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Effectiveness of an educational video intervention on the nutritional knowledge of rural farm women in Warangal district of Telangana: A quasi-experimental, covariate-adjusted and cluster-sensitive evaluation

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ABSTRACT

Rural farm women grow much of the food their households eat, yet they often know little about how to use that food well. The study tested whether a nutrition education video, designed on the cognitive theory of multimedia learning, could raise their nutritional knowledge. A quasi-experimental pre-test post-test non-equivalent control group design was used in Warangal district of Telangana. Sixty farm women drawn from two villages formed the experimental group and thirty women from a third village formed the control group. Nutritional knowledge was measured with a 30-item test standardised on a separate non-sample village (KR-20 = 0.855). The experimental group was shown a self-developed nutrition education video; the control received no exposure. The two groups were statistically comparable before the intervention ($t(88) = 0.049$, $p = 0.961$; Hedges' $g = 0.01$, 95% CI -0.43 to 0.44). After exposure, the experimental group rose from 4.28 to 9.77 marks out of 30, a gain of 5.48 marks (95% CI 4.89–6.07; $t(59) = 18.620$, $p < 0.001$, $d_z = 2.40$). The control group changed by only 0.10 marks, which was not significant ($t(29) = 1.795$, $p = 0.083$). The difference-in-differences was 5.38 marks (95% CI 4.78–5.98) and the post-test between-group Hedges' g was 2.53 (95% CI 1.95–3.10), a 96 per cent probability that a randomly chosen exposed woman outscored an unexposed one. Analysis of covariance confirmed the difference after adjusting for the pre-test score ($F(1,87) = 172.489$, $p < 0.001$, partial $\eta^2 = 0.665$) with adjusted means of 9.76 and 4.38. The effect exceeded the minimum detectable effect even under a village-level intraclass correlation of 0.10 (MDE = 1.30 SD). A normalised gain of 0.21 indicates that substantial learning remained uncovered, supporting repeated, spaced rather than single-round exposure.

Keywords: ANCOVA, Nutritional educational video, Knowledge gain, Nutrition education, Rural farm women, Quasi-experimental design, Warangal, Telangana, Cognitive theory of multimedia learning, Normalised gain, Effect size

Introduction

Farm women in India carry a double burden. They work in the field and they also decide what the family eats. Their decisions shape the diet of every household member. Yet the same women are often the last to eat and the least informed about nutrition. A large share of rural women in India remains underweight and anemic (IIPS and ICF, 2021) [1]; according to the fifth National Family Health Survey, 57.0 per cent of all women aged 15–49 years in India and 57.6 per cent in Telangana are anaemic. Food production alone has not closed this gap. A household can grow enough grain and still eat badly because what is grown is sold and what is eaten is decided by habit rather than knowledge. In southern Asia, 71 per cent of women workers are engaged in agrifood systems, compared with 47 per cent of men workers (FAO, 2023) [2]. Farm women therefore sit at the centre of the agriculture–nutrition pathways through which farm production, income, women's time and women's knowledge are translated into household diets (Kadiyala *et al.*, 2014) [3]. Knowledge about good nutrition is one of the few causes of this problem that an extension worker can directly address. Land holdings, income and market access are hard to shift within a project cycle to ensure food and nutritional security. The knowledge level of farm women about dietary diversity, food safety and feeding practices can be changed with well-designed teaching material. Earlier researchers have provided the evidence for change in nutritional knowledge of farm women. A training programme delivered to 1,500 rural women across three districts of Haryana produced an increment of about 51 per cent in their knowledge of nutrition, value addition and post-harvest management (Satyapriya *et al.*, 2018) [4] and a printed module on diet and nutrition prepared for farm women in aspirational districts was judged useful by nearly 70 per cent of its recipients (Dominic *et al.*, 2023) [5]. In neighbouring Andhra Pradesh, women in villages covered by a nutrition-sensitive agroecology programme had a higher dietary diversity score than those in comparison vil

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lages (6.53 vs 5.81), with 87 against 79 per cent consuming a diverse diet (Ch *et al.*, 2024) [6]. Knowledge is, however, a necessary rather than a sufficient condition for better diets: in a systematic review, 65.5 per cent of studies reported significant, positive but weak ($r < 0.5$) associations between nutrition knowledge and dietary intake (Spronk *et al.*, 2014) [7], and nutrition education succeeds most often when it is theory-based, limited to three or fewer focused objectives and sustained for five months or longer (Murimi *et al.*, 2017) [8]. Printed leaflets and lectures are the most prominent methods through which most nutrition messages are targeted for rural women. Because limited literacy remains a major constraint among rural populations, so these teaching methods failed to achieve the goal. Therefore, the audio-visual experience stands well above purely verbal instruction in its power to convey meaning (Dale, 1969) [9], although the retention percentages popularly attached to Dale's 'cone' have no empirical basis and should not be cited (Masters, 2013) [10]; pictures combined with spoken words are understood better than words alone (Mayer, 2009) [11], and material that is not matched to the literacy level of its audience will not work at all (Doak *et al.*, 1996) [12]. The cognitive theory of multimedia learning explains why: verbal and pictorial information are processed in separate, capacity-limited channels, so narration synchronised with images distributes the processing load across both channels instead of overloading one (Mayer, 2009; Sweller *et al.*, 2019) [11, 13]. Pictures linked to spoken or written text improve attention, comprehension, recall and adherence, and people with low literacy benefit most (Houts *et al.*, 2006) [14]. Video further enables observational learning, through which viewers acquire behaviour and self-efficacy by watching credible models who resemble themselves (Bandura, 2004) [15]. Therefore, messages in pictures and speech are preferred rather than in printed materials only. A video meets that description directly and delivers an identical message can be delivered in every village, which a live demonstration cannot guarantee.

