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The potential effectiveness of community health and nutrition volunteers on mothers' infant and young children feeding knowledge and practice in remote areas, Hajjah, Yemen

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Abstract

Background The Infant and young child feeding (IYCF) practices directly affect the health, development and nutritional status of children under two years of age. However, IYCF counseling is one of the Community Health and Nutrition Volunteers (CHNVs) activities provided, which may contribute to improving the IYCF knowledge and practice among mothers. Since establishment of the CHNVs program in Yemen, its outcome has never been evaluated. Therefore, the aim of this study was to evaluate the role of CHNVs in improving the IYCF knowledge and practice among mothers in Hajjah governorate.

Methods A comparative cross-sectional study design was conducted in Bani Qais and Al-Maghrabah districts, Hajjah governorate between January and April 2023. A three-stage cluster sampling method was used to select districts, volunteer villages and households. A total of 926 mothers were interviewed. A pre-tested structured questionnaire was used to collect data. SPSS 26 was used for data analysis. The multinomial logistic regression and Chi-Square test were used to compare the IYCF knowledge and practices among mothers between the volunteer and non-volunteer villages. Odds Ratio (OR) with 95% Confidence Interval (CI) were calculated. A p-value < 0.05 was considered statistically significant.

Results The mothers in volunteer villages had significantly better breastfeeding and complementary feeding (CF) knowledge than mothers in non-volunteer villages. The OR of having good and moderate knowledge of breastfeeding were 3.5 (95%CI: 2.4–5.2) and 1.6 (95% CI: 1.2–2.2), respectively. The OR for good and moderate knowledge of CF were 1.7 (95% CI: 1.1–2.7) and 2.2 (95% CI: 1.5–3.0), respectively. Moreover, there is a statistically significant association in prevalence of Exclusively breastfed for the first two days after birth (EBF2D), Mixed milk feeding under six months (MixMF) and Bottle feeding 0–23 months (BoF) between volunteer and non-volunteer villages [(OR = 1.4, 95% CI: 1.0–1.8), (OR = 0.4, 95% CI: 0.2–0.8) and (OR = 0.5, 95% CI: 0.4–0.7), respectively].

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Conclusions The study found that CHNVs play a significant effect in improving the breastfeeding and CF knowledge, and prevalence of EBF2D, MixMF and BoF practices among mothers in their villages compared to non-volunteer villages. Future follow-up study and expansion to other settings in different governorates is recommended.

Keywords Community health and nutrition volunteers, Volunteer and non-volunteer villages, Infant and young child feeding knowledge and practice, Hajjah, Yemen

Introduction

The first 23 months of life is a critical period, because the growth, neurologic and immunologic development of children have adversely affected by malnutrition [1–3]. Poor nutrition in early childhood impairs cognitive development, learning and adult educational attainment [4, 5]. infant and young child feeding (IYCF) practices directly affect the health, development and nutritional status of children under two years of age and, ultimately, affect child survival. Improving IYCF practices in children 0–23 months of age is critical to improved nutrition, health and development [6]. However, proper and adequate nutrition for children helps ensure their growth, reinforces their immune system, improves their cognitive development, and decreases their risk of getting infectious diseases [3, 7–11]. Moreover, the first 6 months of life represent a transition from the neonatal period to childhood [11]. Breastfeed them exclusively for the first 6 months of their life, then complement them with a diversity of foods every day promotes healthy growth, strengthens the immune system, improves cognitive development and decreases the risk of infectious diseases [2, 11].

Conversely, poor IYCF practices, such as untimely introduction, lack of diversity, and inadequate amounts of complementary foods, are major contributors to child malnutrition, particularly between the ages of 3 and 24 months [1, 12–14]. The World Health Organization (WHO) recommends early initiation of breastfeeding (EIBF) within one hour of birth, exclusive breastfeeding under six months (EBF) and continued breastfeeding (CBF) at least until the age of 2 years, A variety of adequate, safe and nutrient-dense complementary foods should be introduced from 6 months of age [14–16].

New global goals on maternal, and infant and young child (IYC) nutrition have been agreed upon and integrated into the 2030 Agenda for Sustainable Development. However, supporting countries to operationalize a current national nutrition strategy and plan of action is needed to achieve global targets [17–19]. Consequently, WHO recommends several actions to improve nutrition through expanded nutrition interventions related to the health services and other nutrition-related interventions that can be delivered through the broader health system, away from health facilities [18].

