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Applying the Health Belief Model to plan and implement a nutrition behavior change intervention in school children: A randomized controlled trial in Mumbai

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Presentation Outline

- Introduction

- Aims and Objectives

- Methods

- Results

- Summary and Conclusions

- References

Introduction

School based nutrition education

1 • Good nutrition is critical to meet the demands of physical and cognitive growth and development, provide adequate stores of energy and prevent early onset of lifestyle-related non communicable diseases("WHO | Adolescent Nutrition," 2018)

2 • The school setting is a perfect place for learning so a school based nutrition education intervention can provide expedient opportunities for improving health promoting information.

3 • Nutrition education programs with successful outcomes are more likely to be behaviorally focused and based on appropriate theory and prior research (Contento et al 2017, Birch & Fisher, 2018; Goh et al., 2015; Silva et al., 2017, Baghel SS, et al, 2015, Ha and Caine-Bish 2019, Kim, Ahn, & No, 2018).

Behavior Change Interventions

- Behavior change is an iterative, complex process that requires a thorough understanding of what is relevant and culturally acceptable and which behavior-centered approaches must be integrated to address the resistance points.
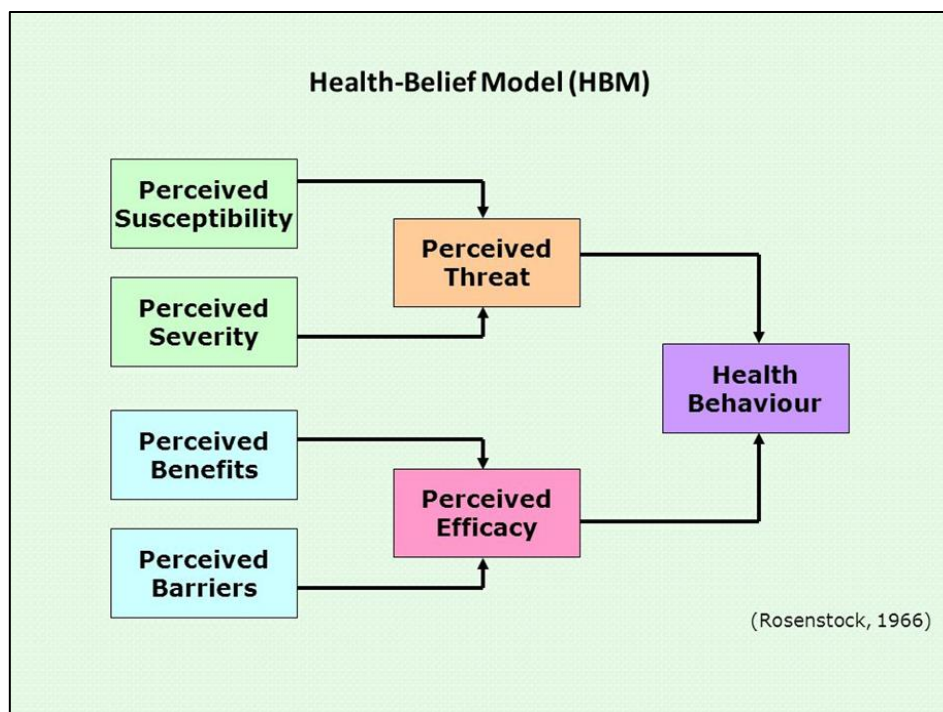

FIG 1: THE HEALTH BELIEF MODEL

A behavior change intervention (BCI) is a systematic approach that is based on an underlying behavior change theory and includes behavior change communication (BCC) strategies to reduce risk behaviors and promote desired practices.

When the benefits of taking preventive action are viewed as greater than the perceived barriers of behavior change, the individual is likely to modify or engage in health behavior

Intervention Mapping Approach of Program Planning

Planning process must entail **theoretical wisdom** to back feasible and **context-specific and evidence-based strategies** adapted to meet the identified **needs of the target group**
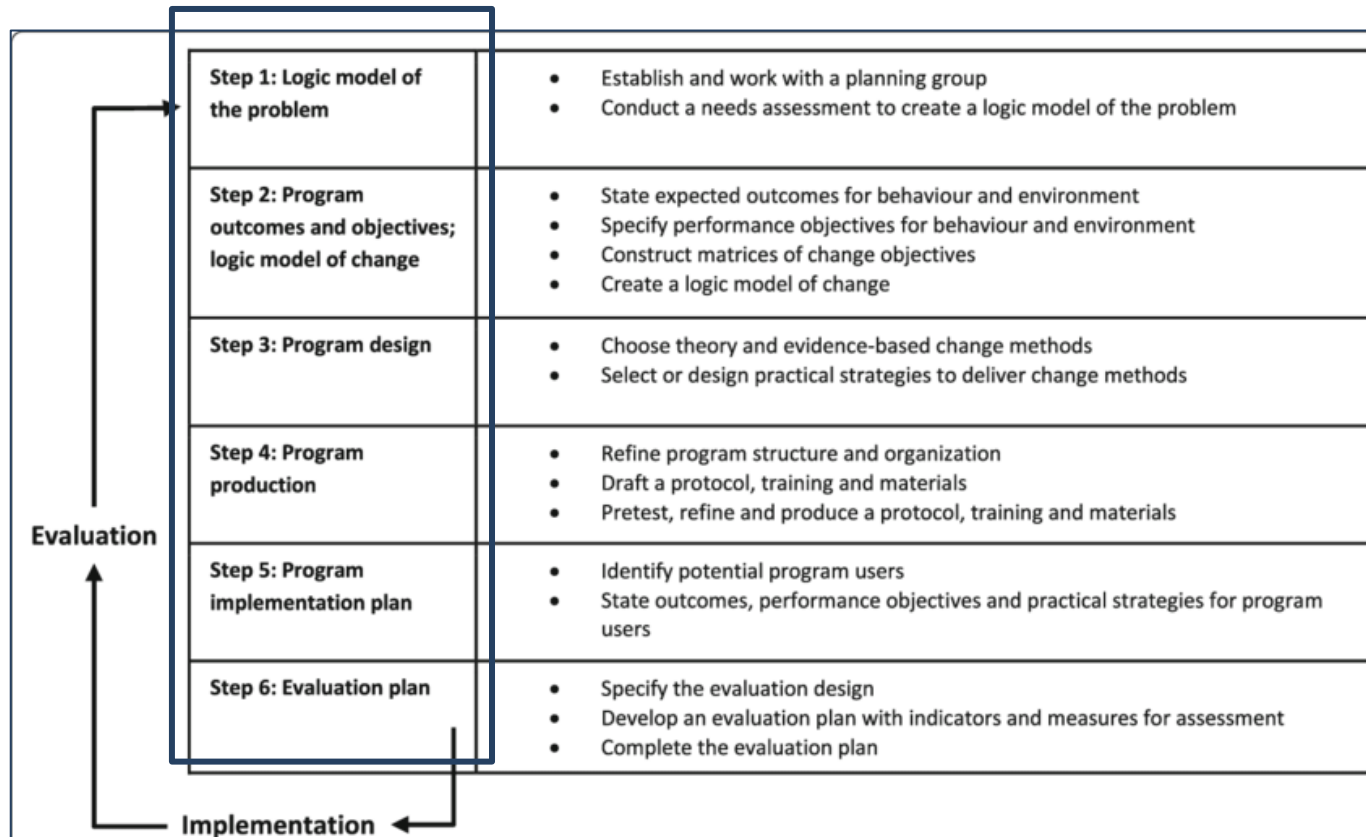

FIG 2: STEPS IN INTERVENTION MAPPING FRAMEWORK

Intervention Mapping (IM) is a systematic approach that includes a **series of evidence-based steps to plan and evaluate** the effectiveness of any health promotion program or nutrition interventions

INTERVENTION MAPPING IN THEORY

Step 1: Needs Assessment

Step 2: Formulating change and performance objectives

Step 3: Choose the underlying theoretical framework

Step 4: Design Nutrition Education Intervention Program

Step 5: Implement Intervention Program

Step 6: Evaluate Effectiveness of Intervention

INTERVENTION MAPPING IN PRACTICE

Step 1: Conduct focus group discussion to identify the knowledge gaps and explore the perceived barriers and facilitators of adopting healthy behaviors in children.