Field evidence on the medium is accumulating but remains thin for adult rural audiences. Video based instructions improved the nutritional knowledge of the school pupils by 0.45 standard deviation more than conventional classroom teaching in a randomised field experiment in 50 schools of northern Cameroon, although no differen-

tial effect was seen among parents (Collishaw *et al.*, 2024) [16]. In the largest Indian trial of the use of video as a medium, women's groups in rural Odisha that viewed and discussed nutrition videos improved maternal and child diet quality (Kadiyala *et al.*, 2021) [17]; notably, only the arm that combined nutrition-specific videos with participatory learning and action improved both women's dietary diversity (adjusted RR 1.30) and child minimum dietary diversity (adjusted RR 1.27). Among rural mothers in Kanpur district, video-assisted teaching raised weaning knowledge scores from 17.33 to 33.0 (Yadav *et al.*, 2025) [18]. Across low- and middle-income countries, community-based educational videos improved knowledge and feeding practices such as colostrum feeding and continued breastfeeding (Boynito *et al.*, 2025) [19], and a meta-analysis of 105 studies found that adding video to existing teaching produced strong learning benefits ($g = 0.80$), whereas substituting video for teaching produced small ones ($g = 0.28$) (Noetel *et al.*, 2021) [20]. In agricultural extension, smallholders in Uganda who watched a short video scored significantly higher on a knowledge test and obtained about 10.5 per cent higher maize yields (Van Campenhout *et al.*, 2021) [21]. Structured programmes for rural women elsewhere have raised mean knowledge from 49.1 to 63.7 per cent with the gain retained at six-month follow-up (Mangwane *et al.*, 2024) [22]. Most of these works relates to children or bundles several methods together and most Indian studies report only the treatment group which cannot separate learning from repeated testing. The present study therefore measured the effectiveness of a single nutrition education video on the nutritional knowledge of rural farm women using a control group and a covariate adjusted analysis.

To our knowledge, this is the first controlled evaluation of a stand-alone nutrition video among farm women in Telangana that (i) separates learning from test-retest and maturation effects through a concurrent control group, (ii) reports covariate-adjusted estimates together with confidence intervals for every effect size, (iii) locates the gain on Hake's normalised-gain plane to quantify the learning that remains unrealised, and (iv) tests whether the inference survives plausible village-level clustering. The hypothesised pathway from the video to knowledge and, ultimately, to dietary diversity is shown in Fig. 1.

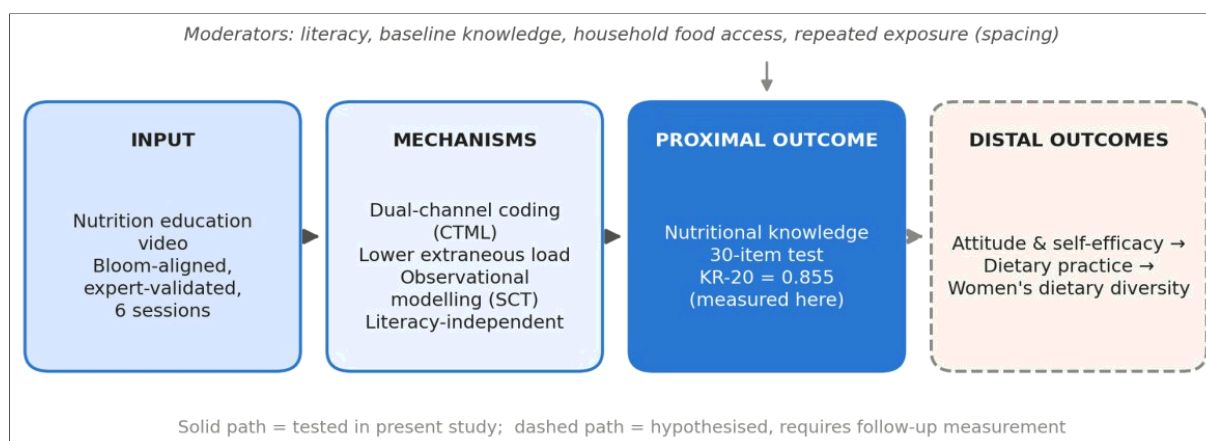


Figure 1. Conceptual framework of the study. The video is hypothesised to raise nutritional knowledge through dual-channel processing, reduced extraneous cognitive load and observational learning (Mayer, 2009; Sweller *et al.*, 2019; Bandura, 2004) [11, 13, 15]. Distal outcomes (dashed) were not measured in the present study.