Furthermore, one of strategies to address the human resources shortage is shifting some tasks in health

services to trained community members to provide some basic health services and to promote healthy behaviors at the community-level [20–22]. Community health workers (CHWs) tasks range from health promotion to disease prevention [23]. CHWs have played an important role in linking communities to health services for over 50 years [23].

Although there have been many published studies that assessed the outcomes of CHWs activities, there is no specific framework or model for their evaluation. Evaluation models could depend on resource availability, time constraints, and design considerations. Many studies were designed to assess the outcome of volunteers by comparing between the intervention and control areas. The studies showed that the CHWs are effective in improving IYCF practice and knowledge, such as CHWs can promote EIBF [16, 24–28], early breastfeeding [29] and EBF [15–17, 24, 26, 27, 30]. Other studies indicated that the CHWs can improve complementary feeding (CF) practice, such as minimum dietary diversity 6–23 months (MDD) [8, 9, 12, 30–34], minimum meal frequency 6–23 months (MMF) [1, 7, 9, 12, 26, 31, 34], and minimum acceptable diet 6–23 months (MAD) [8, 9, 31, 34]. Moreover, they can improve IYCF knowledge among mothers [4, 31, 32].

Despite IYCF practices being primary determinants of child nutritional status, Yemen faces significant challenges in this area About 53% of infants were breastfed within one hour of birth, and 76% began breastfeeding within one day of birth. Only 10% of children under age 6 months are exclusively breastfed, and 21% eat complementary foods in addition to breast milk. As well as 44% of children under age 6 months are using a bottle with a nipple. About 71% of children continue breastfeeding at 1 year of age. Nearly 27% of children had an adequately diverse diet and 59% had been fed the minimum number of times appropriate for their age [35].

Yemen's healthcare system faces the challenge of dispersing 70% of the rural population in scattered clusters. However, the Ministry of Public Health and Population (MPHP) has implemented the Community Health and Nutrition Volunteers (CHNVs) program to enhance healthcare accessibility [36]. It started by covering 244 villages in 10 districts with 371 volunteers [37]. It subsequently expanded from 918 CHNVs at 35 districts in 2010 to 25,352 at 243 districts across 21 governorates by 2019 [36]. Despite this expansion in recent years, the

activities of CHNVs have never been evaluated in Yemen. The need for such study has become crucial in determining if the CHNVs program is effective, and the provided services contribute to improving the IYCF knowledge and practice among mothers. Moreover, the study will provide invaluable information to the MPHP officials and partners to gain insight on the CHNVs program activities. Therefore, the aim of this study was to evaluate the role of CHNVs in improving the IYCF knowledge and practice among mothers in Hajjah governorate.

Methodology

Study design, area and population

A comparative cross-sectional study design was conducted in Bani-Qais and Al-Maghrabah districts, Hajjah governorate, Yemen. It was carried out among mothers and their IYC, during the period from January to April 2023.

The outcome (potential effectiveness) of the CHNVs was assessed by comparing the IYCF knowledge and practices among mothers between the volunteer and non-volunteer villages.

Hajjah governorate has the highest number of districts compared to other Yemen's governorates. It has the second-highest poverty rate (83%) after Al-Hodeidah compared to other Yemen's governorates, and nearly 90% of the population in need of assistance [38]. It has the highest number of CHNVs, with 1,912 active CHNVs [39]. Out of 31 districts of Hajjah, 26 (84%) were covered by the CHNVs program [40].

Inclusion and exclusion criteria

This study included all mothers and their IYC aged 0 to 23 months who have lived in the selected villages in Bani-Qais and Al-Maghrabah districts for the past year. Mothers with children older than 23 months or those who did not provide verbal consent, were excluded from this study.

Sample size

A total of 454 mothers with their IYC from each district were considered as a sample size (227 from volunteer and 227 from non-volunteer villages). It was calculated using the G-Power software (version 3.1.9.4), based on the following assumptions and results of pilot study: proportion of CBF 12–23 months was 0.67 (67%) in the volunteer villages and 0.50 (50%) in the non-volunteer villages, with an alpha error of 5% and a power of 95%. The sample size was increased by 5% to avoid non respondents to be 476 mothers with their IYC from 476 households (238 from volunteer and 238 from non-volunteer villages) for each district. For each IYC selected from a volunteer village, an age- and sex-matched IYC was enrolled from a non-volunteer village.