Step 2: Formulate behavior change goals related to eating habits and activity patterns in children

Step 3: Select Health Belief Model as the underlying theory to inform behavior change strategies.

Step 4: Develop the intervention program and design education modules and teaching-learning aids and materials

Step 5: Implement the program

Step 6: Evaluate the effectiveness using a pre post, randomized controlled trial

Aim of the Study

To **evaluate the effectiveness** of **a multicomponent school based nutrition behavior change intervention program** on knowledge, attitudes and practices related to dietary habits in 10-12 years old children in Mumbai, India.

Objectives of the Study

- To evaluate the **knowledge, attitude and perceptions** regarding healthy eating and activity patterns among children, parents and teachers using **focus group discussions.**

- To **develop and validate questionnaires** that measure knowledge, attitudes and practices to healthy eating in children

- To **design nutrition education modules based on the Health Belief Model**, targeted at both participants and their parents.

- To **assess the changes in knowledge, attitudes, dietary habit** related practices after 12 weeks of behavior change intervention between participants, ages 10-12 years who participated in the program compared to those who did not.
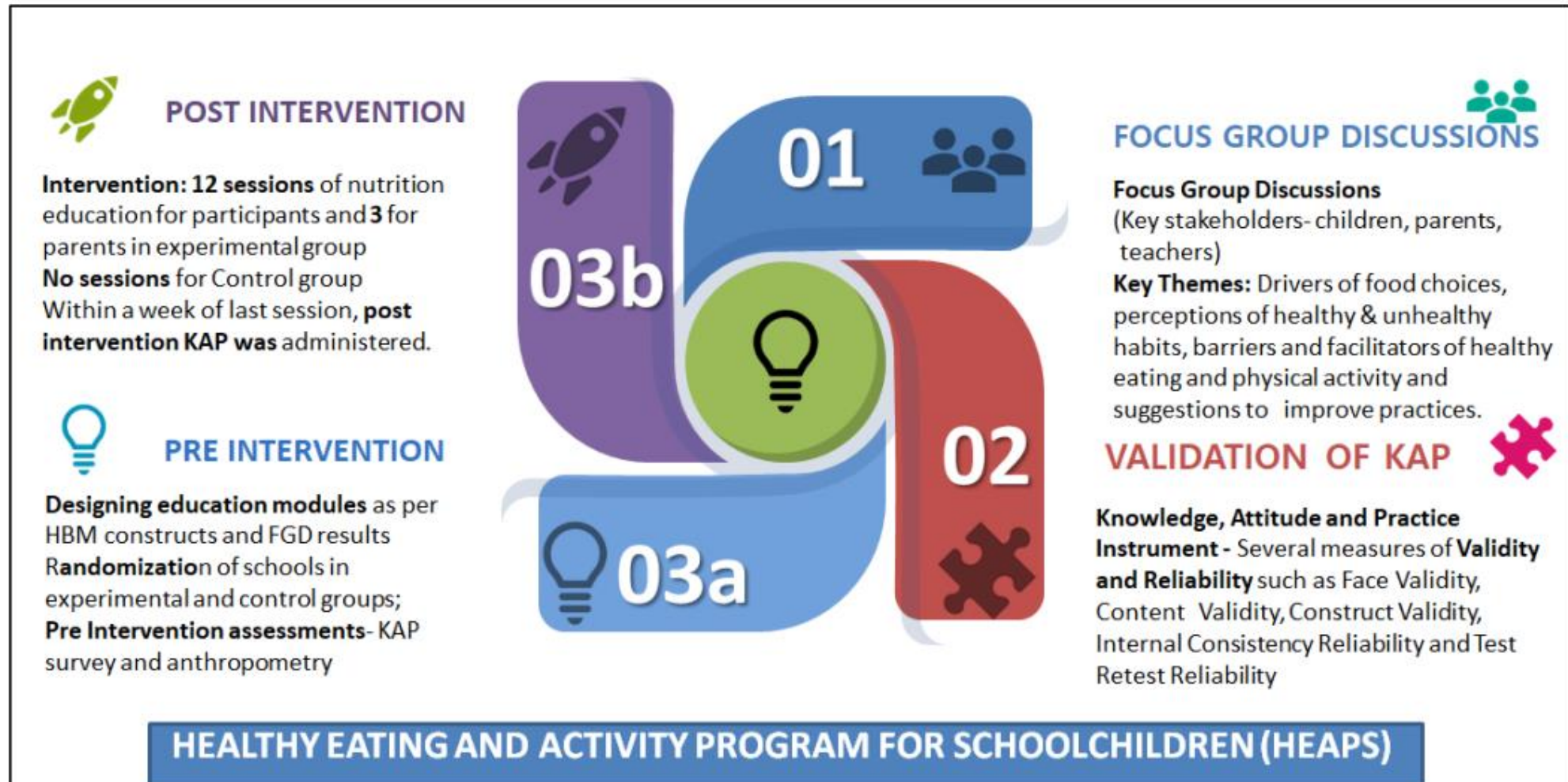
Methods

FIG 3: OVERVIEW OF THE PHASES IN THE STUDY

Phase 1: Focus Group Discussions

- **Number of FGDs conducted**: Overall, **fourteen focus group discussions**—six with children, five with parents and three with teachers—were conducted.

- The discussions were audio-recorded and transcribed verbatim.

- **Method of Analysis**: The transcripts were **reviewed, coded, and analyzed** using the scissor and sort or cut-paste method to derive common themes based on the constructs of the Health Belief Model and key research questions.

- A posteriori inductive approach of data analysis ensured that the codes and interpretations were generated from the actual data

- **Recurrent emergent themes and key quotes** under each theme were identified

Phase 2: Development & Validation of KAP

Study Sites: Two purposively selected private schools and two aided schools in Mumbai.

Study Participants for Validation of KAP- HEAL

1. All students studying in the selected classes of grades 6 and 7 were explained the study protocol and information sheets were sent home to receive parental consent.
2. Overall, **295 children** returned the signed parent consent forms
3. Of these, **28 children participated in the face validity exercise**, and **252 completed the KAP questionnaire** for testing validity and internal consistency reliability.
4. A **subsample (n=132) took the retest** after approx. three weeks of the first administration for test retest reliability estimation.