Materials and Methods

The study was undertaken in Warangal district of Telangana. A pre-test and post-test control group design was adopted. Three villages were selected randomly from within the district. One village was assigned as the control (no intervention) group and the remaining two villages were assigned as the experimental (video intervention) group.

Both experimental villages received an identical video intervention and their respondents were pooled for analysis as a single experimental group ($n = 60$), against the control group ($n = 30$). Because allocation was at the village level and villages were not randomly assigned to arms, the design is a non-equivalent control group quasi-experiment; it is reported following the TREND guidelines for non-randomised evaluations of behavioural and public health interventions (Des Jarlais *et al.*, 2004) [23].

Table 1. Distribution of sample size among the villages.

S. No.	Group	Treatment	Sample Size
1.	Village-1	Control Group	30
2.	Village-2 + Village-3	Experimental Group	60
3.	Total		90

Nutritional knowledge was measured with a test developed and standardized for the study. It carried 30 items in Yes/No format across five areas, namely dietary diversity, healthy foods, nutritional care and practices, health and sanitation and nutritional awareness. Each correct answer scored one mark and the total score ranged from 0 to 30. The nutritional knowledge test comprised 30 items in a dichotomous Yes/No format. No “don’t know” option was given or provided to the respondents. A correct response was awarded one mark whereas an incorrect or unanswered response scored zero. It is acknowledged that two-point format the expected score from random responding is 15 and the observed pre-test mean of 4.3 lies well below that level. This indicated that the respondents were not responding at random. It was standardized on a separate sample of 30 farm women from a non-sample village where mean item difficulty was 0.382, mean discrimination was 0.517 and reliability (Kuder–Richardson-20; Kuder and Richardson, 1937) [24] was 0.855. Internal-consistency values between 0.70 and 0.95 are generally regarded as acceptable, while values above 0.90 may signal item redundancy (Tavakol *et al.*, 2011) [25]; the value obtained therefore supports the use of the instrument for group comparisons. These indices describe the standardization sample, not the main study respondents. Scores were classified as Low (0-10), medium (11-20) and high (21-30).

The experimental group was shown a self-developed nutrition education video whose learning objectives were framed using Bloom’s Taxonomy. The video was validated by a panel of subject experts and pre-tested before use. It was shown in six sessions over Oct-2025 to Feb-2026. The control group received no exposure and continued with the routine services available in their village. The educational video was of 5 minutes 41 seconds duration and 8 segments. The narration was in Telugu language. In the first week the pre-test was administered to the respondents of all the three villages. The nutritional educational video was thereafter administered to the respondents of two villages over a period of six weeks; one session being conducted in each week. The two villages received the intervention on the same day each week, in separate setting. The two experimental groups were exposed to identical content within the same interval. The respondents of the third village received no exposure to the intervention material, treated as control group. Each session was of 25-30 minutes, comprising the screening of the educational video followed by 15 to 20 minutes of group discussion. A gap of three months was allowed after the concluding session before the post-test was administered to all the three villages. The video designed in accordance with the principles of multimedia learning (Mayer, 2009; Des Jarlaris *et al.*, 2004) [11]. The modality principle was applied by conveying the message wholly through spoken narration accompanying the visuals, no part of it being presented as printed test, which is of particular consequence of an audience of limited literacy.

The nutritional knowledge test was administered to both groups before and after the intervention, over the same interval. Independent samples t-tests compared the groups at each stage and paired samples t-tests measured change within each group. Analysis of covariance with the post-test score as dependent variable, the pre-test score as co-

variate and group as fixed factor, served as the primary test of effectiveness (Vickers *et al.*, 2001) [26]. Homogeneity of regression slopes was examined first. Cohen’s *d* and partial η squared were computed as effect sizes (Cohen, 1988) [27] and normalised gain as the proportion of available gain achieved (Hake, 1998) [28]. Welch’s correction was applied wherever variances were unequal, because it controls the Type I error rate better than Student’s test when both variances and group sizes differ (Delacre *et al.*, 2017) [29]. Within-group effects were expressed as Cohen’s d_z (mean change divided by the standard deviation of change) and between-group effects as bias-corrected Hedges’ *g*, each with a 95 per cent confidence interval obtained from the non-central *t* distribution (Lakens, 2013) [30]. The difference-in-differences of gain scores and the common-language effect size (probability of superiority) were also computed. Because ANCOVA and change-score analysis can diverge in non-randomised designs (Lord’s paradox), both estimates were reported (Van Breukelen, 2006) [31]. As the three villages are clusters, a sensitivity analysis estimated the minimum detectable effect (MDE; 80 per cent power, two-sided $\alpha = 0.05$) after deflating each group by the design effect $1 + (m - 1)ICC$, with $m = 30$ respondents per village and $ICC = 0.05$ and 0.10 (Campbell *et al.*, 2012) [32]. Normalised gain was interpreted against Hake’s bands (low < 0.3 , medium $0.3-0.7$, high ≥ 0.7) (Hake, 1998) [28], with the caveats discussed by Marx *et al.* (2007) [33].

