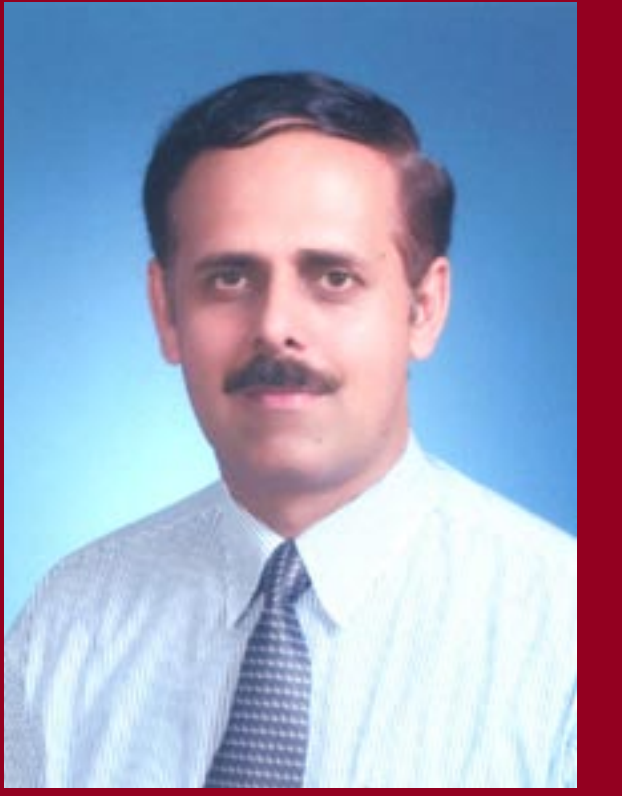


# EFFECTIVENESS OF SPRINKLES™ INTERVENTION TO CONTROL ANEMIA IN PAKISTANI AND AFGHAN INFANTS

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## BACKGROUND

Anemia affects 60% to 90% of children aged 6-36 months in Pakistan. Iron deficiency may be associated with more than 50% of the cases of anemia. An alternative way of providing iron and other micronutrients to infants and young children who are already consuming complementary food, Sprinkles™, has been developed by The Hospital for Sick Children in Toronto, Canada. This product contains microencapsulated iron, zinc, Vitamin A, Vitamin C and folic acid mixed in powder form, packaged in single dose sachets that are to be emptied on and mixed into semi-solid foods right before feeding once a day at home with negligible side effects (Figure 1). In view of the high prevalence of IDA, an effectiveness trial using 60 sachets of Sprinkles™ to be given to children aged 6-36 months over 2 months was conducted in the Kagan area of Mardan district, North Western Frontier Province in Pakistan.

## AIM

The objectives were to:

- measure the effectiveness of Sprinkles™ to reduce the prevalence of anemia in children aged 6 to 36 months of age; and
- assess the compliance and acceptability of the intervention among the mothers of study children.

## METHODS

Ethical clearance was obtained from the Research Ethics Board at the Hospital for Sick Children,

Canada and from an appropriate authority in Pakistan. Informed consent was obtained from parents. Inclusion criteria were the following:

- parental consent to participate in all aspects of the study including surveys, focus group discussions and hemoglobin assessment;
- intention to maintain a permanent residential address during the intervention period;
- reportedly free from acute illness; and
- ongoing and regular complementary feeding with semi-solid. A total of 844 eligible children aged 6-36 months were given Sprinkles™ daily for two months by their mothers.

Baseline data was collected in August (Figures 2 & 3). Frontline female health workers conducted monitoring visits and provided mothers with a two-week supply of Sprinkles™ every two weeks. Data on coverage, compliance, acceptability of the intervention, and associated side effects was collected monthly during the monitoring visits and interviews with care givers and focus groups. Hemoglobin and anthropometric measurements were made at baseline in August and at the end in December. Hemoglobin was measured in capillary blood in a sub-sample of 270 randomly selected children, using a portable HEMOCUE® B-Hemoglobin photometer. Data was entered with EPI-Info (version 7.0) and analyzed with SPSSWIN (version 11.0) adjusting for age of child in months, initial hemoglobin and time.

## RESULTS

As is evident from Figures 4 to 7, mean hemoglobin concentration significantly increased from 95.0 g/L to 109.5 g/L (p<0.05). Anemia prevalence significantly decreased from 85.8% to 50.8% (p<0.05)

for a cure rate of 40% even 3 months after the intervention had ended. Compliance was relatively high: children consumed 73% of the 60 sachets distributed. Acceptability of the intervention was also found to be high. The prevalence of stunting remained the same throughout the study. However, there were significant improvements in weight and weight for age (p<0.001) as well as in the prevalence of wasting (p<0.01); but given the lack of a control group the association of these changes with the intervention cannot be inferred as causal. Reported benefits of the intervention included children being more talkative, playful, and with noticeably larger appetite.

## CONCLUSIONS

Over one-third reduction of anemia was achieved with 70% compliance of a two months intervention with Sprinkles™. This novel intervention was found to be highly acceptable by the children, their caregivers and the community at large in Kagan area of Mardan district in NWFP, Pakistan. The etiology of the anemia that did not respond to the intervention remains unknown and merits in further research. Further research to assess the duration of the protective effect of fixed numbers of Sprinkles™ doses against resurgence of anemia during the complementary feeding phase of growth and development is necessary to facilitate the transition from long schedules of supplementation with liquid iron preparations.

