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RESEARCH ARTICLE

Evaluating a DOHaD-informed breastfeeding education programme for adolescents in rural South African schools

Gudani Goodman Mukoma[a]*, Nkhensani Precious Golele[a], Tinstwalo Doreen Maswanganyi[a] and Andrew Macnab[b]

[a]*Faculty of Health Sciences, Department of Biokinetics, Recreation and Sport Science, University of Venda, Thohoyandou, South Africa*
[b]*Stellenbosch Institute for Advanced Study, Wallenberg Research Centre, Stellenbosch, South Africa*
**Correspondence: gudani.mukoma@univen.ac.za*

Background: Breastfeeding is essential for infant survival and health, yet South Africa's exclusive breastfeeding rates remain below global targets, with adolescents, future parents, and influencers seldom engaged in breastfeeding education.
Methods: A quasi-experimental design study was conducted with 119 Grade 11 and 12 learners in two rural South African public schools. A standardised 40-minute education session, based on WHO guidelines and the Developmental Origins of Health and Disease (DOHaD) framework, was delivered in English and Tshivenda during regular school hours. Breastfeeding knowledge was assessed using a 10-item questionnaire administered before and after the intervention. Preferences for breastfeeding benefits were ranked post-intervention. Statistical analyses involved paired *t*-tests, McNemar's test, chi-square tests, and logistic regression.
Results: Breastfeeding knowledge scores improved significantly, rising from a mean score of 6.45 ± 1.3–7.53 ± 1.2 ($p < 0.001$), with a large effect size (Cohen's $d = 0.83$). Notable changes were observed in awareness of fathers' roles in breastfeeding (54% to 83%, $p < 0.001$) and in awareness of the benefits for fathers (17% to 66%, $p < 0.001$). Adolescents found maternal (38.7%) and paternal (30.3%) benefits most interesting. Female sex was identified as a significant predictor of high engagement, defined as rating two or more breastfeeding benefit categories as most interesting (OR = 1.80, 95% CI: 1.05–3.20, $p = 0.04$)
Conclusion: A brief classroom intervention improved adolescents' understanding and involvement in breastfeeding, emphasising parental roles. Integrating DOHaD-informed education in secondary schools may strengthen family and community support for breastfeeding in rural South Africa.

Keywords: adolescents, breastfeeding education, DOHaD, health promotion, parental roles, rural schools, South Africa

Introduction

Breast milk is widely described as a baby's 'first vaccine' protecting against diarrhoea and pneumonia, two leading causes of under-five mortality (1.17 million) worldwide.[1,2] Consistent with life-course and human capital perspectives, breastfeeding contributes to long-term health, cognitive development, and economic productivity across generations,[3–6] aligning with the broader principles of the Developmental Origins of Health and Disease (DOHaD) framework.[7] The World Health Organization (WHO) recommends exclusive breastfeeding for the first six months of life.[8] However, global prevalence remains suboptimal, with approximately 44% of infants younger than six months exclusively breastfed worldwide.[9,10]

In sub-Saharan Africa, only one in three infants is exclusively breastfed, and South Africa falls below this average at 32%.[11] Despite supportive national policies, early introduction of water, other milk, or complementary foods is common, and one in four infants is not breastfed at all.[11,12] These practices contribute to preventable morbidity and mortality and impose long-term health system and economic costs.[4,6,13] Strengthening breastfeeding promotion is a pressing public health priority, particularly in underserved rural areas.

Despite this knowledge, most breastfeeding interventions focus on women during pregnancy or postpartum, overlooking adolescence as a critical window of influence.[14,15] Adolescence represents a critical life-course stage during which knowledge, attitudes, and social norms related to health behaviours are formed.[15,16] Within the DOHaD framework, exposures and behaviours before conception may influence health trajectories across generations.[17] Improving adolescents' understanding of breastfeeding may contribute to future breastfeeding outcomes by shaping intentions prior to parenthood, strengthening supportive attitudes among future fathers, siblings, and peers, and reinforcing community norms that enable breastfeeding.[18] Evidence from life-course and human capital research suggests that early health knowledge can influence later caregiving practices and intergenerational health outcomes, underscoring the importance of including adolescents in breastfeeding education strategies.[6,15]