Results

Comparability of the two groups before the intervention

It could be observed from Table 2 that the two groups were statistically indistinguishable before the intervention. The experimental group scored 4.28 and the control group 4.27, a difference of 0.02 marks on a 30 mark scoring test with an effect size of 0.01 (Hedges’ *g*; 95% CI -0.43 to 0.44). Levene’s test confirmed similar dispersion. The groups were therefore comparable at the outset and any subsequent difference may be attributed to the intervention rather than to a pre-existing advantage. The confidence interval is, however, wide enough to admit a baseline imbalance of up to about 0.4 SD, so equivalence is supported by the point estimate rather than formally demonstrated.

$n = 90$

Both groups answered less than one item in six correctly, placing every respondent in the low knowledge band before exposure. Nutritional knowledge among these farm women was very poor, echoing the deficits reported among farm women in other Indian states (Dominic *et al.*, 2023) [5]. At post-test the experimental group had reached 9.77 marks against 4.37 for the control group, a difference of 5.40 marks. Because the post-test variances were unequal, the Welch correction was applied and the difference remained highly significant (mean difference 5.40; 95% CI 4.59–6.21).

Change in nutritional knowledge within each group

Table 3 presents the mean pre-test and post-test nutritional knowledge scores of the experimental and control groups, along with the result of the paired *t*-test conducted separately for each group. It could be observed from Table 3 that the experimental group advanced from 4.28 to 9.77 marks. This gain of 5.48 marks (95% CI 4.89–6.07) was highly significant with a very large effect size ($d_z = 2.40$; 95% CI 1.90–2.90). In practical terms the group moved from answering about 14 per cent of the items correctly to answering about 33 per cent correctly. The control group changed by 0.10 marks and the change did not reach significance ($d_z = 0.33$; 95% CI -0.04 to 0.69).

Table 2. Comparison of experimental and control groups at pre-test and post-test

Stage	Group	N	Mean	SD	Mean difference	t	df	p
Pre Test	Experimental	60	4.28	1.54	0.02	0.049	88	0.961
	Control	30	4.27	1.44				
Post Test	Experimental	60	9.77	2.36	5.40	13.193	82.93	< 0.001
	Control	30	4.37	1.50				

$n = 90$

Table 3. Paired *t*-test analysis for both the groups (Change in knowledge within each group)

Group	Stage	Mean	SD	Mean gain	t	df	p	Cohen's d_z
Experimental	Pre-Test	4.28	1.54	5.48	18.620	59	< 0.001	2.40
	Post-Test	9.77	2.36					
Control	Pre-Test	4.27	1.44	0.10	1.795	29	0.083	0.33
	Post-Test	4.37	1.50					

The behaviour of the control group is what permits the experimental gain to be interpreted. Because control respondents took the same test twice over the same interval without improving, the gain in the experimental group cannot be attributed to familiarity with the instrument, to maturation or to events in the wider environment during the study period. Much of the Indian nutrition education literature reports only the treated group and therefore cannot exclude these explanations which is a design advantage of the present study. The control data also offer an instrument-level check. The standard deviation of

change implied by the control group's paired *t* statistic is only 0.31 marks, which corresponds to a test-retest correlation of about 0.98 over the study interval; the instrument was therefore highly stable in the absence of teaching. In the experimental group the implied pre-post correlation fell to about 0.38 and the SD widened from 1.54 to 2.36, showing that women responded heterogeneously to the video (Fig. 2). Such heterogeneity points to moderators, such as literacy, age or prior exposure, that should be modelled in future work.

