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ORIGINAL RESEARCH ARTICLE

Effect of a Community Health Worker Led Intervention on the Practice of Exclusive Breast-feeding in Mwingi West Sub-County, Kenya; A Pre test - Post test Experiment

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Abstract:
Introduction: World Health Organization (WHO) recommends breast milk as the ideal food for newborns and infants. In 2011, suboptimal breastfeeding practices accounted for more than 800,000 deaths among children under five years of age. Though the 2014 Kenya Demographic and Health Survey reported Exclusive Breast-Feeding (EBF) prevalence at 61%, poor breastfeeding practices are widely documented in Kenya. In 2006, Kenya developed a new Community Health Worker (CHW) led Primary Health Care intervention referred to as the Community Health Strategy (CHS). In Mwingi West sub-county, CHS was initiated in 2011. The aim of this study was to assess the effect of CHS on EBF among infants in Mwingi west sub-county. **Methods:** This was a pretest -posttest experimental study design with 1 pretest and 2 post-test surveys conducted in intervention and control sites. Sample size in each survey was 422 households. Women with a child aged 9-12 months were main respondents. **Results:** CHS increased EBF prevalence marginally by 6.4% in intervention site. This increased EBF prevalence in Mwingi west sub-county from 7.9% at baseline to 13.9% at end term survey. In intervention site, infants in the end term survey were 1.4 times more likely to receive EBF compared to infants at baseline (Adj. OR=1.447, P<0.05; 95%CI: 1.145-1.829). **Conclusion and Recommendation:** CHS was effective in marginally increasing EBF prevalence in intervention site compared to control. To improve EBF rates in arid and semi-arid rural areas in Kenya, the government needs to fast-track implementation of CHS in all counties.
Key words: *Community Health Strategy, Community Health Workers, Exclusive Breast-feeding*

BACKGROUND INFORMATION

World Health Organization (WHO) recommends breast milk as the ideal food for newborns and infants[1-4]. Optimal child breastfeeding practices consist of; early initiation of breastfeeding (within the first hour of life), Exclusive Breast-Feeding (EBF) for the first six months and continued breastfeeding for 2 years or beyond[5]. Breastfeeding has a wide range of benefits for mother and child. Besides providing infants with all the nutrients they need for healthy development, breastmilk is safe and contains antibodies that help protect infants from common childhood illnesses such as diarrhea and pneumonia which are the two primary causes of child mortality worldwide[5]. Breastfeeding is essential for early childhood development, it supports healthy brain development, increased intelligence quotient scores, and better school performance[5]. Beyond the immediate benefits for children, breastfeeding contributes to a lifetime of good health. Adolescents and adults who were breastfed as babies are less likely to be overweight or obese. They are less likely to have type-II diabetes and perform better in intelligence tests[1]. Breastfeeding has substantial benefits on maternal

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health which include; improving birth spacing and reducing the risk of post-partum hemorrhage, decreasing risk of premenopausal breast cancer, ovarian cancer, type 2 diabetes and some cardiovascular diseases[5,6]. Besides reducing maternal and child morbidity and mortality, breastfeeding also contributes to environmental sustainability by providing a natural, renewable food that needs no packaging, transportation, storage, or cooking, hence making it environmentally friendly[5]. Based on these evidences, breastfeeding is explicitly recognized by the International Convention on the Rights of the Child as a key component of every child's human right[5]. In 2011, suboptimal breastfeeding practices accounted for more than 800,000 deaths among children under five years of age[5]. Suboptimal infant breastfeeding has been associated with an increased incidence of infectious morbidity, including otitis media, gastroenteritis, and pneumonia, as well as elevated risks of childhood obesity, type 1 and type 2 diabetes, leukemia, and Sudden Infant Death Syndrome (SIDS). Among premature infants, lack of breast milk is associated with an increased risk of necrotizing enterocolitis[6].