Sampling technique

A three-stage cluster sampling method was used to select districts, volunteer villages and households. In the first stage, districts were randomly selected. In the second stage, villages were randomly selected from each chosen district. In the third stage, households were randomly selected from each chosen village. A Probability Proportional to Size sampling method was used to select households from each volunteer village. If there was no eligible IYC in the household, the next household was selected.

Data collection and measurements

A pre-tested structured questionnaire has been adopted from previous literature [6, 13, 35, 41]. It was used to collect data on the participants characteristics, the IYCF knowledge and practices. Face-to-face interviews with mothers/caretakers were used to collect data.

The IYCF practices were assessed by using the breastfeeding and CF indicators recommended by the WHO [6]. The breastfeeding indicators included ever breastfed (EvBF), EIBF, exclusively breastfed for the first two days after birth (EBF2D), EBF, mixed milk feeding under six months (MixMF), and CBF. CF indicators included introduction of solid, semi-solid or soft foods 6–8 months (ISSSF), MDD, MMF, minimum milk feeding frequency for non-breastfed children 6–23 months (MMFF), and MAD. Additionally, bottle feeding 0–23 months (BoF) indicator was used. Knowledge of mothers about IYCF was assessed by questions on breastfeeding and CF.

The multiple-choice and yes/no questions/statements were scored 1 for each correct or yes answer, and 0 for incorrect, no and don't know answers. Four questions were used to assess the breastfeeding knowledge (with a maximum score of 4), and five questions were used to assess the CF knowledge (with a maximum score of 5). Therefore, the maximum overall score for IYCF knowledge was 9 points. The percentage score of knowledge was calculated by dividing the total achieved score by the maximum score. If the percentage score was less than the median of 50%, the knowledge level was considered as poor. If the score was equal to or greater than the median, it was considered moderate (50–74%) or good (75–100%).

A pilot study was conducted among 16 mothers from volunteer and non-volunteer villages. Any misunderstandings in the questions were revised and corrected to be more understandable and culturally appropriate.

To validate and ensure accuracy of the questionnaire, It was translated into Arabic and back into English by two different translation centers. discrepancies were corrected.

Quality assurance and control during data collection and measurements

A supervisor and 4 female data collectors were trained on CHNVs program, IYCF, interviews, and data collection for two-days. Role-play was used to help them understand the questionnaire and how to ask questions correctly.

To avoid a selection bias and ensure comparability between volunteer and non-volunteer villages, the closest non-volunteer village was selected for each volunteer village from the same level of health facilities catchment areas. This helped to control the potential effects of other interventions provided by other activities or programs.

Data on IYCF practices was collected through mothers/guardians' recall. Questions about EvBF, EIBF, and EBF2D practices were based on mothers/guardians' recall practices immediately after the child's birth. Conversely, questions about the remaining IYCF practices were based on the recall in the previous day (24 h before the survey) to avoid recall bias. A supervisor randomly checked 10% of collected questionnaires through home visits.

Statistical analysis

Statistical Package for the Social Sciences version 26 (SPSS 26) was used for data entry and analysis. Almost all the data of the quantitative variables were not normally distributed, as determined by the Shapiro-Wilk test ($p < 0.05$). Consequently, the data were presented in medians and interquartile range (IQR) as quartile 1 and quartile 3. The frequency and percentage were used for categorical variables.

The multinomial logistic regression analysis was used to compare the knowledge of mothers about the IYCF between the volunteer and non-volunteer villages. Poor knowledge was considered the reference category. The Chi-Square test was used to compare the practices of mothers about the IYCF between the volunteer and non-volunteer villages. Odds Ratio (OR) with 95% Confidence Interval (CI) were calculated. A p -value < 0.05 was considered statistically significant.

Results

A total of 952 mothers with their IYC enrolled in this study from Al-Maghrabah and Bani-Qais districts. Of these, 926 were interviewed and completed the questionnaire, with a response rate of 97%.