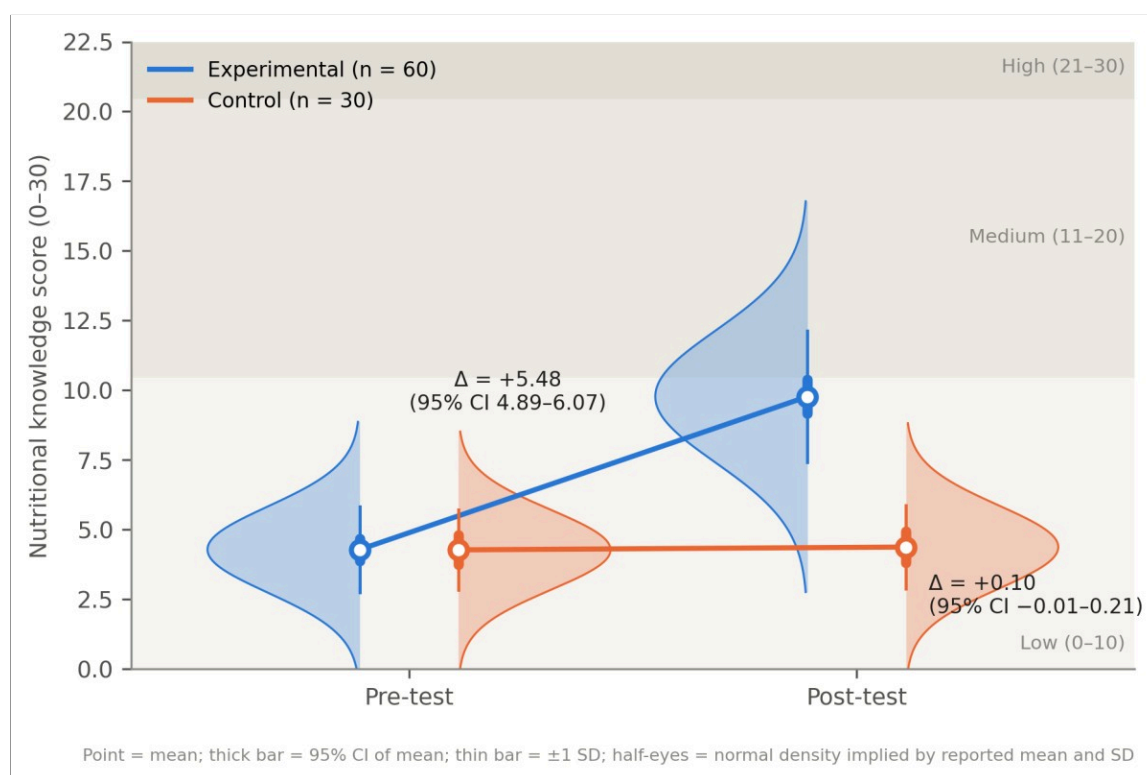


Figure 2. Half-eye trajectory plot of nutritional knowledge before and after the intervention. Background bands mark the Low, Medium and High knowledge classes. Half-eye densities are normal approximations reconstructed from the reported means and SDs and are illustrative only.

Adjusted comparison between the groups

Although the groups were comparable at baseline, the pre-test score remained a predictor of the post-test score, so analysis of covariance was used to improve precision. Homogeneity of regression slopes was examined first in a preliminary model containing the group by pre-test interaction. The interaction was not significant ($F(1,86) = 2.481$, $p = 0.119$), so the regression of post-test on pre-test score may be

treated as parallel across the two groups and the interaction was dropped (Table 4).

$n = 90$

It could be observed from Table 4 that group membership accounted for about 67 per cent of the variance in post-test remaining after the pre-test score was taken into account ($F(1,87) = 172.489$, $p < 0.001$, partial η squared = 0.665). By conventional benchmarks this is a large effect. The covariate was also significant ($F(1,87) = 29.957$, $p < 0.001$), confirming that women who knew more at the outset also

knew more at the end, which is the behaviour expected of a reliable instrument. The model as a whole explained 70 per cent of the variance in post-test scores. Expressed as Cohen's f , the group effect was 1.41, far beyond the 0.40 threshold for a large effect (Cohen, 1988)

[27]. Fig. 3 partitions the corrected total sum of squares: the video accounted for 59.4 per cent, the pre-test covariate for 10.3 per cent and residual error for 30.0 per cent, with 0.3 per cent shared between group and covariate.

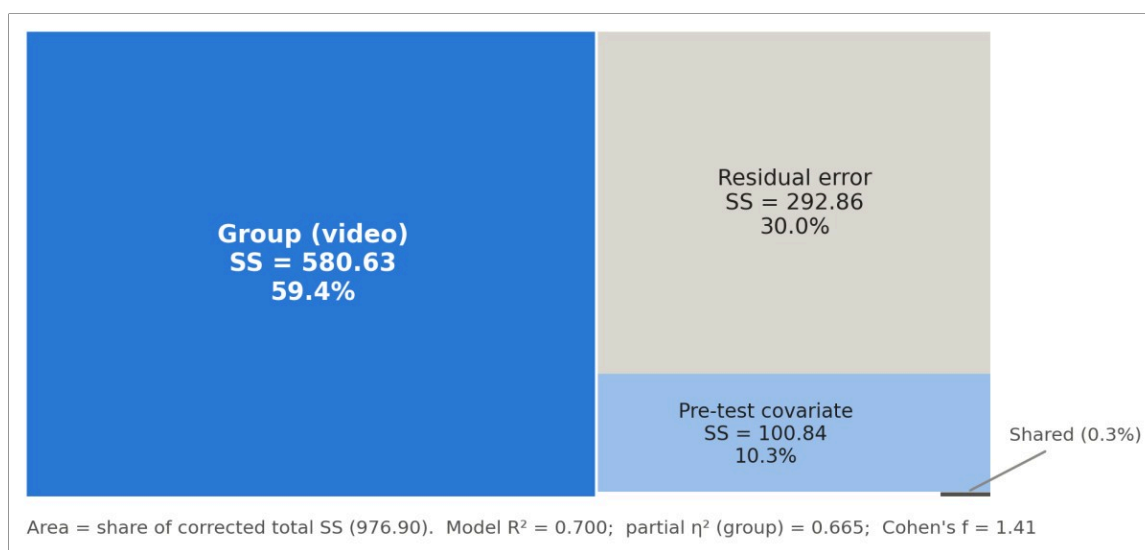


Figure 3. Variance-partition map of the ANCOVA model (Table 4). Tile area is proportional to each source's share of the corrected total sum of squares (976.90).