The need to improve Maternal and Child Health (MCH) and meet targets of Millennium Development Goals (MDGs) by 2015 saw many countries design and adopt a number of interventions aimed at improving EBF. A meta-analysis which reviewed 110 breastfeeding promotion interventions studies established that interventions which promoted breastfeeding education or support were effective in increasing EBF prevalence[7]. Another review of community based programs established that EBF was highly responsive to community efforts especially in developing countries[8]. Another systematic review that investigated a total of 17 studies conducted to assess effectiveness of Community Health Workers (CHWs) delivering preventive interventions for Maternal and Child Health (MCH) in low- and middle-income countries points out that though there was no sufficient evidence available to draw firm conclusions for most interventions, CHWs were effective in promoting EBF[9]. A review of randomized controlled trials investigating effectiveness of community-based interventions in improving EBF in low and middle-income countries indicates that the odds of EBF was 5.6 times greater in intervention sites compared to the control group[10].

Despite the commendable efforts employed by individual countries aimed at improving EBF and despite growing evidence that exclusive breastfeeding plays a critical role in reducing maternal and child morbidity and mortality, a WHO fact sheet reports that global EBF prevalence by 2015 was at 36%. This was low compared to the tremendous efforts employed by individual countries aimed at meeting MDGs by 2015. Regionally countries in eastern Mediterranean have the highest EBF prevalence reported at 40%, Africa was reported to have 36% while countries in western Pacific have the lowest EBF prevalence reported at 29%[11]. In Africa, some countries have low EBF prevalence. These include; Chad-3%, Algeria-7%, South Africa-8%, Cote d'Ivoire-12%, Nigeria-17%, Botsana-20%, and Congo-21% among others[11]. In Kenya, the proportion of children younger than age 6 months who are exclusively breastfed markedly increased from 32% in the 2008-09 KDHS to 61% in the 2014 KDHS and - more than half of children in Kenya (51%) are still breastfeeding at age 20-23 months[12]. Though Kenya is a breastfeeding success story, poor breastfeeding practices are widely documented in the Country[13].

In 2006, Kenya developed a Community Health Worker (CHW) led Primary Health Care intervention popularly referred to as the Community Health Strategy (CHS) with the aim of improving health service delivery at the community level[14]. In Mwingi West sub-county, CHS was initiated in 2011[15]. The aim of this study was to assess the effect of CHS on EBF among infants in Mwingi west sub-county.

METHODS

The Study Area

This was an experimental study with intervention and control site. The intervention site was Mwingi west sub-county and the control site was Mwingi North sub-county. Both sub counties are located in Kitui county. Mwingi West sub-

county had a total population of 103,774 people in the 2009 population census with a projection of 111,346 people by 2015. While Mwingi North sub county was reported to have a total population of 139,967 in 2009 population census with a projection of 150,179 persons by 2015(16). The intervention and control sites have similar climatic and ecological characteristics, poor infrastructure and are located in a rural arid and semi-arid area[17].

The Intervention

CHS is a CHW led intervention (14) with the following key elements;

Community mobilization

MoPHS and AMREF-Kenya mobilized community in Mwingi west sub-county through community meetings led by local chiefs (popularly referred to as chief *barazas*). The aim was to create awareness of the new intervention and mobilize community members to select potential volunteer CHWs for training.

Identification and training of volunteer CHWs

Identified volunteer CHWs were trained on two things; one, primary health care health service provision and two, formation and maintenance of Community Units (CUs).

Enumeration, mapping of households and creating Community Units (CUs)

Enumeration of the community members was conducted at household level. The product of this exercise was household registers with demographic data of households. A total of 10 CUs were created namely; Kisovo, Waita, Kyethani, Kairungu, Nzeluni, Kea, Kalanga, Mutyangome, Munyuni, and Wikithuki CUs.

