastfed a child, but s/he keeps crying. You seldom know for sure that he/she is contented/satisfied, but s/he cries. But when you opt to give her/him water, s/he stops crying and sleeps. Therefore, sometimes mothers' milk is not enough to quench the thirst of the child; that is why I decided to introduce water to my child.

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Porridge is another supplement that mothers prefer to give their infants. The results in Table 3 show that nearly 90%of the interviewed mothers gave porridge to their babies. It was revealed during FGD that the preparation of porridge differs by type of flour used. Cassava flour porridge, whole maize flour porridge, and maize flour porridge require four steps for porridge to be ready for the baby; such steps include flour sifting, boiling water, and pouring flour. The nutrient flour has an additional of one procedure of milling for those who prepare the mixture themselves. Mothers find porridge as an essential supplement to satisfy the infant when breast milk assumed insufficient as one of the respondents stated:-

It happens several times that breast milk fails to satisfy/content a child. To ensure that a child is satisfied, I prepare a light-porridge. It can be by using cassava flour or unprocessed maize flour, and it is true that when you give a child gets satisfied.

In the study by Inoue and Binns (2014), it was found that mothers in many countries in the Asia Pacific region introduced porridge to their infants. However, mothers in those countries used rice or cereal porridge for infants as the first foods next to breast milk. Similar findings were presented in a cohort study by Lee (2019) in Chengdu China, which reported that foods first introduced to infants include rice porridge. This is unlike mothers in Mkomaindo ward in Masasi. Although they commonly give their infants porridge, the porridge is made by using whole maize flour (*dona)*, maize flour (*sembe)*, and cassava flour. This is an indication that maize and cassava are readily available in Masasi and in Mkamaindo in particular.

Table 3: Multiple responses results for types of supplements introduced to infants before six months of age (n=149)

Supplement	Responses	Percent
Plain water	142	95.3
Fresh or industrial juice	49	32.9
Vegetable or meat soup	18	12.1
Powdered or fresh milk	51	34.2
Infant formula	8	5.4
Food made from grain	52	34.9
Pumpkin, carrots, sweet potatoes that are yellow or orange inside	12	8.1
White potatoes, white yams, cassava, white sweet potatoes, plantains, or any other foods made from roots	23	15.4
Vegetables	11	7.4
Fruits	34	22.8

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Available online 03 May 2021

Supplement	Responses	Percent
Any meat	2	1.3
Eggs	5	3.4
Organ meat	1	0.7
Fresh or dried fish	7	4.7
Any food made from beans or nuts	49	32.9
Cheese or other food made from milk	2	1.3
Porridge	134	89.9

3.3 Determinants of mixed-feeding practices to infants

Determinants of mixed-feeding practices are reported based on mothers' opinions, socio-economic and demographic characteristics of respondents. It was found that the respondent's mother played a significant role (40.7%) in advising young mothers on when and what food should be given to infants. 10.5 %mentioned having received advice from friends,as shown in Table 4.

Table 4: Main mothers' advisor on infant feeding (n=204)

Variable	Frequency	Percent
Mother	83	40.7
Grandmother/grandfather	5	2.5
Friends	21	10.3
Sister/brother	9	4.4
Husband/father's child	23	11.3
Personal decision	13	6.4
Total	**204**	**100.0**

Chi-square test analysis results indicate that six factors had evidence of a significant association with mixed-feeding (see Table 5). Our results are in line with findings of other previously conducted studies that infants' mothers rely on many sources for advice on infant feeding, as indicated earlier. Such sources include a mother's own experience, non-professional advice (family, friends, and online) and professionals (doctors, nurses, midwives, and pharmacists) (Chouraqui *et al*., 2018; Eisenberg *et al*., 2015). The results showed that delivery through a caesarean section, attaining the age of 3 months or more, having ability to spend at least more than Tsh 30,000 on infant supplement, hot living with your infant father, place of delivery being in a health facility and infant mother's age is less than 35 years are factors statistically associated with the infant being introduced into mixed feeding before the age of 6 months.

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Accepted September 2019
Available online 03 May 2021

Table 5: Chi-square results for determinants of mixed-feeding practice

Factor	*HH in category*	*Frequency of Mixed feeding*	*% within category*	χ^2 value	p-value
Sex of the child					
Female	104	75	72.1	0.631	0.427
Male	100	67	67.0		
Mode of delivery for the current child				15.8	0.000***
Caesarean Section	78	67	85.9		
Normal Vaginal delivery	126	75	59.5		
Age of the current child					
Less than 3 months	75	36	48.0	26.2	0.000***
3 months or more	129	106	82.2		
Amount of money spent on the infant supplement				12.8	0.000**
Tshs0 - 30,000	173	112	64.7		
More than Tshs 30,000	31	30	96.8		
Age in months at which infants introduced to supplement				10.3	0.001**
Less than 3 months	52	27	51.9		
3 to 6 Months	152	115	75.7		
Marital status					
Have a partner	115	66	57.4	18.6	0.000***
Otherwise	89	76	85.4		
Place of delivery					
Health facilities	194	139	71.6	7.8	0.005**
Otherwise	10	3	30.0		
Occupation of the mother					
Housewife	60	44	73.3	0.6	0.455
Employment	144	98	68.1		
Infant Mother's Age					
16 – 35 years	161	119	73.9	6.7	0.010*
35+ years	43	23	53.5		
The educational level of the mother				0.3	0.615
<= Primary education	123	84	68.3		
More/ equal to Secondary	81	58	71.6		
Ethnic groups					
Makua	96	59	61.5	5.69	0.017*
Others	108	83	76.9		
Count for mother's biological children				0.3	0.617