Levene's test for the model was significant, indicating unequal error variances across the two groups. The departure is in the conservative direction because the large group carries the larger variance which makes the F test less rather than more likely to return a spurious re-

sult. The Welch corrected between-group comparison reported in Table 2 reaches the same conclusion independently of the assumption. Table 5 gives the adjusted means.

Table 4. Analysis of covariance for post-test knowledge scores

Source	Sum of squares	df	Mean square	F	p	Partial eta squared
Pre-test (covariate)	100.842	1	100.842	29.957	< 0.001	0.256
Group	580.631	1	580.631	172.489	< 0.001	0.665
Error	292.858	87	3.366			
Corrected total	976.900	89				

$n = 90$

Table 5. Adjusted post-test means of the two groups

Group	Adjusted mean	SE	95% CI lower	95% CI upper
Experimental	9.76	0.237	9.29	10.23
Control	4.38	0.335	3.71	5.04

It could be observed from Table 5 that after adjustment the experimental group scored 9.76 and the control group 4.38, a difference of 5.39 marks whose confidence interval runs from 4.57 to 6.20 and nowhere approaches zero. The adjusted difference is almost identical to the unadjusted difference of 5.40 marks, which is expected given that the groups began from the same level. The standard error of the ANCOVA-adjusted difference (0.41) was virtually identical to that of the Welch comparison (0.41), and the change-score difference-in-differences (5.38; 95% CI 4.78–5.98) agreed with both, so the conclusion does not depend on the choice between ANCOVA and gain-score analysis that underlies Lord's paradox in non-randomised designs (Van Breukelen, 2006) [31]. Table 7 and Fig. 4 bring all effect estimates together with their confidence intervals. The between-group post-test effect (Hedges' $g = 2.53$) corresponds to a common-language effect size of 0.96 and is about three times the benchmark of 0.80 re-

ported when video is added to instruction (Noetel *et al.*, 2021) [20]. This magnitude partly reflects the very low baseline and the no-treatment control, and it should be interpreted in that light rather than compared directly with trials that used active comparators.

$n = 90$

Magnitude of the knowledge gain

It could be observed from Table 6 that the experimental group more than doubled its score, yet closed only 21 per cent of the distance between its starting point and the maximum. A normalised gain below 0.30 is conventionally classed as low (Hake, 1998) [28]. The video therefore produced a real and substantial improvement without approaching the ceiling of the test and the two readings of the same result are complementary rather than contradictory. The relative movement was large because the respondents began near the floor of the scale, while the absolute position they reached was still modest.

Table 6. Supplementary inferential indices derived from the reported statistics

Index	Estimate	95% CI
Baseline difference, Hedges' g (E vs C)	0.01	-0.43 to 0.44
Mean gain, experimental (marks)	5.48	4.89 to 6.07
Mean gain, control (marks)	0.10	-0.01 to 0.21
Cohen's d_z , experimental	2.40	1.90 to 2.90
Cohen's d_z , control	0.33	-0.04 to 0.69
Difference-in-differences (marks)	5.38	4.78 to 5.98
Welch post-test difference (marks)	5.40	4.59 to 6.21
Hedges' g , post-test (E vs C)	2.53	1.95 to 3.10
Common-language effect size	0.96	—
Cohen's f , group (ANCOVA)	1.41	—
Implied test-retest r , control	0.98	—
Implied pre-post r , experimental	0.38	—
MDE at ICC = 0 / 0.05 / 0.10 (SD units)	0.63 / 1.01 / 1.30	—

E = experimental; C = control; MDE = minimum detectable effect at 80% power. CIs for d_z and g from the non-central t distribution; implied correlations from $r = (s_1^2 + s_2^2 - s_d^2) / (2s_1s_2)$.