Recruitment and training of Community Health Extension Workers (CHEWs)

CHEWs were selected from medical staff trained at certificate and/or diploma levels and working for the Ministry of Health. These professionals were identified from dispensaries and health centers within the CUs, trained and recruited to work in the CHS intervention. Their role was to support, supervise and coordinate CHWs with each CHEW supervising up to 25 CHWs. CHEWs also facilitated health education meeting sessions in the community and provided a linkage between CHWs and health facilities.

Health service provision

The responsibility of CHWs was to provide day to day health services at household level. These services included; promotion of community hygiene and environmental sanitation, provision of Insect Treated Mosquito Nets (ITNs), child immunization services, provision of essential drugs, health education and counselling, provision of family planning services, identification and tracking of newly expectant women to ensure that; they seek ANC services as recommended, they delivered under care of skilled medical professionals, they went through postnatal care, and that their infants received vaccines in Routine Child Immunization Program (RCIP) in time. CHWs also provided health education on maternal and infant nutrition with emphasis on infant feeding and importance of exclusive breastfeeding of infants in their first six months of life. CHWs also played a role in detecting complications related to pregnancy and child birth and providing referral services for treatment at dispensaries and health centers. CHWs further monitored the health of newborn babies within their CUs and provided referrals for any sick child for treatment at the local health centers.

The Research Design

This was a non-randomized prospective (pretest-posttest) experimental study in which 1 pre- test and 2 post-test time series household surveys were conducted in both intervention and control sites. Data was collected at 3 time points; a baseline survey was used to collect baseline data in both intervention site and control sites. First post intervention survey data was collected 9 months after implementation of the CHS in intervention site and control site. This survey was defined as mid-term evaluation. Second post intervention survey data was collected in both intervention and control sites 18 months after implementation of the CHS. This is defined as end-term evaluation survey. Data was collected at household level with women of reproductive age with a child aged 9-12 months being the main respondents. Based on nature of phenomena to be examined, data was collected from different participants in all the three surveys. For example, it was not possible to guarantee that a woman who was sampled at baseline survey and data collected on her quality of ANC

services provided, place of delivery etc., will be expectant again after 9 months or even 18 months to enable investigators to measure the same parameters again. This informed the choice of having different participants at baseline, midterm and end-term evaluation surveys.

Sample size determination

Reference (18) provides the Fisher's formula for calculating a representative sample size of a population with more than 10,000 participants. After employing this formula, a representative sample size of 384 households was established. Thirty-eight households (10 percent of 384 households) were added into this sample in order to carter for non-response. A total sample size of 422 households was determined.

Sampling Procedure

Purposive and simple random sampling methods were employed. Purposive sampling was used to identify intervention and control sites. Mwingi west sub county was purposively selected as intervention site based on the fact that the CHS program was to be implemented in the sub county. Mwingi north sub county was also purposively sampled as the control site based on the following; CHS was not under implementation in the sub county, the sub county borders Mwingi West and both sub-counties have many similarities which include similar ecological and climatic characteristics (17).

Simple random sampling was applied in all the pre-and post-intervention surveys in the study and control sites. The first step was to develop a sampling frame for each of the three surveys conducted in the study site and the control site respectively. Sampling frames in Mwingi west sub county was 1243 households (in Waita CU) at baseline and 927 households (in Kyethani CU) and 1107 households (Wikithuki CU) at midterm and end term surveys respectively. The sampling frame was developed using household registers which were developed during creation of CUs. In the control site, the researchers together with village elders and local chiefs conducted a series of community meetings to help in identification of households with a child or children aged between 9-12 months. This was done in Kyuso, Ngomeni and Mumoni wards. A sampling frame of 971 households, 1032 households and 1208 households was developed in Kyuso, Ngomeni and Mumoni wards respectively. Using SPSS a sample size of 422 households was drawn from each sampling frame.