STEPS INVOLVED IN DEVELOPMENT AND VALIDATION OF KAP-HEAPS# INSTRUMENT

ITEM POOL	ITEM ANALYSIS	VALIDITY	RELIABILITY
Literature Review	Expert Opinions I-CVI ᵒ	Face Validity (n=28)	Final Draft (n=84) Knowledge- 22 Attitude- 20 Practice-42
Focus Groups	Item Difficulty Index	Second Draft 88 items	Internal Consistency KR-20 ᵖ, Cronbach α
First Draft 128 items	Item Discrimination	Exploratory Factor Analysis	Test Retest Reliability Intra class Correlation Coefficient Estimates
		Extraction of Factors	

Knowledge, Attitude and Practices (KAP) to Healthy Eating and Activity Patterns in School children (HEAPS)

ᵒ I-CVI, Item Content Validity Index
ᵖ KR, Kuder Richardson formula-20

FIG 4: SUMMARY OF STEPS INVOLVED IN THE DEVELOPMENT AND VALIDATION OF KAP- HEAL QUESTIONNAIRE

Reference: **Moitra P,** Verma P & Madan J (2021) Development and validation of a questionnaire measuring knowledge , attitudes , and practices (KAP) to healthy eating and activity patterns in school children (HEAPS). *Nutr. Health*. Sage Publications 1-10.

PHASE 3: DESIGNING EDUCATION AIDS & CONDUCTING INTERVENTION STUDY

PANCHALI MOITRA
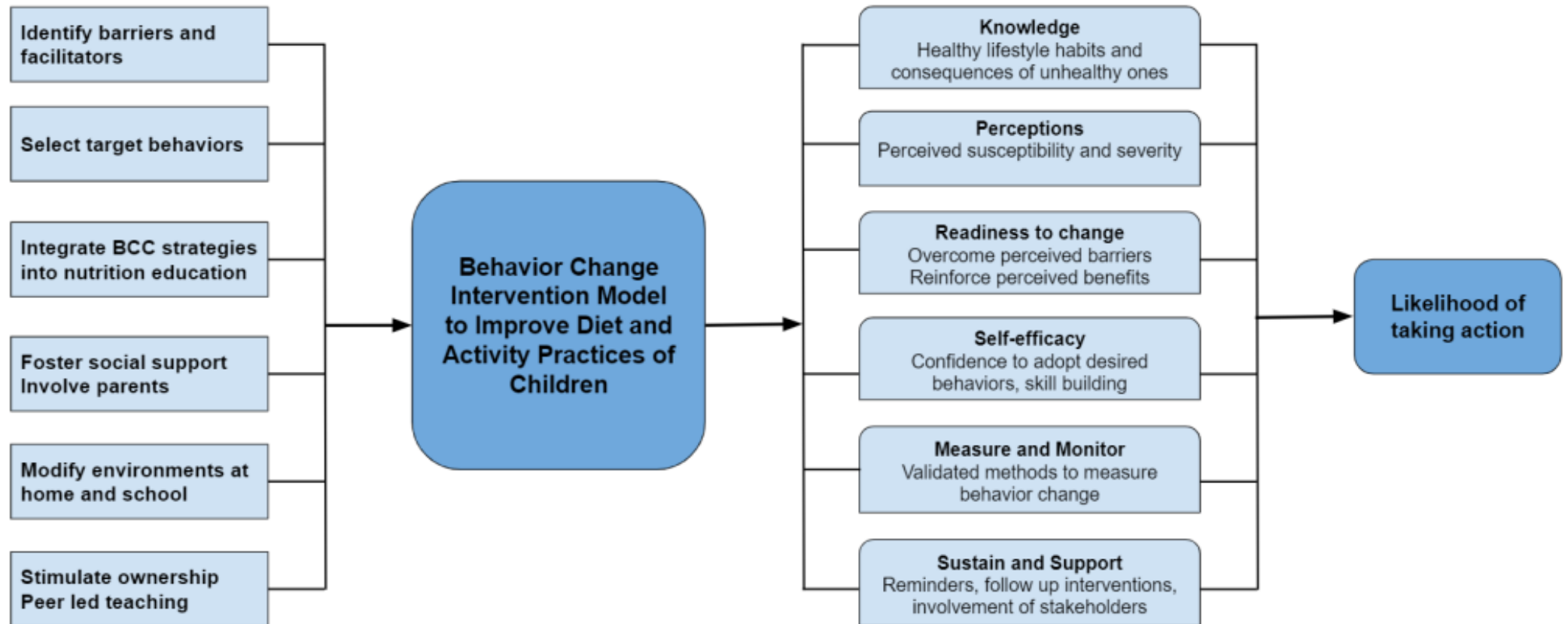
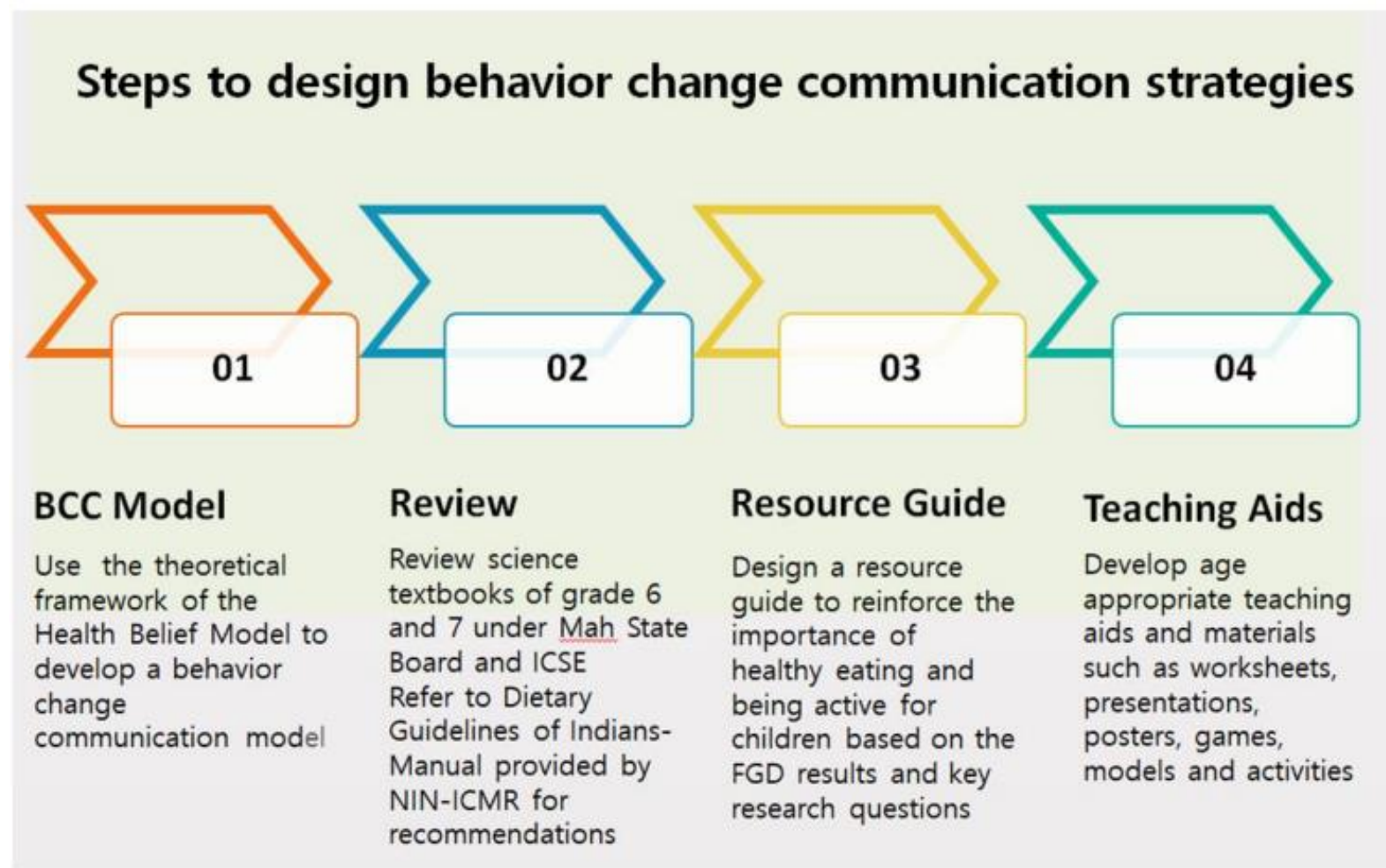FIG 5: BEHAVIOR CHANGE INTERVENTION (BCI) MODEL DEVELOPED AS A PART OF THE PRESENT STUDY