South Africa's Integrated School Health Policy[19] recognises schools as key platforms for health promotion, yet breastfeeding education is rarely integrated into curricula.[18,20] Evidence on school-based breastfeeding interventions remains limited, particularly in rural South African settings. This study aimed to evaluate the impact of a classroom-based, DOHaD-informed breastfeeding education programme on adolescents' knowledge and preferences in rural South African public schools. We hypothesised that the intervention would significantly improve knowledge of breastfeeding and increase engagement with maternal, paternal, and societal benefits of breastfeeding.

Materials and methods

Study design and setting

This study utilised a pre–post single-group design (quasi-experimental) targeting senior secondary school students in two public schools located in the Vhembe district of Limpopo

province, South Africa. This region is primarily rural and faces significant socioeconomic challenges, including high poverty rates, inadequate health infrastructure, and a reliance on subsistence agriculture as defined elsewhere.[21] The district's youthful demographic and educational framework make it a priority setting for health promotion interventions.

Ethics

This study was conducted according to the guidelines laid down in the Declaration of Helsinki, and all procedures involving human subjects were approved by the University of Venda's Human and Clinical Trials Ethics Committee (HCTREC: FHS/23/BSBK/02/0102) and the Limpopo Provincial Research Ethics Committee (LPREC: LPREC/191/2023:PG). School principals granted institutional permission. Written consent was obtained from all participants aged 18 and older. For those under 18 years, written parental consent and learner assent were also obtained before participation. Participation in the study was voluntary, anonymous, and carried no academic consequences.

Participants

All senior secondary learners (grades 11 and 12) present in designated classes at two rural public secondary schools were eligible to participate in the study. The schools were purposefully selected in consultation with the Department of Education to represent resource-constrained rural contexts.

During the data collection period, the accessible population at the two schools comprised approximately 130 learners across grades 11 and 12. All learners present were invited to participate, and 119 provided consent or assent, completing both the pre- and post-intervention assessments ($n = 69$ females, $n = 50$ males). This accounts for about 92% of the accessible population, with no exclusions made.

Intervention

During scheduled self-study periods within normal school hours, a standardised 40-minute classroom-based education session was delivered. These sessions were not extracurricular or after-school activities and were scheduled in consultation with school management. They also did not replace examinable curriculum subjects. A trained and experienced member of the research team, not part of the regular teaching staff, facilitated the sessions. The content was adapted from the WHO breastfeeding guidelines and informed by the DOHaD framework. Key topics covered the first 1 000 days of life, nurturing care, and the benefits of breastfeeding for infants, mothers, fathers, and society. Presentation materials included PowerPoint (Microsoft Corp, Redmond, WA,. USA) slides and flip charts in English and Tshivenda. To ensure fidelity, all sessions were conducted by the same facilitator following a structured script.

Instruments

Two structured questionnaires were developed based on WHO breastfeeding materials and piloted for clarity among students not included in the study sample.

- Questionnaire 1: Contained 10 dichotomous (Yes/No) items assessing knowledge and awareness of breastfeeding and nurturing care.
- Questionnaire 2: Assessed engagement and perceived relevance of breastfeeding benefits. Participants were asked to rank their level of interest in three factual statements within each of four benefit categories: (1) benefits for the baby, (2) benefits for the mother, (3) benefits for the father, and (4) benefits for the community/society. All participants completed responses for all four categories. Within each category, participants identified the statement they found most interesting and the least interesting. For analysis and reporting, responses were aggregated by benefit category rather than by individual statement and classified as most interesting, interesting, or least interesting.

The questionnaires were pretested for clarity and comprehension among learners from a rural secondary school not included in the study sample. Feedback from the pretesting phase resulted in minor wording refinements to improve comprehension; no items were removed or substantively modified. Formal psychometric validation was not conducted.