Data Collection Process

The first step in data collection was to conduct a pre-intervention survey to collect baseline data in both intervention and control sites. The aim was to obtain pretest measurements on both intervention and control groups to allow assessment of initial comparability of the two groups. In the intervention site, baseline data was collected from a total 416 households in Waita Community CU while in the control site baseline data was also collected from a total of 411 households in control site. This exercise took place from March 2012 to June 2012. Baseline survey was followed by two post intervention surveys in both intervention and control sites. Data for first post intervention survey (mid-term survey) was conducted 9 months (from March 2013 to June 2013) after implementation of the CHS in Mwingi west sub county. In the intervention site data was collected in 413 households in Kyethani CU while in the control site data was also collected from 413 households. The second post intervention survey took place 18 months (from March 2014 to June 2014) after implementation of the CHS. In this survey, data collection in intervention site was done from 417 households in Wikithuki CU and in the control site data was collected from 420 households.

Variables in the study

The independent variable in the study is the intervention-CHS, while the dependent variable was Exclusive Breast-Feeding (EBF).

Study Validity and Reliability

A pilot study was conducted in Nzeluni in Mwingi west sub-county before the main study. The objective of the pilot was to test the reliability of data collection tool. Data was collected in a randomly selected sample of 45 households (slightly above 10 per cent of the sample size) in three villages in Nzeluni sub location. Upon testing the data on reliability, the coefficient of internal consistency (Cronbach's *alpa*) was 0.864. This value was within the recommended range of 0.70-0.95 (19) and therefore we were assured that the data collection tool (questionnaire) was reliable. Internal validity of the study was ensured by applying a sound methodology

while external validity was ensured by use of a representative sample size.

Data Analysis and Presentation

Frequencies and percentages were used to provide descriptive statistics. Z score tests were used to determine if proportions of EBF before and after the intervention were significantly different. Binary logistic regression was used to control for potential confounders (socio-demographic characteristics) and to establish the odds of infants who were exclusively breastfed in the first 6 months of life before and after the intervention. Data was presented using tables.

Study limitations

The study had several important limitations; the most important of these was selection of intervention and control sites. Since implementation of the CHS was a MoPHS and AMREF-Kenya project which was designed to be implemented in Mwingi West sub county as a whole, it was not feasible to randomly assign the CHS intervention to community members in Mwingi west sub county. This is the reason why a non-randomized pre-test and post-test experimental study design was deemed appropriate. Though this method has been employed in other similar studies (20-24) the design is weaker compared to a randomized controlled trial. Secondly, researchers were also not able to account for possibility of other programs that could influence MCH outcomes of interest in the intervention site. However, there was an attempt to reduce the effect of confounding factors through, treating socio-demographic characteristics of both intervention and control sties as potential confounders and having them controlled in the binary logistic regression model used in data analysis, and by matching the control to the intervention sites by geographical location, and infrastructural characteristics.

Part of data collection involved collecting data from a Mother and Child Health (MCH) booklet at the household level. In the event that this booklet was not available, respondents were requested to remember the MCH events that happened in a span of 12 months. Though this method has been successfully used in other studies including Demographic and Health Surveys (DHS) (12), the method introduced a retrospective data collection aspect that required respondents to recall past events. Though this was limited only to respondents who could not produce their mother and child booklets, it was a potential source of recall bias error.

Ethical Considerations

Ethical clearance for this study was provided by the National Council of Science and Technology (NCST) of the Government of Kenya (GoK).

RESULTS

Socio demographic characteristics of study population

Table 1 shows the social demographic characteristics of the study population

EBF prevalence in Intervention and Control Sites

In the intervention site, the proportion of women who reported to have exclusively breastfed their infants in the first six months of life was 7.5%, 10.5% and 13.9% at baseline, midterm and end-term surveys respectively. In the control site the proportion of infants who received EBF in the first 6 months of life was 9.5%, 5.8% and 7.4% at baseline, midterm and end-term surveys respectively. These results are summarized in **table 2**.