Steps to design behavior change communication strategies

01

BCC Model

Use the theoretical framework of the Health Belief Model to develop a behavior change communication model

02

Review

Review science textbooks of grade 6 and 7 under Mah State Board and ICSE Refer to Dietary Guidelines of Indians- Manual provided by NIN-ICMR for recommendations

03

Resource Guide

Design a resource guide to reinforce the importance of healthy eating and being active for children based on the FGD results and key research questions

04

Teaching Aids

Develop age appropriate teaching aids and materials such as worksheets, presentations, posters, games, models and activities

FIG 6: STEPS IN DESIGNING BCC STRATEGIES

Presentations

Skill based Activities

Plan your Pyramid
- You are provided with a a blank food pyramid that needs to be filled with right number of servings and your choice of foods under each food group category. Steps to complete this task:
1. First write the number of servings of each food group in the pyramid
2. Choose the foods that you wish to eat under each food group
3. Write the appropriate servings of each food that you wish to eat
4. Check if the number of servings that you have planned are matching with the recommended servings of the specific food group
5. Be confident! You can do it!

Skill based Activities

ACTIVITY- BE a SUGAR DETECTIVE

Look At 3 packets of your favorite food and check if sugar is listed among the ingredient. If yes, does the packet mention how much of sugar is present? Write down the amount of sugar in each packet.

Packet 1 ( ) ------------------ grams of sugar
Packet 2 ( ) ----------------- grams of sugar
Packet 3 ( ) --------------------- grams of sugar
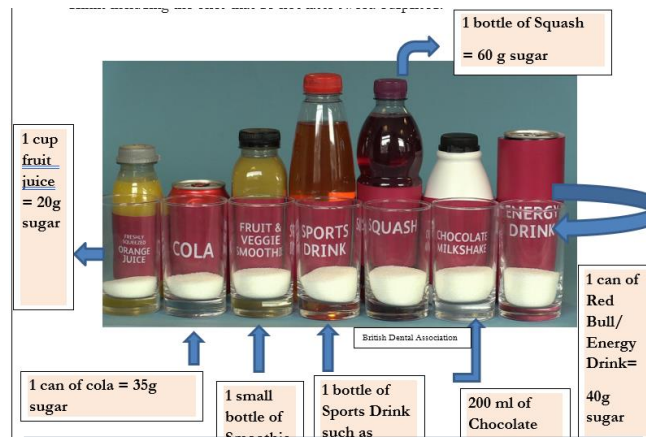
Market Survey

Activity Book

EAT RIGHT MOVE MORE
Workbook for Grade 6 and Grade 7
HEAPS
Healthy Eating and Activity Program for School Children

Case study & Swap Games

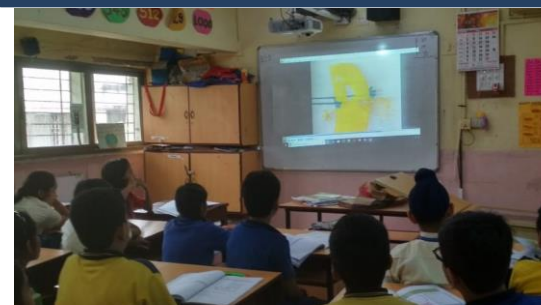**Fun Assignments**

FUN ACTIVITY: Jumble Tumble
Look at these jumbled up words and then rearrange the alphabets to find the correct word related to what we have studies in last two chapters.

1. TRGNSO SEBNO _____
2. NIOR _____
3. YBAHRCSAORDTE _____
4. EIBSVIL TASF _____

Videos

Theme Notice Boards

Cross word Puzzles
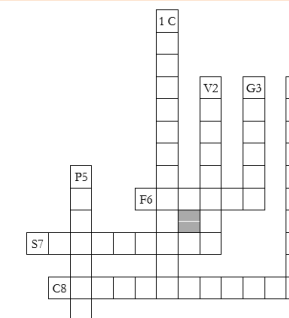
FUN ACTIVITY AT HOME: Nutrient Genius CROSSWORD

Across
6. Have 2 servings of me in a day to be healthy and happy
7. Eating too much of ------------fat is bad for health
8. I am rich in Vitamin C

Down
1. Energy Giving Nutrient
2. I am the SUNSHINE nutrient
3. I stay at the bottom of the pyramid
4. Give Me Five for Good Health
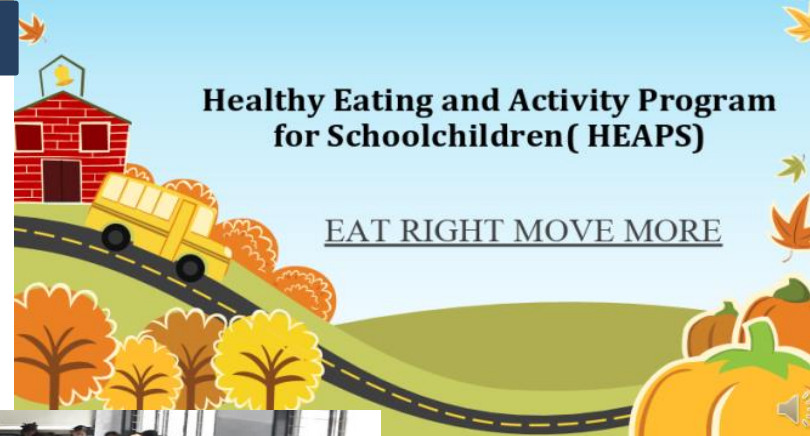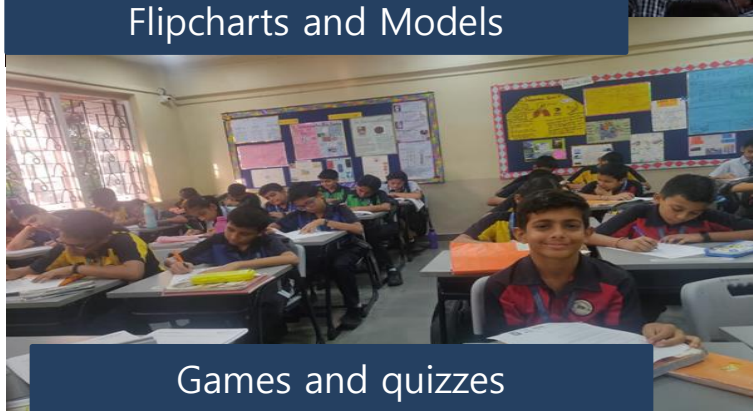5. If you want to build muscles, take me in a hustle