Data collection

Questionnaire 1 was administered immediately before the education session to establish baseline breastfeeding knowledge scores. The same questionnaire was administered again immediately after the intervention to assess changes in breastfeeding knowledge scores. Questionnaire 2 was administered after the intervention to assess adolescents' engagement with breastfeeding education content by asking participants to indicate which breastfeeding benefit statements they found most and least interesting.

During questionnaire administration, the facilitator read questions aloud to support comprehension while learners simultaneously viewed translated text on flip charts. After completion of the questionnaires, an open discussion session allowed participants to ask questions and reflect on the material presented.

Statistical analysis

Knowledge scores were calculated as the sum of correct responses on Questionnaire 1 (range: 0–10) and treated as continuous variables. Pre- and post-intervention knowledge scores were compared using paired *t*-tests. Changes in individual knowledge items were evaluated using McNemar's test for paired proportions. Preferences regarding breastfeeding benefits were summarised using descriptive statistics, and sex differences were assessed using chi-square tests.

Subgroup analyses examined within-group changes using paired *t*-tests, while between-group differences in knowledge gain scores were assessed using independent-samples *t*-tests. Age was examined both as a continuous variable and in exploratory subgroup analyses to assess differences in knowledge gain and high engagement. High engagement was defined as rating two or more breastfeeding benefit categories (out of four) as 'most interesting'. Logistic regression models were used to examine predictors of high engagement, including age, sex, and parental employment status as covariates. The effect size for the overall knowledge gain was estimated using Cohen's *d*. Analyses were conducted using Stata/SE version 15 (StataCorp, College Station, TX, USA), and statistical significance was set at $p < 0.05$.

Results

Participant characteristics

Of the 119 adolescents enrolled, 69 (58.0%) were female. The mean age was 18.3 years (SD 1.7; range 15–25). Nearly half (48.7%) reported that both parents were unemployed,

while 13.4% reported that both parents were employed (Table 1).

Knowledge scores of breastfeeding and nurturing care

At baseline, adolescents had moderate knowledge scores of breastfeeding and nurturing care. Their correct response percentages ranged from 16.8% (Breastfeeding benefits fathers) to 96.6% (Breastfeeding supports a baby's health and growth). Knowledge scores improved significantly from pre- to post-intervention, increasing from 6.5 (SD 1.3) to 7.5 (SD 1.2) ($p < 0.001$, paired t-test). The largest improvements were observed in recognising fathers' roles in breastfeeding (53.8% to 83.2%, $p < 0.001$) and the benefits of breastfeeding for fathers (16.8% to 66.4%, $p < 0.001$) (Table 2).

Preferences regarding breastfeeding benefits

When asked which breastfeeding benefits they found most interesting, adolescents more often chose those related to mothers (38.7%) and fathers (30.3%) than those related to the baby (28.6%) or society (29.4%). This is indicated in Table 3.

Subgroup analysis

All subgroups showed significant increases in breastfeeding knowledge scores from pre- to post-intervention (mean knowledge gain = 1.1; all $p < 0.05$). Improvements were consistent across sex and parental employment status. Although all subgroups improved significantly (Table 4), there were no significant differences in knowledge gain between groups (all $p > 0.05$). The intervention produced a large overall effect (Cohen's $d = 0.83$).

Predictors of engagement

Logistic regression analysis showed that female sex was associated with higher odds of high engagement (OR = 1.80, 95% CI: 1.05–3.20, $p = 0.04$), defined as rating two or more breastfeeding benefit categories (out of four) as 'most interesting'. Age was not significantly associated with high engagement (OR = 1.05, 95% CI: 0.90–1.20, $p = 0.50$) (Table 5).

Discussion

This study is one of the first to implement and assess a brief classroom-based breastfeeding education intervention informed by the DOHaD framework among adolescents in rural South African schools. The findings demonstrate that a single 40-minute session delivered during regular school hours can significantly improve adolescents' knowledge of breastfeeding and foster greater engagement with parental roles. The observed large effect size suggests that even short, low-intensity interventions can lead to meaningful knowledge gains in resource-constrained school settings.