Effect of CHS on EBF

Z score tests measuring Change in EBF prevalence in Intervention and Control sites

Initial assessment at baseline indicated a 2% difference between prevalence of EBF in intervention site (7.5%) and prevalence of EBF in control site (9.5%). Z score test however indicated no significant difference between the 2 proportions ($Z=-1.0523$; $P>0.05$). In intervention site, proportion of infants who were exclusively breast fed in the first six months of life increased from 7.5% at baseline to 10.7% at midterm survey. Z score test indicated that the 3.2% increment in EBF prevalence was not significant ($Z=1.6069$; $P>0.05$). In the same site (intervention), EBF prevalence increased from 7.5% at baseline to 13.9%. The 6.4% increase was confirmed significant by a Z score test ($Z=3.0164$; $P<0.05$). In the control site, EBF prevalence decreased by 3.7% from 9.5% at baseline to 5.8% at midterm. Z score test confirmed the 3.7% difference as significant ($Z=-1.9865$; $P<0.05$). In the same site (control) no significant difference was found between

Table 1: Socio demographic Characteristics of respondents

Variable	Categories	Baseline Survey				Midterm Survey (9 Months)				End term Survey (18 months)			
		Mwingi West		Mwingi North		Mwingi West		Mwingi North		Mwingi West		Mwingi North	
		F	%	F	%	F	%	F	%	F	%	F	%
Age	16-20 years	8	1.9	12	2.9	14	3.4	18	4.4	29	7.0	20	4.8
	21-25 years	35	8.4	63	15.3	61	14.8	59	14.3	64	15.3	76	18.1
	26-30 years	106	25.5	134	32.6	141	34.1	127	30.8	112	26.9	117	27.9
	31-35 years	149	35.8	139	33.8	126	30.5	143	34.6	132	31.7	138	32.9
	36-40 years	113	27.2	57	13.9	69	16.7	59	14.3	80	19.2	63	15.0
	41-45 years	5	1.2	6	1.5	2	0.5	7	1.7	0	0	6	1.4
Parity	1 Child	20	4.8	23	5.6	25	6.1	22	5.3	13	3.1	30	7.1
	2 children	19	4.6	22	5.4	28	6.8	15	3.6	26	6.2	13	3.1
	3 children	60	14.4	58	14.1	74	17.9	64	15.5	65	15.6	67	16.0
	4 children	105	25.2	124	30.2	93	22.5	93	22.5	122	29.3	89	21.2
	5 children	93	22.4	89	21.7	95	23.0	113	27.4	99	23.7	100	23.8
	6 children	63	15.1	74	18.0	66	16.0	82	19.9	65	15.6	88	21.0
	6 and above	56	13.5	21	5.1	32	7.7	24	5.8	27	6.5	33	7.9
Education Level	No education	33	7.9	12	2.9	25	6.1	16	3.9	27	6.5	8	1.9
	Primary level	141	33.9	86	20.9	127	30.8	108	26.2	102	24.5	124	29.5
	Secondary level	149	35.8	228	55.5	167	40.4	187	45.3	208	49.9	167	39.8
	College/University	93	22.4	85	20.7	94	22.8	102	24.7	80	19.2	121	28.8
Occupation	Not working	8	1.9	10	2.4	13	3.1	15	3.6	34	8.2	15	3.6
	Peasant Farmer	206	49.5	233	56.7	225	54.5	247	59.8	226	54.2	230	54.8
	Business	105	25.2	117	28.5	91	22.0	92	22.3	99	23.7	108	25.7
	employment	97	23.3	51	12.4	84	20.3	59	14.3	58	13.9	67	16.0
Marital Status	Single	21	5.0	31	7.5	30	7.3	44	10.7	40	9.6	34	8.1
	Married	306	73.6	350	85.2	299	72.4	328	79.4	311	74.6	337	80.2
	Windowed	24	5.8	12	2.9	16	3.9	15	3.6	18	4.3	18	4.3
	Sep./ Divorced	65	15.6	18	4.4	68	16.5	26	6.3	48	11.5	31	7.4
Monthly Income	**≤2500**	118	28.4	219	53.3	153	37.0	221	53.5	161	38.6	242	57.6
	2501 - 5000	129	31.0	109	26.5	122	29.5	94	22.8	133	31.9	86	20.5
	5001 - 7500	45	10.8	32	7.8	53	12.8	29	7.0	47	11.3	22	5.2
	7501 - 10000	66	15.9	12	2.9	14	3.4	18	4.4	15	3.6	19	4.5
	> 10000	58	13.9	39	9.5	71	17.2	51	12.3	61	14.6	51	12.1
F. and %. totals each Variable		**416**	**100**	**411**	**100**	**413**	**100**	**413**	**100**	**417**	**100**	**420**	**100**