Classroom Teaching

Competitions & Awards

Healthy Eating and Activity Program for Schoolchildren (HEAPS)
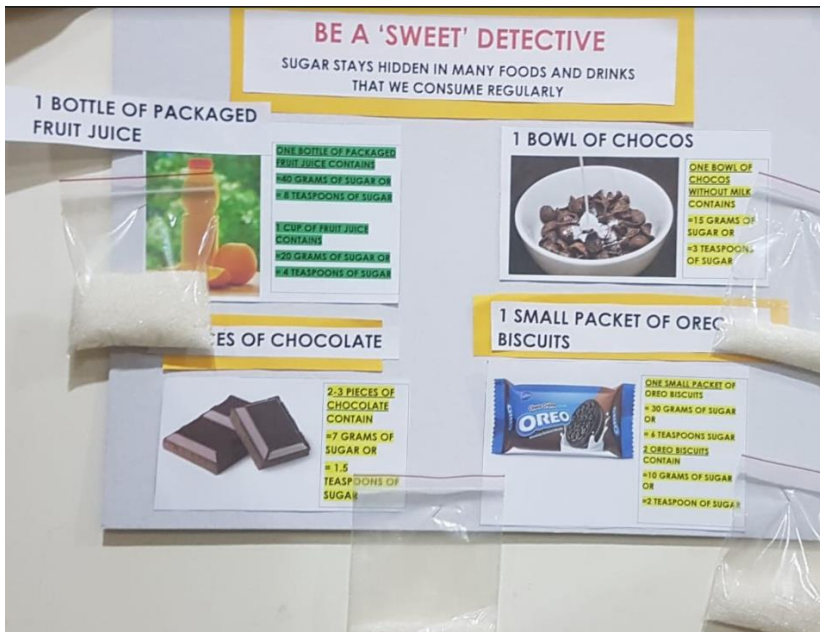
EAT RIGHT MOVE MORE

Flipcharts and Models

Games and quizzes

Classroom Teaching

Role Play Skits

Parent Awareness Sessions included activities such as Healthy Plate, Posters, Display Corners, Recipe Demonstrations

Phase 3: Intervention Protocol and Assessments

Study design: Cluster randomized controlled trial using school as an unit of randomization

Study Sites: Two aided schools and two private schools in Mumbai, **randomly allocated to either experimental or control group.**

Participants: Children, ages 10-12 years and studying in grade 6 and 7 of selected schools

Intervention: **12 weekly sessions of nutrition education for participants and 3 sessions for their parents** at experimental schools. The duration of each module was 50 minutes.
No sessions were conducted for participants in the control schools.

FIG 7: SAMPLING PROCEDURE FOR CLUSTER RANDOMIZED TRIAL
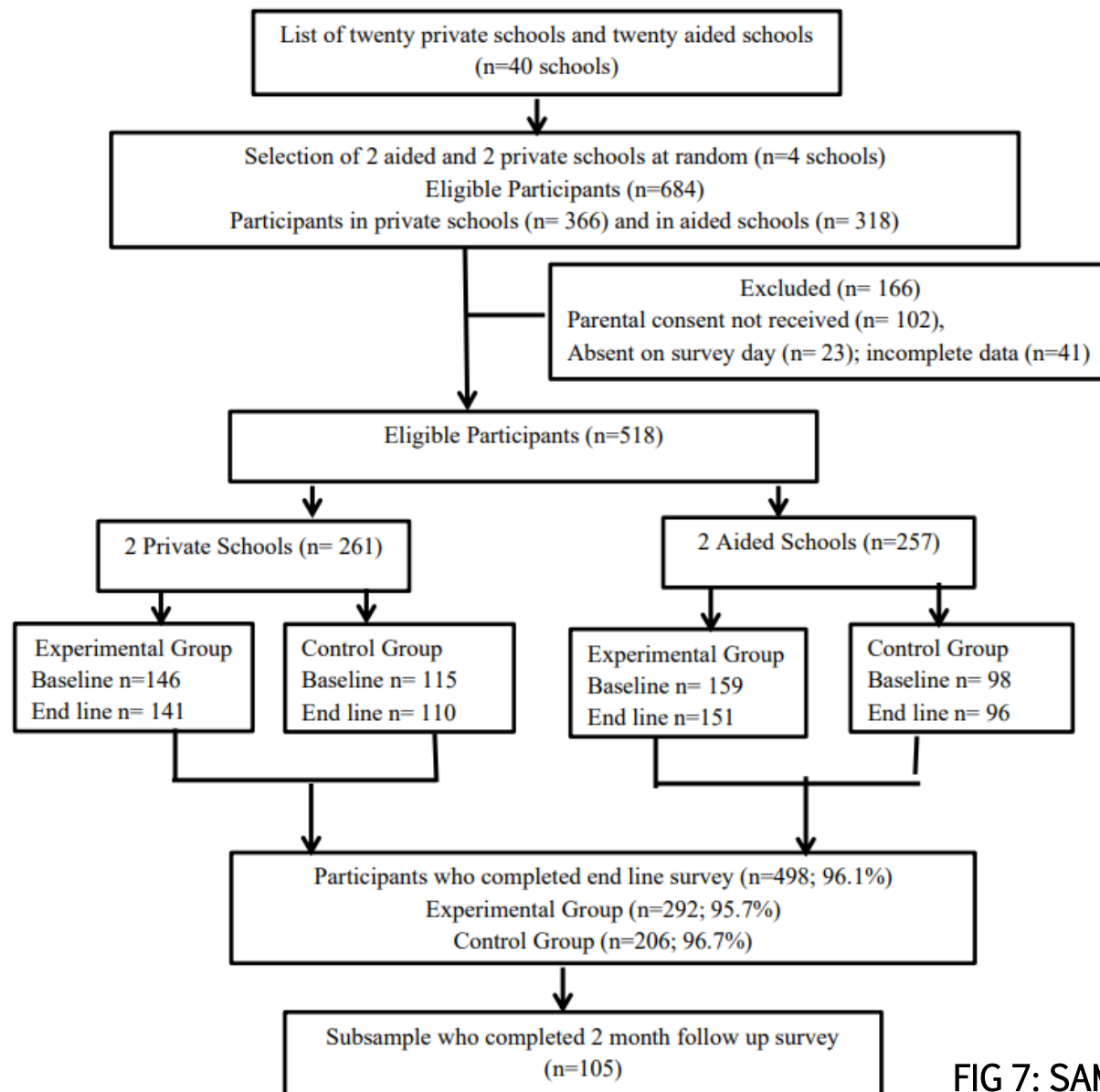
- Out of the four selected schools, one private school and one aided school were **randomly assigned to be the experimental schools**, and the other two schools (one private and one aided school) were designated as the control schools.