Socio-demographic characteristics of participants

Table 1 shows the sociodemographic characteristics of participants were similar in volunteer and non-volunteer villages.

Infant and children feeding knowledge

Table 2 shows that mothers in volunteer villages had significantly better knowledge of IYCF than mothers in non-volunteer villages. The percentage of mothers with good and moderate knowledge of breastfeeding was significantly higher in volunteer villages (25.9% and 45.6%, respectively), compared to non-volunteer villages (11.4% and 44.1%, respectively). The OR of having good and moderate knowledge of breastfeeding were 3.5 (95% CI: 2.4–5.2, p value < 0.0001) and 1.6 (95% CI: 1.2–2.2, p value = 0.001), respectively.

Regarding the CF knowledge, the percentage of mothers who had good and moderate knowledge of CF was significantly higher in volunteer villages (10.2% and 24.6%, respectively) compared to non-volunteer villages (7.3% and 13.8%, respectively). The OR for good and moderate knowledge of CF were 1.7 (95% CI: 1.1–2.7, p value < 0.031) and 2.2 (95% CI: 1.5–3.0, p value < 0.0001), respectively.

Moreover, there was a statistically significant difference in overall IYCF knowledge among mothers between volunteer and non-volunteer villages. The OR for good and moderate IYCF knowledge were 4.5 (95% CI: 1.5–13.7, p value < 0.009) and 2.4 (95% CI: 1.8–3.3, p value < 0.0001), respectively.

Infant and children feeding practices

Table 3 shows the distribution of IYCF practices of mothers by village type in Hajjah governorate. Among all breastfeeding indicators, only EBF2D and MixMF indicators showed a significant difference between volunteer and non-volunteer villages. The percentage of mothers who exclusively breastfed their IYC for the first 2 days after birth was significantly higher in volunteer villages (69.0%) compared to non-volunteer villages (62.3%), (OR = 1.4, 95% CI: 1.0–1.8, p value = 0.034). The percentage of mothers who fed their under 6 months child mixed milk was significantly lower in volunteer villages (54.3%) compared to non-volunteer villages (73.3%), (OR = 0.4, 95% CI: 0.2–0.8, p value = 0.008). The percentage of BoF practice among mothers was significantly lower in volunteer villages (57.5%) compared to non-volunteer villages (71.9%), (OR = 0.5, 95% CI: 0.4–0.7, p value < 0.0001).

Discussion

The CHNV program is expected to be effective in improving the knowledge and practices of mothers about the IYCF. It provides PHC services to mothers and their children who live in the villages of the 2nd or 3rd levels of the health facilities catchment areas. The study evaluated the potential effectiveness of the CHNVs activities by comparing the IYCF knowledge and practices among mothers between volunteer and non-volunteer villages, in Hajjah governorate. It found that the CHNVs are more

Table 1 Characteristics of the study participants by village type

Characteristics	Volunteer villages (n = 463)	Non-volunteer villages (n = 463)	Total (n = 926)
Infant and young children			
Age (months): median (IQR)	11.7 (7.3 and 17.2)	11.8 (7.1 and 17.0)	11.7 (7.2 and 17.1)
Sex: no (%)			
Male	242 (52.3)	242 (52.3)	484 (52.3)
Female	221 (47.7)	221 (47.7)	442 (47.7)
Number of siblings: median (IQR)	3.0 (1.0 and 5.0)	3.0 (1.0 and 5.0)	3.0 (1.0 and 5.0)
Rank: median (IQR)	4.0 (2.0 and 6.0)	4.0 (2.0 and 6.0)	4.0 (2.0 and 6.0)
Mothers			
Age (years): median (IQR)	25.0 (22.0 and 30.0)	25.0 (21.0 and 30.0)	25.0 (21.0 and 30.0)
Educational level: no (%)			
Illiterate	344 (74.4)	395 (85.3)	739 (79.8)
Basic school	90 (19.4)	50 (10.8)	140 (15.1)
Secondary school	27 (5.8)	17 (3.7)	44 (4.8)
University	2 (0.4)	1 (0.2)	3 (0.3)
Occupational status: no (%)			
Working	4 (0.9)	6 (1.3)	10 (1.1)
Not working	459 (99.1)	457 (98.7)	916 (98.9)
Fathers			
Age (years): median (IQR)	30.0 (25.0 and 36.0)	30.0 (25.0 and 36.0)	30.0 (25.0 and 36.0)
Educational level: no (%)			
Illiterate	121 (26.1)	148 (32.0)	269 (29.0)
Basic school	235 (50.8)	253 (54.6)	488 (52.7)
Secondary school	90 (19.4)	44 (9.5)	134 (14.5)
University	17 (3.7)	18 (3.9)	35 (3.8)
Occupational status: no (%)			
Working	329 (71.1)	340 (73.4)	669 (72.2)
Not working	134 (28.9)	123 (26.6)	257 (27.8)