baseline EBF prevalence (9.5%) and end term EBF prevalence (7.4%) (Z=-1.0939 P>0.05). These results are summarized in **Table 3.**

Odds of EBF of infants in Intervention and Control sites

Both crude Odds Ratios (OR) and adjusted OR were analyzed in the binary regression analysis performed. In the adjusted regression analysis; maternal age, education, parity, marital status

Table 2. EBF prevalence in Intervention and Control Sites

Survey	Intervention site				Control Site			
	Infant EBF		Infant Not EBF		Infant EBF		Infant Not EBF	
	Frq.	%	Frq.	%	Frq.	%	Frq.	%
Baseline	31	**7.5**	385	92.5	39	**9.5**	372	90.5
Midterm (9months)	44	**10.7**	369	89.3	24	**5.8**	389	94.2
End-Term (18 months)	58	**13.9**	359	86.1	31	**7.4**	389	92.6

Table 3. Z score tests measuring Change in EBF prevalence in Intervention and Control sites

Study site	Baseline	Mid-term (9 months)	End term (18 months)	Midterm *vs* Baseline (Z tests)	End term *vs* Baseline (Z tests)
Intervention EBF prevalence	7.5% (31/416)	10.7% (44/413)	13.9% (58/417)	Z=1.6069 P=0.1074	**Z=3.0164 P=0.00252**
Control EBF prevalence	9.5% (39/411)	5.8% (24/413)	7.4% (31/420)	**Z=-1.9865 P=0.0466**	Z=-1.0939 P=0.27572
Intervention vs Control (Z tests)	Z=-1.0523 P=0.29372	**Z=2.5318 P= 0.0114**	**Z=3.0633 P=0.00222**		

Table 4. Odds of Exclusive Breastfeeding of infants in Intervention and Control sites

Study sites	Surveys	Crude % Adj.	Sig	OR	95%CI
Intervention site	**Midterm vs Baseline**	Crude OR	0.110	1.481	0.915-2.396
		Adjusted OR	0.069	1.588	0.344-1.016
	End term Vs Baseline	Crude OR	**0.003**	**1.411**	**1.126-1.767**
		Adjusted OR	**0.002**	**1.447**	**1.145-1.829**
Control Site	**Midterm vs Baseline**	Crude OR	**0.049**	**0.588**	**0.347-0.998**
		Adjusted OR	0.057	0.592	0.344-1.016
	End term Vs Baseline	Crude OR	0.255	0.861	0.665-1.114
		Adjusted OR	0.249	0.857	0.660-1.114

and average household income were perceived as potential confounders and controlled in the binary logistic regression model. In intervention site, binary logistic regression revealed no significant difference in the odds of EBF of infants between baseline and midterm survey [(crude OR=1.481, P>0.05; 95% CI: 0.915-2.396), Adj. OR=1.588, P>0.05; 95%CI: 0.344-1.016)]. However, infants in end term survey of the intervention site were found to be 1.4 times more likely to be exclusively breastfed compared to infants at baseline survey of intervention site [(crude OR=1.411, P<0.05; 95% CI: 1.126-1.767), Adj. OR=1.447, P<0.05; 95%CI: 1.145-1.829)].