$n = 90$

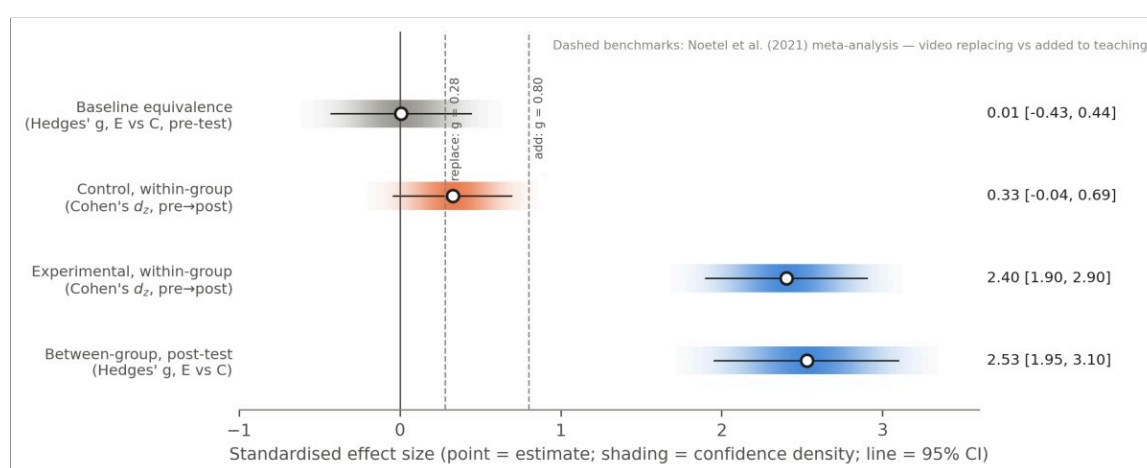


Figure 4. Confidence-density forest plot of standardised effects. Colour intensity is proportional to the normal-approximation likelihood of each value; dashed lines mark meta-analytic benchmarks for video-based learning (Noetel *et al.*, 2021) [20].

The relative gain of 128 per cent recorded here is more than twice the increment of about 51 per cent reported from a large training programme for 1,500 rural women in Haryana and the gap is best explained by the starting position rather than by the strength of the treatment, since a group beginning at 14 per cent of the maximum has far more proportional room to move than one beginning higher (Satyapriya *et al.*, 2018) [4]. Comparable programmes for rural women have reported retention of knowledge by participants to around 64 per cent of upto six-month follow-up but they had combined several teaching methods rather than relying on one (Mangwane *et al.*, 2024) [22]. The same pattern appears in school settings where teacher-led lectures, role play and demonstrations delivered over six weeks produced significant knowledge gains among students in rural Karnataka (Salam *et al.*, 2023) [34]. Plotted on the normalised-gain plane (Fig. 5), the experimental group lies below the low/medium boundary, and the multi-method programme of Mangwane *et al.* (2024) [22] ($g = 0.29$, computed from its reported means) also falls in the low-gain band despite a far longer and more intensive delivery. In normalised terms, therefore, a single video achieved roughly three-quarters of the gain of a multi-component pro-

gramme. Together with evidence that spaced repetition markedly improves long-term retention of verbal material (Cepeda *et al.*, 2006) [35], this argues for delivering the video as a spaced series with brief recall exercises rather than as a single round.

Table 7. Indices of knowledge gain

Index	Experimental ($n = 60$)	Control ($n = 30$)
Pre-test mean (% of maximum)	4.28 (14.28)	4.27 (14.22)
Post-test mean (% of maximum)	9.77 (32.56)	4.37 (14.56)
Absolute gain (marks)	5.48	0.10
Relative gain (%)	128.02	2.34
Normalised gain (Hake's g)	0.21	0.004
Cohen's d (within group) _z	2.40	0.33

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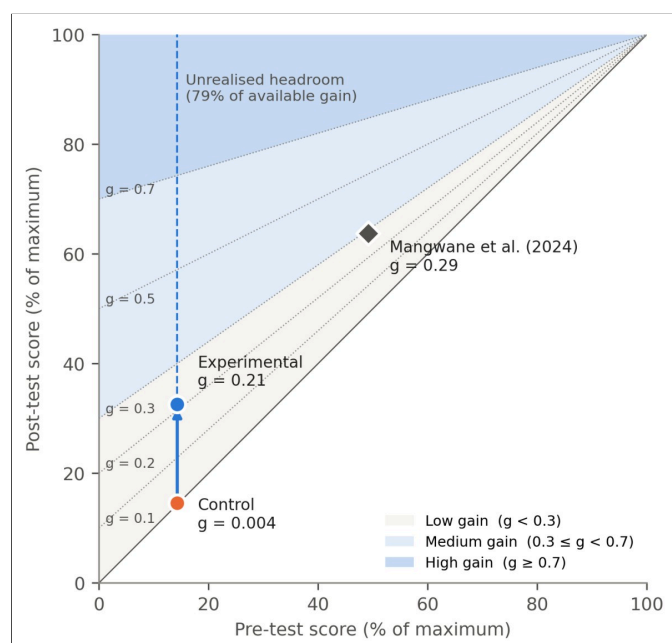


Figure 5. Normalised-gain plane (after Hake, 1998) [28]. Iso-gain lines join points with equal proportions of the available gain realised; the dashed segment shows the headroom not yet realised by the experimental group. The comparator was computed from the reported means of Mangwane *et al.* (2024) [22].