- Selection of schools using the cluster randomization method ensured that there was a **proportional representation from each type of school** (private or aided school, used as a proxy for SES) in both the control and experimental groups.

- **Ethics committee approval** for the study protocol was obtained from Intersystem Biomedica Ethics Committee, Mumbai

Statistical Analysis

- Data was analysed using the IBM SPSS Statistics for Windows Version 21.0 software.

- Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy was conducted to test sample adequacy for applying factor analysis. Test-retest reliability was determined using intra class correlation coefficients, correlations were considered significant at $p < 0.05$ and KR-20 and Cronbach's alpha was analyzed for internal consistency reliability.

- **Comparisons of the between- group and within-group changes** from baseline to end line were made using independent samples t test and paired t-tests respectively.

- Repeated measures ANOVA determined the changes in EG from baseline to endline to 2 months follow up, considered significant at $p < 0.05$.

Key Findings

FOUR MAIN THEMES

The **discussions with children, parents and teachers revealed:**

1 **Knowledge** about healthy eating habits, activity and sedentary behavior recommendations

2 **Perceived susceptibility and severity** of consequences of unhealthy behaviors

3 **Environmental determinants** such as availability and accessibility of foods at school and home, parent perceptions and practices

4 **Individual factors** such as time, personal preferences, convenience and will power.

Results published: Moitra P & Madan J (2020) Perceived barriers and facilitators of healthy eating and physical activity: focus groups with children, parents and teachers in Mumbai, India. *Int. J. Community Med. Public Heal.* 7, 2363

Scale/ Subscale	Items	Questions	Response Scoring	Mean (SD)	KR-20 or α	ICC (95% CI)
Knowledge						
Food Groups and Nutrients	6	Food group that should take most space on your plate Recommended daily servings of fruits and vegetables for children Food items at the top of the food pyramid Sources of simple carbohydrates in diet Sources of healthy fats in diet Foods high in fiber content		4.18 (1.2)		0.961[**] (0.92-0.99)
Eating habits	6	Components of healthy eating plan Healthy breakfast choices Identify nutritious afterschool snack Allowed daily consumption of sugar Identify unhealthy eating habits [a] Effect of consuming too many junk foods Healthy alternatives to SSBs	each correct response= 1 Incorrect response/ don't know/ not sure = 0 Maximum possible scores= 25	5.44 (2.3)	0.832	0.782[*] (0.70- 0.82)
Non Communicable Diseases (NCDs)	5	Modifiable risk factors of NCDs [a] Symptoms related to diabetes Foods for healthy heart Ways to prevent NCDs Health problems associated with obesity		3.10 (1.8)		0.875[**] (0.84-0.91)
Activity patterns	5	Identify moderate to vigorous activities [a] Benefits of being active How often should you indulge in MVPA How long should you watch TV or play on computer everyday Consequences of physical inactivity		3.82 (2.1)		0.821[**] (0.79- 0.85)
Attitude						
Perceived Susceptibility and Severity	5	I will get diseases if I don't eat healthily I will feel tired if I am physically inactive I am worried about getting diabetes, I am worried about getting heart diseases I am worried about overweight/obesity	For all items except perceived barriers- Strongly agree=3 Agree=2 Disagree=1 Strongly Disagree=0	7.23 (3.4)		0.752[*] (0.687-0.826)
Perceived Benefits	6	Healthy eating can reduce risk to diseases Fruits can fight infections Eating vegetables can help lose weight Regular breakfast helps improve alertness Exercising is good for my muscles and bones Being physically active will increase my energy levels and improve my moods		12.28 (6.2)	0.892	0.942[**] (0.91- 0.96)
Perceived Barriers	6	It is difficult to eat 2 fruits a day I am not sure what and how much should I	For perceived barrier items- Strongly agree=0 Agree=1			

TABLE 2: DESCRIPTION OF THE ITEMS, MEAN SCORES, INTERNAL CONSISTENCY AND ICC VALUES OF ITEMS IN KAP_HEAL

The overall I-CVI scores for clarity and relevance were 0.910 and 0.828 respectively.
For knowledge items, ICC values ranged from 0.72 to 0.99

The overall KR-20 value for knowledge subscale was 0.832 and Cronbach's α values for the attitude and practice scales were 0.892 and 0.810 respectively.

Factors/ Dimensions	Initial Eigenvalues			Extraction Sums of Squared Loadings			Range of factor loadings
Attitude Items							
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	
1 Perceived Susceptibility and Severity	3.042	15.290	15.290	3.042	15.209	15.209	0.519-0.646
2 Perceived Benefits	2.249	11.287	26.577	2.249	11.247	26.456	0.525-0.675
3 Perceived Barriers	1.721	8.604	35.181	1.721	8.604	35.060	0.519- 0.632
4 Readiness to change and self – efficacy	1.567	7.837	43.018	1.567	7.837	42.897	0.584-0.767
Dietary and Activity Practice Items							
1. Personal eating habits	6.130	21.322	23.322	8.130	21.322	23.322	0.695-0.761
2. Family dietary habits	4.643	18.525	41.847	6.643	18.525	41.847	0.526- 0.757
3. Consumption of healthy foods	3.011	14.486	56.334	4.011	14.486	56.334	0.552-0.675
4. Consumption of unhealthy foods	2.664	11.367	67.701	2.664	11.367	67.701	0.507-0.691
Activity 1. Moderate to Vigorous Physical Activity	7.834	28.282	28.282	7.834	28.282	28.282	0.519-0.724
Activity 2. Sedentary Activity	4.547	19.891	48.173	4.547	19.891	48.173	0.489- 0.706

Extraction Method: Principal axis factoring. Rotation Method: Varimax with Kaiser Normalization.
Kaiser-Meyer-Olkin Measure of Sampling Adequacy was conducted to test the sample adequacy for applying factor analysis; was found to be adequate

TABLE 3: SUMMARY OF CONSTRUCTS, EIGENVALUES, AND RANGE OF FACTOR LOADINGS EXTRACTED USING PRINCIPAL AXIS FACTORING METHOD FOR KAP-HEAL

From the factor analysis, four factors for attitude and dietary practice scale and two factors explained majority of the variance in the respective items

- A valid and reliable instrument was developed to measure knowledge, attitude and practices towards healthy eating and activity levels in children in India

- The final 84 item KAP instrument comprised of 22 knowledge items, 20 attitude items, 30 dietary practice (6 eating habits and 24 item FFQ) and 12 activity related practice items

VALID

Results Published : **Moitra P,** Verma P & Madan J (2021) Development and validation of a questionnaire measuring knowledge , attitudes , and practices (KAP) to healthy eating and activity patterns in school children (HEAPS). *Nutr. Health*. Sage Publications 1-10.