In the control site; crude OR indicated that the probability of an infant getting exclusively breastfed within the first six months of life reduced by 41% in the midterm survey compared to baseline survey [Crude OR=0.588, P<0.05; 95% CI: 0.347-0.998].However after adjusting for social demographic characteristics, no significant difference was observed in the odds of EBF of infants between baseline survey and midterm survey in control site [Adjusted OR=0.592, P>0.05; 95% CI: 0.344-1.016]. Both the crude and adjusted ORs did not show a significant difference in the odds of EBF of infants in the first six months of life

between baseline survey and end-term survey [(crude OR=0.861, P>0.05; 95% CI: 0.665-1.114), Adj. OR=0.857, P>0.05; 95%CI: 0.660-1.114)]. These results are summarized in **table 4**.

DISCUSSION

Prevalence of EBF in intervention and control sites

Though the 2014 KDHS indicates that the prevalence of EBF in Kenya is 61% up from 32% as indicated in the 2008/09 KDHS (12, 25) this success story unfortunately may not be evenly distributed in Kenya. This is based on the observed low EBF prevalence in the baseline, midterm and end term surveys in both intervention and control sites as indicated in **table 2.** The lowest EBF prevalence observed was in the end term survey in the control site which was 7.4% and the highest was 13.9% in the end term survey of intervention site. Though there is a marginal increase of EBF prevalence in intervention site 18 months after implementation of the CHS intervention, the observed increase is still far much lower compared to national EBF prevalence (61%). The low EBF prevalence observed could be the result of the social demographic characteristics which characterize the people living in both Mwingi west and Mwingi North sub-counties. The 2 sub counties are not only located in a rural area but their environments are also semi-arid with poor rainfall patterns. The residents therefore suffer from not only food insecurity but also water scarcity. This forces women and children to walk for long distances in search of water[17,26]. Perhaps this could be the reason behind the observed poor infant breastfeeding practices in both intervention and control sites. When young mothers are forced by circumstances to leave their infants behind and travel long distances in search of water and food. EBF suffers a major setback. Care takers left with the infants supplement the infants with foodstuffs as they wait for their mothers to return and continue breastfeeding their children. This could be the reason why many infants get started on other foodstuffs besides breastmilk. Supplementing infants with other foodstuffs besides breastmilk interrupts EBF and explains why EBF prevalence is low in both intervention and control sites even after the intervention was implemented in intervention site for 18 months.

Effect of CHS intervention on EBF

In the intervention site, proportion of infants who were exclusively breastfed in the first six months of life (EBF prevalence) increased from 7.5% at baseline to 10.7% at midterm survey and 13.9% at end-term survey. Z score test indicated no significant difference between midterm survey EBF prevalence and baseline survey EBF prevalence. This implies that the observed increment of 3.2% in EBF prevalence was not significant. Z score test however revealed a significant difference between baseline EBF prevalence (7.5%) and end term EBF prevalence 13.9% (Z=3.0164; P<0.05) in intervention site. The observed 6.4% increase in EBF prevalence is significant. Though there was no attempt to control for any confounding factors at this stage, it is possible that the observed marginal increment in EBF prevalence could be as a result of the effect of the CHS intervention. This conclusion is based on two things; pattern of EBF prevalence observed in the control site as will be described in the following paragraphs and binary logistic regression model which controlled socio-demographic characteristics.

In intervention site; binary regression analysis showed no significant difference between baseline and midterm survey in the odds of infants who were exclusively breastfed within the first six months of life, but a binary logistic regression analysis conducted to compare baseline survey and end term survey revealed a significant difference in the odds of infants who were exclusively breastfed within the first six months of life. Both crude and adjusted ORs showed that infants in the end term survey were 1.4 times more likely to receive EBF in the first six months of life compared to infants in the baseline survey. This supports the inference that CHS intervention was accountable for the marginal increment in EBF prevalence in the intervention site. Even after adjusting for social demographic characteristics, the odds of infants receiving EBF in first six months of life remained high in end term survey compared to baseline survey in intervention site as shown in **table 4**.