Table 2 Knowledge of mothers on infant and young children feeding by village type

Variables	Volunteer villages (n = 463) no (%)	Non-volunteer villages (n = 463) no (%)	Total (n = 926) no (%)	OR (95% CI)	P value ^a
Breastfeeding knowledge					
Good knowledge	120 (25.9)	53 (11.4)	173 (18.7)	3.5 (2.4–5.2)	< 0.001
Moderate knowledge	211 (45.6)	204 (44.1)	415 (44.8)	1.6 (1.2–2.2)	0.001
Poor knowledge	132 (28.5)	206 (44.5)	338 (36.5)	Ref ^b	
Complementary feeding knowledge					
Good knowledge	47 (10.2)	34 (7.3)	81 (8.7)	1.7 (1.1–2.7)	0.031
Moderate knowledge	114 (24.6)	64 (13.8)	178 (19.2)	2.2 (1.5–3.0)	< 0.0001
Poor knowledge	302 (65.2)	365 (78.8)	667 (72.0)	Ref ^b	
Overall IYCF knowledge					
Good knowledge	14 (3.0)	4 (0.9)	18 (1.9)	4.5 (1.5–13.7)	0.009
Moderate knowledge	153 (33.0)	81 (17.5)	234 (25.3)	2.4 (1.8–3.3)	< 0.0001
Poor knowledge	296 (63.9)	378 (81.6)	674 (72.8)	Ref ^b	

^a Multinomial logistic regression, ^b reference category, IYCF: Infant and Young Children Feeding

effective in improving IYCF knowledge, and EBF2D, MixMF and BoF practices among mothers.

This study indicated that the age, sex, number of siblings, and rank of IYC are similar in volunteer and non-volunteer villages. This is likely due to study design, which matched the IYC in both groups by age and sex.

The closest non-volunteer villages were selected from the same level of the health facilities catchment areas. Additionally, the population structure of the districts is similar between the two groups.

Regarding characteristics of fathers and mothers of IYC, findings of this study revealed that the age, and

Table 3 Distribution of infant and young children feeding practices of mothers by village type

Indicators	Volunteer villages no (%)	Non-volunteer villages no (%)	Total no (%)	OR (95% CI)	P value ^a
Ever breastfed	449 (97.0)	440 (95.0)	889 (96.0)	1.7 (0.9–3.3)	0.131
Early initiation of breastfeeding	334 (74.4)	311 (70.7)	645 (72.6)	1.2 (0.9–1.6)	0.216
Exclusively breastfed for first 2 days after birth	310 (69.0)	274 (62.3)	584 (65.7)	1.4 (1.0–1.8)	0.034
Exclusive breastfeeding under 6 months	22 (25.6)	17 (18.1)	39 (21.7)	1.6 (0.8–3.2)	0.223
Mixed milk feeding under 6 months	51 (54.3)	63 (73.3)	66 (36.7)	0.4 (0.2–0.8)	0.008
Continued breastfeeding 12–23 months	164 (75.9)	168 (75.3)	332 (75.6)	1.03 (0.7–1.6)	0.886
Introduction of solid, semi-solid or soft foods 6–8 months	55 (75.3)	56 (74.7)	111 (75.0)	1.04 (0.5–2.2)	0.924
Minimum dietary diversity 6–23 months	41 (10.9)	31 (8.4)	72 (9.7)	1.3 (0.8–2.2)	0.253
Minimum meal frequency 6–23 months	331 (87.8)	333 (90.2)	664 (89.0)	1.3 (0.8–2.2)	0.286
Minimum milk feeding frequency for non-breastfed children 6–23 months	157 (42.5)	144 (38.2)	301 (40.3)	1.2 (0.9–1.6)	0.226
Minimum acceptable diet 6–23 months	39 (10.3)	28 (7.6)	67 (9.0)	1.4 (0.9–2.3)	0.188
Bottle-feeding 0–23 months	266 (57.5)	333 (71.9)	327 (64.7)	0.5 (0.4–0.7)	<0.0001