RESULTS OF PHASE 3:
CLUSTER RANDOMIZED CONTROLLED TRIAL

ANH2022
Agriculture, Nutrition and Health Academy Week

Characteristics	Number	Percentage
Gender		
Boys	269	51.9
Girls	249	48.1
Type of School		
Aided	257	49.6
Private	261	50.4
6th	262	50.6
7th	256	49.4
Religion		
Hindu	366	70.7
Muslim	116	22.4
Christian	13	2.5
Parsi	17	3.3
Other	6	1.2
Father's Occupation		
Service	184	35.5
Business	175	33.8
Professional (Doctor/Lawyer/CA)	38	7.3
Menial Jobs (Driver/Plumber/Painter)	94	18.1
Self employed	9	1.7
No Response/Doesn't Know	18	3.5
Mother's Working Status		
Doesn't Work	314	61.1
Part Time	76	14.8
Fulltime	124	24.1

- A total of **518 children**, ages 10-12 years participated in the baseline survey.

- Ninety-six percent of the participants (n=498; 292 from experimental schools and 206 from control schools) completed the post-intervention survey and comprised the final sample for pre-post comparisons.

- The **mean age was 11.2 (1.1) years**, 48% were girls and 49.6 % attended aided schools.

- EG (n=292) comprised of girls (n=140) and boys (n= 152) and CG (n=206) included 101 boys and 105 girls

TABLE 5: CHANGE IN MEAN KNOWLEDGE, ATTITUDE AND PRACTICE SCORES FROM BASELINE TO ENDLINE (AFTER 12 WEEKS) IN EXPERIMENTAL AND CONTROL GROUPS (n=498)

Variables	Survey Period	Experimental Group † (n=292)	Control Group † (n=206)	p-value [b]
Knowledge	Pre-Intervention	15.29 (4.61)	15.36 (5.07)	0.802
	Post Intervention	21.38 (6.03)	14.55 (4.18)	<0.001**
	% Change	39.8 % ⬆	-5.3%	
	p-value [a]	<0.001**	0.077	
Attitude	Pre-Intervention	39.59 (7.38)	37.49 (7.21)	0.516
	Post Intervention	42.47 (10.05)	38.18 (8.45)	<0.001**
	% Change	7.3 % ⬆	1.8%	
	p-value [a]	<0.001**	0.373	
Dietary Practice	Pre-Intervention	53.95 (9.89)	55.85 (6.41)	0.332
	Post Intervention	59.13 (14.46)	54.64 (11.84)	0.004*
	% Change	9.6 % ⬆	-2.2 %	
	p-value [a]	<0.001**	0.021*	

Significant improvements were observed in the mean scores of knowledge, attitude, dietary and physical activity practice from pre to post intervention in experimental group (p <0.001).

No significant changes were observed in any of the variables in the control group

Variable	Intervention Group (n=292)			Control Group (n=206)		
	Pre	Post	p value	Pre	Post	p value
Knowledge						
Food groups	1.15 (0.8)	1.58 (0.7)	< 0.001**	1.10 (0.8)	1.14 (0.7)	0.589
Balanced diet and food pyramid	1.12 (0.4)	1.53 (0.3)	< 0.001**	1.18 (0.4)	1.19 (0.4)	0.799
Nutrients	1.72 (1.1)	2.72 (0.9)	< 0.001**	2.08 (1.1)	1.94 (0.8)	0.140
Healthy eating habits	1.67 (0.8)	2.41 (0.7)	< 0.001**	1.81(0.8)	1.73 (0.7)	0.281
Unhealthy eating habits	2.52 (1.4)	3.84 (0.9)	< 0.001**	2.59 (1.4)	2.64 (1.1)	0.687
Non communicable diseases	1.75 (1.1)	1.98 (0.9)	0.006*	1.28 (0.9)	1.35 (0.6)	0.353
Physical activity pattern	5.32 (2.5)	6.15 (1.8)	< 0.001**	5.29 (2.6)	4.98 (2.1)	0.183
Attitude						
Perceived severity	2.91 (1.6)	4.12 (1.1)	< 0.001**	2.78 (1.5)	2.72 (1.2)	0.654
Perceived susceptibility	4.92 (2.6)	5.61 (2.8)	< 0.001**	5.21 (3.1)	5.18 (2.8)	0.918
Perceived benefits	8.75 (2.8)	9.62 (2.6)	< 0.001**	8.55 (2.5)	8.88 (2.1)	0.148
Perceived barriers	8.80 (2.8)	10.64 (3.1)	< 0.001**	8.99 (2.1)	8.45 (1.8)	0.078
Readiness to change	4.08 (1.4)	4.19 (1.3)	0.325	4.54 (1.1)	4.66 (0.9)	0.226
Self- efficacy	8.99 (2.1)	9.43 (2.2)	0.014*	8.65 (1.9)	8.52 (1.6)	0.453

EG reported a significant improvement in all subscales in the post intervention assessment as compared to CG, except in the attitude sub scale of readiness to change, dietary practice subscales of consumption of fruits, high fat foods and high salt foods.

TABLE 7: MEAN DAILY INTAKES OF FOOD ITEMS FROM BASELINE TO 12 WEEKS FOLLOW UP IN EXPERIMENTAL AND CONTROL GROUPS

| Food Items	Mean daily intakes of food and beverage items in grams or ml			
	Experimental Group (n=292)		Control Group (n=206)	
	Baseline	Endline	Baseline	Endline
Fruits	18.2(8.9)	18.6 (5.4)	18.9 (6.1)	19.1 (3.5)
Green leafy Vegetables	40.5(23.2)	58.9 (18.4) **	38.9 (12.2)	40.1 (7.9)
Chocolates	20.9(11.8)	18.6 (8.2) *	19.2 (3.5)	20.3 (4.9)
Wafers	27.5(22.8)	26.8 (8.8)	30.1 (5.6)	29.7 (6.9)
Samosa	68.3 (21.1)	66.2 (11.6)	69.5 (18.9)	72.8 (19.3)
Vada Pav	53.3 (10.1)	51.8 (8.3)	54.1 (5.5)	58.6 (8.1)
Noodles	49.2 (3.9)	52.3 (6.5)	48.8 (8.8)	50.2 (11.2)
Biscuits	18.7 (2.1)	19.3 (3.2)	17.5 (6.8)	18.8 (3.7)
Carbonated beverages	98.3(41.1)	84.4 (23.1) **	97.2(32.2)	98.6 (28.5)

*p value< 0.05; **p value < 0.001

Significant improvements were reported in the mean daily intake of green leafy vegetables (58.9 (18.4) g, p < 0.001), chocolates (18.6 (8.2) g, p 0.006) and carbonated beverages (84.4 (23.1), p < 0.001) in EG but not in CG

TABLE 8: MEAN KNOWLEDGE, ATTITUDE AND DIETARY PRACTICE SCORES FROM BASELINE TO ENDLINE TO 2 MONTHS FOLLOW UP IN EXPERIMENTAL GROUP (n=105)

Variable	Pre	Post	Follow up	ANOVA	Significance
Knowledge	16.12 (4.61)	21.89 (8.11)	19.65 (7.82)	F= 21.01	<0.001**
Attitude	38.27 (5.16)	43.17 (8.86)	42.19 (12.20)	F=17.17	< 0.001**
Dietary Practice	52.15 (7.26)	59.13 (14.46)	55.34 (11.15)	F= 22.42	0.014*