In the control site; a different pattern of EBF prevalence was

observed. Compared to midterm EBF prevalence of 5.8%, baseline EBF prevalence (9.5%) decreased by 3.7%. This decrease was found to be significant though the Z score test level of significance was low (Z=-1.9865, P=0.046). A crude OR also indicated a significant difference between baseline and midterm surveys in the odds of infants who were exclusively breastfed in their first six months of life between [Crude OR=0.588, P<0.05; 95% CI: 0.347-0.998]. This slight decrease in EBF prevalence at midterm survey could be accounted by confounding sociodemographic factors. This was confirmed by adjusted OR (adjusted for maternal age, maternal education, parity, marital status and average household income) which indicates no significant difference between baseline survey and midterm survey in the odds of infants who received EBF in the first six months of life [Adjusted OR=0.592, P>0.05; 95% CI: 0.344-1.016]. A comparison between end-term EBF prevalence and baseline EBF prevalence in control site indicated no significant change in the 2 proportions and this was also confirmed by both crude and adjusted ORs which showed no significant difference between the 2 groups in the odds of infants who were exclusively breast fed in the first six months of life [(crude OR=0.861, P>0.05; 95% CI: 0.665-1.114), Adj. OR=0.857, P>0.05; 95%CI: 0.660-1.114)].

Based on observed change in EBF prevalence and observed change in odds of EBF in intervention and control site, two inferences on effect of CHS on EBF were made; that CHS intervention increased EBF prevalence in intervention site (Mwingi west sub-county) by a 6.4% (from 7.9% at baseline to 13.9% at end term survey), and that in intervention site, infants were 1.4 times more likely to be breastfed exclusively in end-term survey (18 months after implementation of the CHS) compared to baseline. A number of studies do support the findings in this study. A review of 110 studies on breastfeeding interventions conducted in resource poor countries indicates that interventions which targeted breastfeeding education and support increased EBF rates in intervention sites[7]. Another review of 17 articles from low and middle income countries on effectiveness of CHWs (in specific) in delivering preventive interventions on MCH provided evidence that CHWs are effective in promoting exclusive breastfeeding[10]. A WHO report which assessed the role of CHWs in the interventions geared towards achieving MDGs in different countries of the developing world indicates that CHWs played a significant role in promoting EBF among other MCH services[27]. In India, a study conducted to assess influence of seasonality and Community-Based Health Worker (CBHW) provided counselling on EBF concluded that CBHW counselling was effective in increasing practice of EBF irrespective of season[28]. A study conducted in Busia-Kenya to assess effectiveness of first pilot projects of CHS in delivering community-based maternal and newborn health care concluded that CHS was effective in increasing EBF rate in intervention site[29]. These studies support the findings of this study.

CONCLUSION AND RECOMMENDATION

CHS increased EBF prevalence marginally by 6.4% in intervention site (Mwingi West sub-county). This increased EBF prevalence from 7.9% to 13.9%. In the intervention site (Mwingi west sub-county), infants at end-term survey were 1.4 times more likely to be exclusively breastfed at end-term survey compared to baseline survey. Though Kenya realized a high EBF prevalence in the 2014 KDHS (61%) and won global praise as a EBF success story, the observed EBF proportions in intervention and control sites indicate that the EBF success is not evenly distributed in the country. To improve EBF prevalence rates in rural semi-arid areas in Kenya, the country needs to fast track implementation of CHS in all Counties.

COMPETING INTERESTS

The authors declare no competing interest.

AUTHORS' CONTRIBUTIONS

JMN conceived the study and wrote the manuscript, **ROO** and **JHO** provided academic supervision and leadership and JO analyzed data.

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