^a Chi-Square test,

education and occupational status of fathers and mothers of IYC are comparable in volunteer and non-volunteer villages. This is likely due to the two districts are rural areas where the rates of illiteracy or low education level and unemployment are high among their residents. The Yemen National Health and Demographic Survey (YNHDS) in 2013 indicated that a low level of education exists in Yemen among women, with 67% of women aged 15–49 in Hajjah governorate having never been to school [35]. Our study, supported by many previous surveys conducted in Hajjah [42, 43], Sa'adah [44], Taiz [45], and Dhamar Governorates [46], reported a high level of illiteracy among caregivers.

Furthermore, our study demonstrated that mothers in volunteer villages had significantly better good or moderate breastfeeding knowledge compared to those in non-volunteer villages. Mothers in volunteer villages are 3.5 times more likely to have good breastfeeding knowledge than mothers in non-volunteer villages. Similarly, they are 1.6 times more likely to have moderate breastfeeding knowledge.

This study is dissimilar to three previous studies, which found no statistically significant difference in breastfeeding knowledge among caregivers between the intervention and comparison groups [9, 16, 32].

Moreover, mothers in volunteer villages had significantly higher CF knowledge compared to those in non-volunteer villages. Mothers in volunteer villages were 1.7 times more likely to have good CF knowledge and 2.2 times more likely to have moderate CF knowledge than mothers in non-volunteer villages. This result is consistent with the result of a previous study, which found a statistically significant difference in CF knowledge among mothers between the intervention and comparison groups [32]. In contrast, our result is inconsistent with two previous studies that found no statistically significant difference in CF knowledge among caregivers between the intervention and comparison groups [1, 9, 13].

Overall, mothers in volunteer villages had significantly higher IYCF knowledge compared to those in non-volunteer villages. Mothers in volunteer villages were more likely to have good or moderate IYCF knowledge than mothers in non-volunteer villages, with a 4.5-fold increase in the likelihood of good and a 2.4-fold increase in the likelihood of moderate IYCF knowledge. This improvement is possible because CHNVs conducted home visits and provided counseling/education about IYCF to mothers in their villages.

Our result agrees with results of earlier studies, which found that there was a statistically significant difference in IYCF knowledge among caregivers between the intervention group compared to the comparison group [4, 9, 31]. However, our result disagrees with the result of a previous study, which showed that caregivers with good knowledge about dietary diversity and child feeding were lower in SURE covered districts (57.5%) compared to non-covered districts (71.2%) [33].

Regarding the IYCF practice, our results indicated that there is a statistically significant association in prevalence of EBF2D, MixMF and BoF practices among mothers between volunteer and non-volunteer villages.

The mothers in volunteer villages were 40% more likely to exclusively breastfeed their child for the first 2 days after birth than mothers in non-volunteer villages. The mothers in volunteer villages are 60% less likely to feed their under 6 months child formula and/or animal milk in addition to breast milk than mothers in non-volunteer

villages. Our result is supported by an evaluation in Yemen, which found that the exclusive breastfeeding practice is good [37]. Although the prevalence of EvBF, EIBF, EBF and CBF indicators was (70%, 20%, 60% and 3%, respectively) more likely to be higher in volunteer than non-volunteer villages, these differences are not statistically significant. The differences in breastfeeding practices may be attributed to the fact that mothers in volunteer villages are more likely to have received counseling/education on IYCF from CHNVs.

Our result agrees with the result of a previous study, which found a statistically significant difference in the prevalence of EBF2D between the intervention and control groups [15]. Moreover, many previous studies support ours, which found no significant differences in the prevalence of EvBF [31], EIBF [1, 32, 47], EBF [12, 13, 17, 25, 32, 47, 48] and CBF [5, 7, 8, 12, 30–32] between the intervention and control groups.

Conversely, our results disagree with results from many previous studies, which found statistically significant differences in the prevalence of EIBF [10, 13, 16, 25, 26], EBF [1, 10, 15, 16, 26, 30], and CBF [47] between the intervention and control groups.