Most previous breastfeeding interventions have targeted women during pregnancy or the postpartum period,[14,22,23] with limited attention to adolescents as a distinct group, especially in rural settings.[20,24–26] School-based breastfeeding education studies conducted in Europe and North America have reported improvements in adolescents' knowledge and attitudes,[27,28] particularly among female learners,[24] but evidence from sub-Saharan Africa remains sparse. Our findings align with studies from Croatia, Canada, and Taiwan, showing that adolescents are receptive to breastfeeding education when content is age-appropriate and delivered within

Table 1: Demographic characteristics of study participants ($n = 119$).

Variable	Category	*n* (%)
Sex	Male	50 (42)
	Female	69 (58)
Age (years)	Mean ± SD	18.3 ± 1.7
	Range	15–25
Parental work status	Both parents unemployed	58 (48.7)
	Only mother employed	19 (16.0)
	Only father employed	26 (21.8)
	Both parents employed	16 (13.4)

Table 3: Preferences regarding breastfeeding benefits among adolescents after the intervention

Category of benefit	Most interesting *n* (%)	Interesting *n* (%)	Least interesting *n* (%)
Benefits for the baby	34 (28.6)	28 (23.5)	57 (47.9)
Benefits for the mother	46 (38.7)	32 (26.9)	41 (34.5)
Benefits for the father	36 (30.3)	42 (35.3)	41 (34.5)
Benefits for society	35 (29.4)	29 (24.4)	55 (46.2)

Table 2: Knowledge of breastfeeding and nurturing care among adolescents before and after the intervention

Knowledge item (Yes = correct)	Pre *n* (%)	Post *n* (%)	*p*-value
A baby's health can already be influenced during pregnancy	114 (95.8)	116 (97.5)	0.69
It is important for both parents to bond with the baby at birth	111 (93.3)	114 (95.8)	0.51
The first year of life affects risk of diseases later in life	72 (60.5)	78 (65.6)	0.43
Eating healthy food is more important than just eating enough	41 (34.5)	43 (36.1)	0.88
A fat baby is a healthy baby	32 (26.9)	28 (23.5)	0.58
Fathers have an important role in supporting breastfeeding	64 (53.8)	99 (83.2)	**< 0.001***
Breastfeeding is good for the baby's health and growth	115 (96.6)	118 (99.2)	0.38
Breastfeeding has health benefits for the mother	86 (72.3)	106 (89.1)	**< 0.001***
Breastfeeding has benefits for fathers	20 (16.8)	79 (66.4)	**< 0.001***
Total knowledge score (mean ± SD)	6.5 (1.3)	7.5 (1.2)	**< 0.001****

*McNemar's test for paired proportions; **paired t-test for comparison of total knowledge scores. Bold values indicate statistical significance ($p < 0.05$).

Table 4: Breastfeeding knowledge gain among adolescents by subgroup.

Subgroup	Pre Mean ± SD	Post Mean ± SD	Knowledge gain (Mean ± SD)	*p*-value (paired *t*-test)
Sex:				
Male ($n = 50$)	6.20 ± 1.4	7.30 ± 1.2	1.10 ± 1.1	0.02*
Female ($n = 69$)	6.60 ± 1.2	7.70 ± 1.1	1.10 ± 1.0	0.01*
Parental employment status:				
Both unemployed ($n = 58$)	6.30 ± 1.3	7.40 ± 1.2	1.10 ± 1.0	0.04*
≥ 1 parent employed ($n = 61$)	6.60 ± 1.2	7.70 ± 1.1	1.10 ± 1.1	0.03*

Significant at $p < 0.05$ for paired *t*-tests comparing pre- and post-intervention knowledge scores within subgroups.

schools,[24,28,29] and extend this evidence to a rural South African context where such interventions are rarely implemented.

A notable finding was the substantial improvement in knowledge regarding fathers' roles during breastfeeding and the benefits of breastfeeding for fathers. Baseline awareness in these domains was low, but post-intervention knowledge gains were among the largest observed. This aligns with emerging evidence that adolescents often perceive infant feeding as primarily a maternal responsibility, and that targeted education can broaden this understanding.[24,28,30–32] Framing breastfeeding as a shared parental responsibility might be particularly important for adolescents as they develop their ideas concerning future family roles.