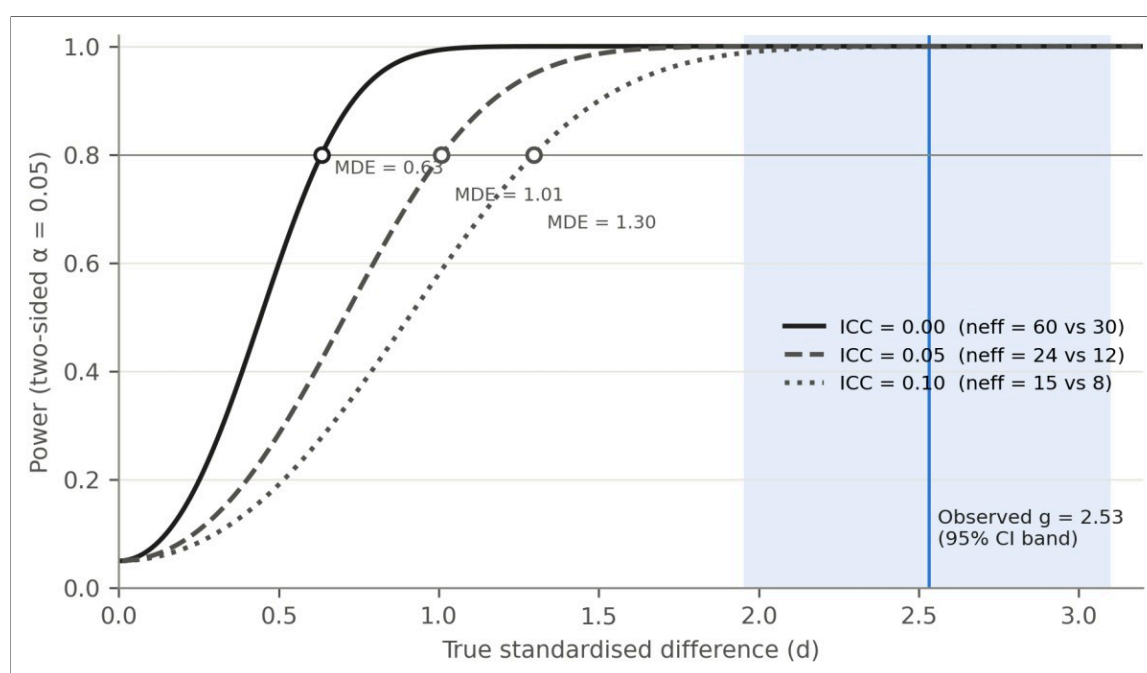


Figure 6. Cluster-sensitivity power curves. Open circles mark the minimum detectable effect at 80 per cent power for ICC = 0, 0.05 and 0.10; the vertical line and shaded band show the observed between-group effect and its 95 per cent CI.

Conclusion

The nutrition education video produced a significant improvement in the nutritional knowledge of rural farm women in Warangal district. The experimental group advanced from 4.28 to 9.77 marks out of 30, while the control group remained unchanged. The two groups were comparable at the outset and analysis of covariance confirmed an adjusted difference of 5.39 marks attributable to the video. The medium suits the audience because it makes no demand on reading, costs little to reproduce and delivers the same message in every village. However, the normalised gain of 0.21 shows that six sessions left most of the available learning uncovered. Delivering the video as a spaced, repeated series rather than as a single-round intervention, and testing whether a participatory or printed component adds to its effect,

Robustness to village-level clustering

Because the intervention was assigned by village, responses within a village may be correlated, which inflates the variance of the estimated effect. With only three villages the intraclass correlation (ICC) cannot be estimated reliably, so a sensitivity analysis was performed instead (Fig. 6). Under an ICC of 0.05 the effective sample fell to about 24 and 12 women and the minimum detectable effect rose from 0.63 to 1.01 SD; under an ICC of 0.10 it rose to 1.30 SD. The observed effect ($g = 2.53$), and even the lower limit of its confidence interval (1.95), exceed all three values, so the finding is robust to plausible clustering. A design with more villages randomly allocated to arms would nevertheless be needed to estimate the ICC and to generalise beyond the study villages (Campbell *et al.*, 2012) [32].

Limitations

Four limitations qualify these findings. First, villages were not randomised, so unmeasured village-level differences cannot be excluded despite baseline equivalence on the outcome. Second, the control group received no alternative activity, so the estimate combines the content of the video with the effect of receiving attention. Third, knowledge was measured only immediately after the sessions; retention, attitudes, practices and dietary diversity were not measured, and the weak knowledge–intake association reported in the literature (Spronk *et al.*, 2014) [7] cautions against inferring behavioural change. Fourth, the Yes/No format permits guessing, and item-level analysis of the misconceptions revealed at baseline would sharpen future video content.

are the obvious next steps. Because the effect (Hedges' $g = 2.53$) survived covariate adjustment, change-score analysis and cluster-sensitivity checks, the video offers a low-cost, scalable and literacy-independent vehicle for nutrition extension in Telangana; linking it with the participatory and agricultural components that changed diets in Odisha (Kadiyala *et al.*, 2021) [17], and following respondents to dietary-diversity outcomes, is the most promising route from knowledge to practice.

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