Many previous surveys conducted in Hajjah and other governorates supported our results in both types of villages. For example, the 2013 YNHDS showed that the overall prevalence of EvBF was 97.1% in Hajjah governorate. Other previous surveys showed that the overall prevalence of CBF was 71% [35], 77.6% [42], 81.5% [43] and 83.5% [49] in Hajjah governorate, 73.7% in Sa'adah governorate [44], 80.6% in Taiz governorate [45], and 78.8% in 2015 and 88.4% in 2016, in Al-Hodeidah governorate [50]. However, the 2013 YNHDS showed that the overall prevalence of EBF2D in Hajjah governorate is higher (81.9%) than our results in both types of villages [35]. Other previous surveys conducted in Hajjah and Dhamar governorates are lower than our results in both types of villages. For example, the overall prevalence of EIBF was 58.3% in Hajjah governorate [35], and the overall prevalence of CBF was 61.0% in Dhamar governorate [46].

Additionally, our result indicated that the overall prevalence of EBF in both types of villages is lower (21.7%) than that recommended by WHO [51]. Similarly, all the previous surveys in Hajjah and other governorates are lower than that recommended by WHO. For example, the overall prevalence of EBF was 10% [35], 23.9% [43], and 31.6% [49] in Hajjah governorate, and 14.8% in 2016 and 18.8% in 2015, in Al-Hodeidah governorate [50], 24.0% in Sa'adah governorate [44], 31.6% in Taiz governorate [45].

These variations in the prevalence of breastfeeding practices may be due to the differences in study setting and design, maternal education, cultural factors and access to healthcare services.

Concerning CF practice, our study indicated that the prevalence rates of ISSSF, MDD, MMF, MMFF, and MAD are (4%, 30%, 30% and 20%, respectively) more likely to be higher in volunteer than non-volunteer villages. However, these differences are not statistically significant. These slight differences in CF practice between volunteer and non-volunteer villages may be due to the fact that mothers in volunteer villages are more likely to be exposed to counseling/education on IYCF which is not sufficient to make a significant difference. An evaluation in Yemen found that the CF practice is good [37]. Our results consistent with results from many previous studies, which found no significant differences in the prevalence of ISSSF [32], MDD [4, 7, 9, 10, 26], MMF [1, 4, 8–10, 32], and MAD [4, 9, 10, 32] between the intervention and control groups. In contrast, our results inconsistent with results from many previous studies, which found statistically significant differences in the prevalence of ISSSF [5, 31], MDD [5, 8, 12, 13, 30–34, 48], MMF [1, 7, 12, 13, 26, 31, 34], and MAD [8, 13, 31, 34] between the intervention and control groups.

Overall, our results in both types of villages are somewhat similar to results of previous surveys conducted in Hajjah and other governorates. For example, the prevalence of ISSSF in Yemen was 69% [35]. The overall prevalence of MDD in Hajjah governorate was 10.5% [43]. The overall prevalence of MMFF was 40.2% [35] and 43.6% in Hajjah governorate [42], and 48.5% in Dhamar governorate [46]. The overall prevalence of MAD was 10.2% in Hajjah governorate [35], and 12.6% in Taiz governorate [45]. Other previous surveys conducted in Hajjah and other governorates are lower than our results in both types of villages. For example, the prevalence of ISSSF was 58.4% in Hajjah governorate [43]. The overall prevalence of MMF was 17.5% [42], 36.6% [43], and 49.1% in Hajjah governorate [35], 24.5% in Dhamar governorate [46], and 55% in Taiz governorate [45]. The prevalence of MAD was 5.6% in Hajjah governorate [43]. However, other surveys indicated a slightly higher prevalence of MDD than ours, such as 16.5% [35], and 15.1% in Hajjah governorate [49], 14% in Sa'adah governorate [44], 27.7% in Taiz governorate [45], and 30.3% in 2015 and 26.4% in 2016, in Al-Hodeidah governorate [50].