Preference data revealed that adolescents more frequently rated breastfeeding benefits related to mothers and fathers as most interesting compared with those related to the baby or society. Similar engagement patterns have been observed in other adolescent health education studies, where learners engage more strongly with content relevant to their future adult identities.[33–36] While this does not diminish the importance of infant or societal outcomes, it suggests that educational approaches which emphasise parental roles can boost engagement among adolescents.

Female learners demonstrated greater engagement with breastfeeding education content, consistent with findings from other school-based health education programmes in sub-Saharan Africa.[20,32,37] This heightened engagement likely arises from traditional gender socialisation around caregiving, where infant care is often viewed as a female responsibility.[38] Furthermore, current education policies often place the sole burden of infant feeding on mothers.[20] This pattern may also reflect broader household dynamics in South Africa, where female-headed households are common. In Limpopo Province, approximately 45.6% of households are headed by women, which may further shape adolescents' perceptions of caregiving responsibilities and infant feeding practices.[39]

In our study, notable knowledge gains were observed in both boys and girls across various household employment contexts, indicating the intervention's broad accessibility. Moreover, engagement with breastfeeding content did not vary significantly across age groups in this adolescent sample, suggesting that the intervention was equally engaging for younger and older learners in the senior secondary school class range.

Considering fathers' crucial role in supporting breastfeeding,[40] future interventions could benefit from strategies that more explicitly engage male learners. The consistent gains in breastfeeding knowledge across sexes and household employment contexts suggest that the school-based delivery model effectively served as a 'levelling' platform. By providing standardised, DOHaD-informed content in a neutral classroom setting, the intervention successfully overcame traditional socioeconomic barriers and gendered filters that often restrict the reach of health information in rural communities. This demonstrates that school-based interventions are not only effective but also a viable means of promoting equitable health literacy among the most vulnerable adolescent populations.

Table 5: Predictors of high engagement among adolescents.

Predictor	OR (95% CI)	*p*-value
Age (years)	1.05 (0.90–1.20)	0.50
Female[1]	1.80 (1.05–3.20)	0.04*
≥ 1 parent employed[2]	1.50 (0.85–2.90)	0.15

OR = odds ratio; CI = confidence interval.
Statistically significant at $p < 0.05$.
[1]Reference category: male.
[2]Reference category: both parents unemployed.

From a policy perspective, these findings align with South Africa's Integrated School Health Policy, jointly implemented by the Departments of Basic Education and Health, which identifies schools as key platforms for health promotion but does not currently include structured breastfeeding education.[19] Furthermore, implementation studies indicate gaps in the delivery of comprehensive content in alignment with this policy.[41–43] The intervention evaluated here was delivered without disrupting examinable subjects and by non-teaching staff, suggesting that similar sessions could be seamlessly integrated into existing school schedules with minimal burden. These findings highlight the potential for low-cost, school-based interventions to strengthen breastfeeding literacy among future parents before childbearing begins. Consequently, embedding breastfeeding education within a life-course and DOHaD framework may therefore represent a feasible strategy to strengthen intergenerational support for breastfeeding in rural communities.

This study has limitations. The pre-post design without a control group limits causal inference, and knowledge was assessed immediately after intervention, preventing assessment of longer-term retention or behavioural impact. The questionnaires were pretested for clarity but not formally validated. Finally, the purposive selection of two schools may limit generalisability. Despite these limitations, the study provides novel evidence on the feasibility and impact of adolescent-focused breastfeeding education in a rural South African context.

Conclusion

This study demonstrates that a brief, classroom-based intervention can enhance adolescents' knowledge of breastfeeding and foster engagement with parental roles. Integrating breastfeeding education into school curricula, guided by the DOHaD framework, can support intergenerational breastfeeding and improve child and family health in rural South Africa and similar contexts.

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ORCID

Gudani Goodman Mukoma http://orcid.org/0000-0002-3305-9274

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