The mean **KAP scores at 2 months follow up showed significant improvements** in **knowledge (21.9%; p < 0.001), attitude (10.2 %; p < 0.001), and dietary practice (6.1 %; p 0.041)** scores as compared to the pre intervention mean KAP scores.
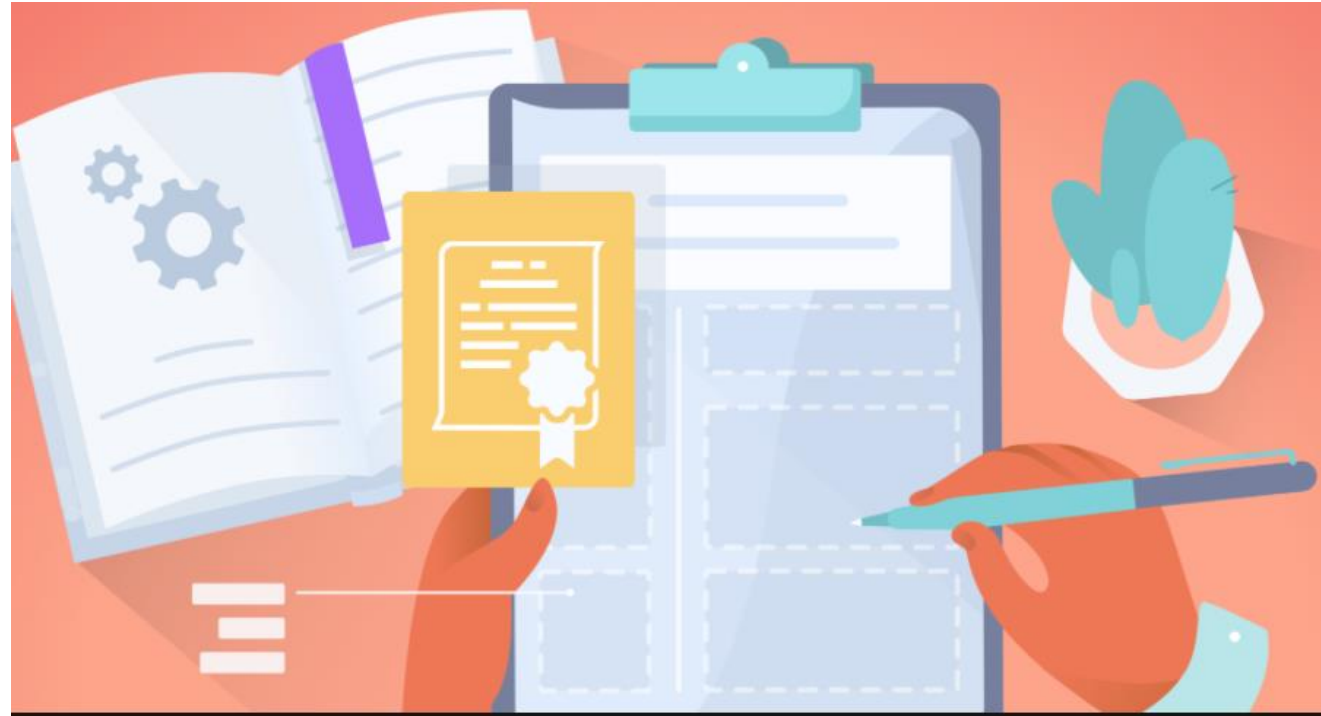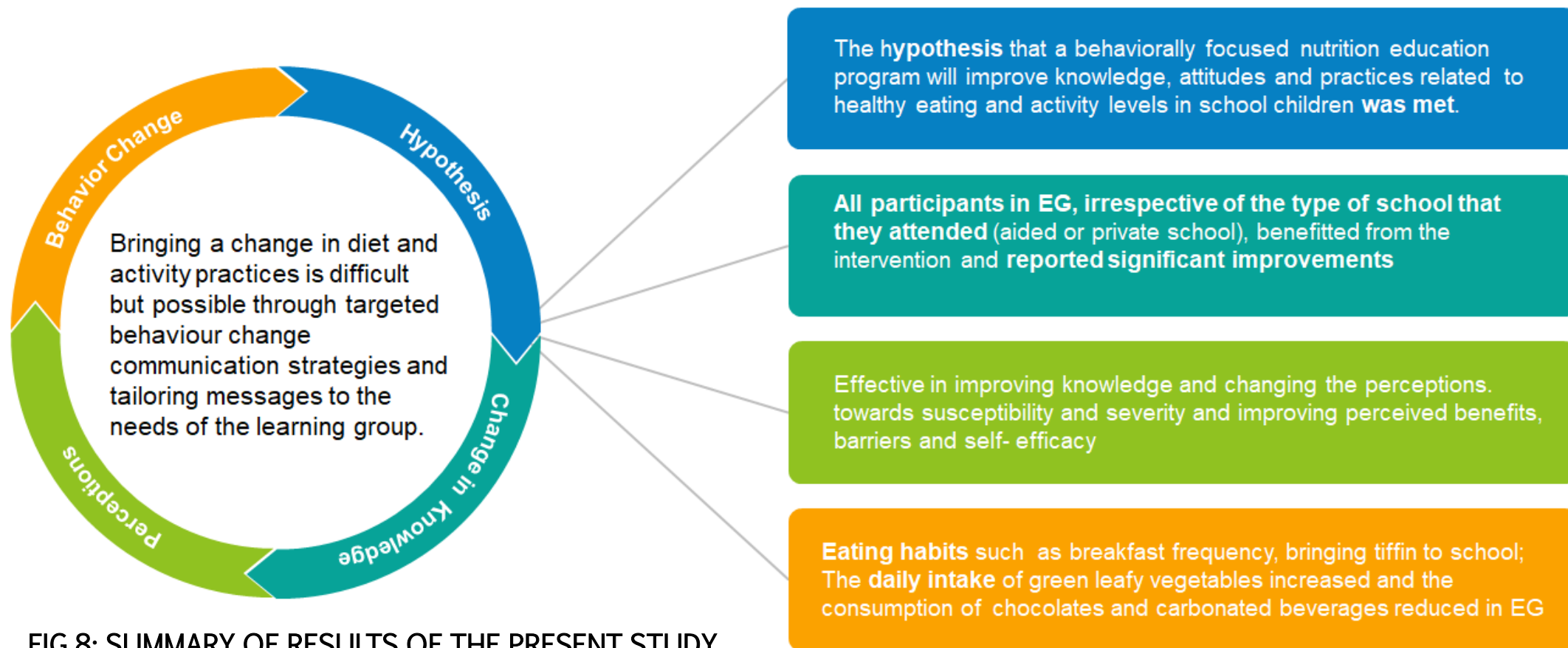
Summary & Conclusions

FIG 8: SUMMARY OF RESULTS OF THE PRESENT STUDY

Conclusions

Integrating nutrition education into the academic schedule and adopting evidence-based BCC strategies that entail discussions, critical thinking and interactive activities can improve nutritional knowledge, and also foster positive attitudes and encourage adoption of healthy eating behaviors in children

The results present a proof of concept of the potential benefits of a behaviorally focused theory driven education intervention in improving dietary behaviors, strongly associated with the risk of early onset of non- communicable diseases in children.

Moreover, the valid KAP instrument can be used as a pre intervention tool to gather baseline information and the detailed description of program planning can serve as a guide for developing future school-based health promotion interventions.

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THANK YOU!

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