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Factor	*HH in category*	*Frequency of Mixed feeding*	*% within category*	χ^2 value	p-value
One child	77	52	67.5		
More than 1 child	127	90	70.9		

Key: *=P<0.05, **= P<0.01, ***=P<0.001

Next to the Chi-square test, a multiple binary logistic regression analysis indicates that predictor variables included in the model explained the predicted variable (mixed-feeding practices) by about 55% (Nagelkerke R^2= 0.549). Multiple binary logistic regressions have proven that amount of money spent for an infant's supplement, age of the child in months, marital status, and mode of delivery had a significant relationship with the mixed-feeding practices in the study area (Table 6). That an increase by one shilling (OR = 1.003, 95% C.I. 1.001-1.004) increased by 1% the odds of introducing infants to foods other than breast milk. Results also indicate that infants aged <4 months were associated with a 59% (OR = 0.409, 95% C.I. 0.167-0.997) reduction in odds for practicing EBF compared to infants aged4+ years. In contrast, mothers living with their partners (OR=4.169, 95% C.I. 1.661-10.467) and mothers who had a vaginal delivery (OR=4.784, 95% C.I. 1.737-13.175) were 4 and 5 times less likely to practice mixed-feeding compared to their counterparts (unmarried and with caesarean delivery respectively).

The study showed that 134(66.7%) of the mothers opted to introduce supplements to their infants because of insufficient breast milk, 112 (54.9%) because of advice received from various sources, 13(6.4%) due to occupational reasons and 7(3.5%) mothers introduced supplements to their infants as they felt nipple's pain when breastfeeding. Our findings differ remarkably with those of Alzaheb (2016) and Appleton *et al.,* (2018) on the relationship between social, demographic, and economic characteristics with the mixed-feeding practices.

Table 6: Multiple logistic regression for determinants of mixed-feeding practices (n=204)

Variables	n	B	p-value	OR	95% C.I. for OR	
					Lower	Upper
Amount of money spent on the infant's food	204	0.003	0.000***	1.003	1.001	1.004
Age of the child						
1=<4 months	75	-0.901	0.049*	0.409	0.167	0.997
0=4+ months (ref)						
Place of delivery						
1=Health facility	194	1.001	0.324	2.722	0.372	19.901

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Variables	n	B	p-value	OR	95% C.I. for OR	
					Lower	Upper
0=Otherwise (ref)						
Age of the respondents						
15-19	14	-0.666	0.506	0.514	0.072	3.663
20-24	42	0.451	0.555	1.570	0.351	7.028
25-29	55	1.221	0.128	3.391	0.703	16.354
30-34	45	1.407	0.073	4.085	0.875	19.066
35-39	30	0.220	0.788	1.246	0.250	6.205
40+ (ref)						
Ethnic groups						
1=Makua	108	0.668	0.119	1.951	0.841	4.524
0=Otherwise (ref)						
Marital status						
1=Have partner	89	1.428	0.002**	4.169	1.661	10.467
0=Otherwise (ref)						
Mode of delivery for the current child						
1=Normal vaginal delivery	78	1.565	0.002**	4.784	1.737	13.175
0=Otherwise (ref)						
Constant		-5.132	0.000	.006		

Key: *=P<0.05, **= P<0.01, ***=P<0.001; R^2=0.549; χ^2=100.22

Alzaheb (2016) and Appleton *et al.* (2018) results pointed out that the main factors for mixed-feeding were the baby's hunger (51.4%) and that the baby is old enough to receive solids (26.6%). That infant's cues of hunger and satiety, other external signals such as the amount of milk in the bottle, and external sources of advice such as that provided on the infant formula tin and other forms of marketing. Interviewed key informants mentioned other determinants of mixed-feeding being the mother's illness, postnatal deaths, and abandonment of the child when the mother becomes pregnant. Others are income poverty, which in turn causes failure in getting a balanced diet, which would promise enough production of breast milk for the baby.

4.0 Conclusion and Recommendation

The mixed-feeding practices at Mkomaindo Ward in Masasi-Mtwara, Tanzania was found to be very high. That mixed-feeding starts as early as one month, mainly infants being given water and porridge. Besides the age of the child (months), marital status, and mode of the delivery being associated with mixed-feeding, the amount of money spent on an infant's supplement had a significant relationship with mixed-feeding practices. We, therefore, argue that there is an urgent

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need to empower mothers with skills related to side effects of mixed-feeding for increased survival of infants.

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