## ACKNOWLEDGEMENTS

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THE SPRINKLES FORMULATION WAS AS FOLLOWS	
• 12.5 mg of iron (microencapsulated ferrous fumarate)	
• 300 µg vitamin A (Retinol acetate)	
• 50 mg vitamin C (Ascorbic acid)	
• 160 µg folic acid (Folic acid)	
• 5 mg zinc (Zinc gluconate)	
• 7.5 µg vitamin D3 (Cholecalciferol)	

Fig. 1

BASELINE DEMOGRAPHIC CHARACTERISTICS (N=256)	
Characteristics	
Sex, %	
Boys	53.5
Girls	46.5
Age, months <sup>1</sup>	20.4±8.1
6-12 mo, %	18.0
12-24 mo, %	46.1
24-36 mo, %	35.9
<sup>1</sup> Mean + SD	

Fig. 2

WEANING PRACTICES (N=256) AT BASELINE	
Characteristics	
Weaning meals given per day <sup>1</sup>	3.3±0.8
Age of weaning, %	
4-5 months	12.1
6 months	47.3
7-8 months	25.8
> 9 months	14.8
Coverage of iodized salt, %	19.9
Ever received iron supplementation, %	5.1
Last dose given in months <sup>1</sup>	3.6±2.2
Ever received vitamin A capsule, %	94.1
Last dose given in months <sup>1</sup>	4.0±0
Ever received deworming syrup/tablet, %	10.9
Last dose given in months <sup>1</sup>	4.3±3.0
<sup>1</sup> Mean + SD	

Fig. 3

SCORES FOR CHILD APPETITE AND LEVEL OF ACTIVITY DURING THE TRIAL (N=240)		
Characteristics	Baseline	End
Appetite <sup>1</sup>	1.52±0.84	1.50±0.77
Level of activity or playfulness <sup>2</sup>	1.45±0.78	1.46±0.71
Appetite rating, %		
Extremely good	65.0	63.3
Somewhat good	22.9	25.4
Neither good nor bad	8.8	9.2
Somewhat bad	2.1	1.7
Extremely bad	1.3	0.4
Level of activity or playfulness, %		
Extremely active	69.2	64.6
Somewhat active	20.8	26.3
Neither active nor inactive	6.7	7.9
Somewhat inactive	2.9	0.8
Extremely inactive	0.4	0.4

<sup>1</sup>Mean scores were based on a 5-point scale: 1=extremely good; 2=somewhat good; 3=neither good nor bad; 4=somewhat bad; 5=extremely bad.  
<sup>2</sup>Mean scores were based on a 5-point scale: 1=extremely active; 2=somewhat active; 3=neither active nor inactive; 4=somewhat inactive; 5=extremely inactive.

Fig. 4

ANTHROPOMETRIC INDICATORS AT BASELINE AND END OF INTERVENTION			
Characteristics	Baseline	End	P-value for difference
Length, cm <sup>1</sup>	77.6±7.0	77.6±6.9	0.9
Weight, kg <sup>1</sup>	9.5±1.7	10.0±1.8	0.0001
Z-scores <sup>2</sup>			
Height-for-age	-1.49±1.43	-1.50±1.43	0.900
Weight-for-age	-1.54±1.17	-1.12±1.22	0.0001
Weight-for-height	-0.79±0.93	-0.24±0.97	0.0001
Wasting, % <sup>3</sup>	7.4	2.5	0.001
Stunting, % <sup>3</sup>	34.8	34.6	1.000
Underweight, % <sup>3</sup>	40.6	22.1	0.0001

<sup>1</sup>Mean + SD  
<sup>2</sup>Scores were calculated by using EPI-INFO (version 6.0; Centers for Disease Control and Prevention, Atlanta).  
<sup>3</sup>Recent wasting, stunting and underweight were calculated based on weight-for-height < -2, height-for-age < -2 and weight-for-age < -2, respectively.

Fig. 5

HEMATOLOGICAL CHARACTERISTICS OF CHILDREN AT BASELINE AND END OF INTERVENTION			
Characteristics	Baseline	End	P-value for difference
Hemoglobin, g/L <sup>1</sup>	95.0±12.9	109.5±12.2	0.0001
Anemia (Hb<110g/L), %	85.8	50.8	0.0001
<sup>1</sup> Mean + SD			

Fig. 6

HEMOGLOBIN CONCENTRATIONS AND THE PREVALENCE OF ANEMIA BY LEVEL OF COMPLIANCE (% OF SPRINKLES™ CONSUMED)		
Compliance (%)	Anemia (%)	Hemoglobin (g/L)
≤ 50	76	102.4±13.4
50-75	54	09.4±12.4
75-100	43	111.3±11.3
P-value	0.007 <sup>1</sup>	0.004 <sup>2</sup>

<sup>1</sup>=chi-square test; <sup>2</sup>=ANOVA

Fig. 7