Additionally, the current study found a strong significant association between the prevalence of BoF among children aged 0–23 months and village type. The prevalence of BoF practice among mothers is 50% less likely to be lower in volunteer than non-volunteer villages. This is likely because of the valuable information on IYCF that mothers have received from CHNVs, leading to improved BoF practice. Result of the current study is similar to the results of two previous studies. These studies found that there is a significant difference in the prevalence of BoF between the intervention and comparison

groups [10, 31]. However, our result is dissimilar to the result of a previous study. This study showed that there is no statistically significant difference in the prevalence of BoF between groups [30].

Overall, the prevalence of BoF among IYC in both types of villages was higher than that reported by a previous survey in Yemen (41.0%) [35].

The observed differences between volunteer and non-volunteer villages are likely because of the valuable information on IYCF that mothers have received from CHNVs, leading to improved IYCF knowledge. This suggests that interventions targeting mothers in volunteer villages may be more effective in improving IYCF knowledge and practice.

Strengths of this study include a large, randomly selected and representative sample of mothers from highland and lowland districts in Hajjah governorate. Additionally, the closest non-volunteer villages for comparison were selected from the same level of the health facilities catchment areas. This helps to control for potential confounding factors, such as socioeconomic status, access to healthcare or exposure to IYCF counselling. However, our study had some limitations. First, the study design may have affected the likelihood of detecting a statistically significant difference. Secondly, the study was conducted in a single governorate in Yemen, which may limit the generalizability of the findings to other parts of the country. Third, the study used self-reported data, which may be subject to recall bias. Fourth, the study did not collect data on the long-term impact of the CHNV program on IYCF knowledge and practices.

Conclusion

The study found that CHNVs play a significant effect in improving the breastfeeding and CF knowledge, and the prevalence of EBF2D, MixMF and BoF practices among mothers in their villages compared to non-volunteer villages. Moreover, slight improvement in the other breastfeeding and CF practices were observed among mothers in volunteer villages compared to non-volunteer villages.

A future follow-up study with a more robust study design and expanded different governorates is recommended to assess the long-term impact of the CHNV program on IYCF knowledge and practices among mothers, and the generalizability of the findings.

Abbreviations

BoF	Bottle Feeding 0–23 Months
CBF	Continued Breastfeeding 12–23 Months
CF	Complementary Feeding
CHNVs	Community Health and Nutrition Volunteers
CHWs	Community Health Workers
CI	Confidence Interval
EIBF	Early Initiation of Breastfeeding
EBF2D	Exclusively Breastfed for the First Two Days After Birth
EBF	Exclusive Breastfeeding Under Six Months
EvBF	Ever Breastfed

IYC	Infant and Young Children
IYCF	Infant and Young Child Feeding
IQR	Interquartile Range
ISSSF	Introduction of Solid, Semi-Solid or Soft Foods 6–8 Months
MAD	Minimum Acceptable Diet 6–23 Months
MDD	Minimum Dietary Diversity 6–23 Months
MixMF	Mixed Milk Feeding Under Six Months
MMF	Minimum Meal Frequency 6–23 Months
MMFF	Minimum Milk Feeding Frequency for Non-Breastfed Children 6–23 months
MPHP	The Ministry of Public Health and Population
OR	Odds Ratio
YNHDS	Yemen National Health and Demographic Survey

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Author contributions

Abdulkareem Ali Hussein Nassar was the principal author involved in the concept, design and implementation of the study, analysis and interpretation of data, wrote the study, and manuscript preparation. Ahmed Al-Haddad was the supervisor who contributed to the concept, design, interpretation of data and review of the study and manuscript. All authors read and approved the final manuscript.

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Data availability

All relevant data are presented in this paper; and more information can be provided upon reasonable request from the correspondence author.

Declarations

Ethics approval and consent to participate

This study is part of research conducted and submitted for the partial fulfillment of the requirements for the degree of Doctorate of Public Health. An official approval was obtained from the Ethics Committee at the Faculty of Medicine and Health Science, Sana'a University. Official letters to conduct this study were sent to the Ministry of Public Health Population of Yemen and the Public Health and Population Offices of Hajjah governorate. Methods of this study were performed in accordance with the Declaration of Helsinki. The aim of the study was explained to all study participants. Informed consent was obtained from all parents. For those aged less than 2 years, informed consent was obtained from their parents and/or legal guardian. A verbal consent was requested from those who are unable to read and/or write. Confidentiality of data was assured and ensured.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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