

## REFERENCES

1. UNICEF. *The State of World's Children*, New York, 1993.
2. World Health Organization. *A manual for the treatment of diarrhoea*. Program for Control of Diarrhoeal Diseases. 1990, Geneva WHO/CDD/SER/80.2 Rev.2.
3. Rahman MM, Aziz KMS, Patwari Y, Munshi MH. Diarrhoea mortality in two Bangladesh villages with and without community based oral rehydration therapy. *Lancet*, 1979; (2):809-12.
4. WHO and UNICEF recommended new oral rehydration salts (ORS) formulation. *Bull Pan Am Health Organ*, 1985; 19(1):99-101.
5. Avery ME, Snyder JD. Oral therapy for acute diarrhoea. The underused simple solution. *N Engl J Med*, 1990; 323:891-4.
6. World Health Organization. *Ninth program report*. Program for Control of Diarrhoeal Diseases. 1992, Geneva WHO/CDD.
7. NCDDP/UNICEF/WHO. *Diarrhoea management in the home. A survey of household case management Oct-Dec, 1990*, Dhaka, Bangladesh, 1991.
8. Poudyal L, Rita T. Home made oral rehydration solution: Feasibility study in Nepal. *WHO Chron*, 1980;34: 496-7.
9. Levine MM, Hughes TP, Black RE, Islam MR. Variability of sodium and sucrose level in simple sugar salt oral rehydration solution prepared under optimal and field condition. *J Pediatr*, 1980; 97:324-7.
10. de Zoysa I, Kirkwood B, Fechem R, Landsay-Smith E. Preparation of sugar salt solution. *Trans R Soc Trop Med Hyg*, 1984; 78:260-2.
11. UNHCR. *Results of household survey among Afghan refugees: Conducted by UNHCR Survey Team in NWF Province, Pakistan*, 1989; Mar-Jun.
12. Molla AM, Sarker SA, Hossain M, Molla A, Greenough WB III. Rice powder electrolyte solution as oral therapy in diarrhoea due to *Vibrio cholerae* and *E.coli*. *Lancet*, 1982; i:1317-9.

13. Molla AM, Molla A, Bari A. Role of glucose polymer (cereal) in oral rehydration therapy. *Clin Therap*, 1990;12 (suppA) : 113-20.
14. Ho TF, Yip WCL, Tay JSB, Wong HB. Rice water, dextrose-saline solution:a comparative study of osmolality. *J Singapore Pediatr Soc*, 1982; 24:87-91.
15. Patra FC, Mahalanabis D, Jalan KN, Sen A, Banarjee P. Is oral rice electrolytes solution superior to glucose electrolyte solution in infants diarrhoea? *Arch Dis Child*, 1982; 57:910-2.
16. Fayad IM, Hashem M, Duggan C, Rafat M, Bakir M, Fontain O, et al. Comparative efficacy of rice-based and glucose-based oral rehydration salts plus early reintroduction of food. *Lancet*, 1993 Sep; 342:772-5.
17. Tanjin Mirja. *A survey of under-five mortality, Oct-Dec 1992*, NCDDP/WHO.
18. Brown KH, Maclean WC. Nutritional management of acute diarrhoea: An appraisal of alternatives. *Pediatr*, 1984; 73:119-25.
19. Samadi AR, Ahmed SM, Bardhan PK, Huq MI, Islam MR. Treatment of infantile diarrhoea with standard ORS and early introduction of milk feed. *J Trop Pediatr*, 1985 Jun; 31(3):162-6.
20. Murtaza A, Zulfiqur I, Khan SR, Lindblad B, Salgren B, Aperia A. The benefits of the very early introduction of powdered rice and dried edible seeds (dal moong) in the oral rehydration solution during the treatment of acute infectious diarrhoea of infancy. *Acta Pediatr Scand*, 1987; 76:861-4.
21. Behrens R, Aras RY. *Integrating ORT and feeding: Dietary management of diarrhoea at the household level. Report of the International Symposium on food-based ORT therapy*, Karachi, 12-14 Nov. 1989.
22. Auricchio S, De Vizia B, Ciccimarra F, De Cicco N. Studies on intestinal digestion of starch in man. II. Intestinal hydrolysis of amylopectin in infant and children. *Pediatr*, 1967; 39:853-61.
23. De Vizia B, Lischitz C. Digestibility of starch in infants and children. *J Pediatr*, 1975; 992:1225-30.

24. Mahalanabis D. Nitrogen-balance during recovery from secretory diarrhoea of cholera in children. *Am J Clin Nutr*, 1981; 34:1545-51.
25. Molla A, Molla AM, Sarker SA, Greenough WB III. Intake and absorption of nutrients in children with cholera and rotavirus infection during acute diarrhoea and after recovery. *Nutr Res*, 1982; 2:233-9.
26. Jelliffe EFP, Reid F. *Traditional practice concerning dietary management during and after diarrhoea*. WHO/UNICEF Nutritional Support Program, 1986.
27. UNICEF/WHO. *Control of Diarrhoeal Diseases Program, January 1992 - December 1995. Plan of action*. Dhaka Bangladesh, 1993.
28. NCDDP/WHO. *A health facilities survey, Feb 1990*, Dhaka, Bangladesh, 1990.
29. Hirschorn N, Kinzie JL, Islam R, Rahman ASMM. Decrease in net stool output in cholera during intestinal perfusion with glucose-containing solution. *N Engl J Med*, 1968; 179:176-81.
30. \*Pierce NF, Greenough WB III, Rahman MM, Islam R. Replacement of water and electrolytes loss in cholera by an oral glucose-electrolyte solution. *Ann Intern Med*, 1969; 70:1173-81.
31. Mahalanabis D, Patra FC, Jalan K, Sen A, Banarjee P. Use of an oral glucose-electrolyte solution in the treatment of paediatric cholera: a controlled study. *J Trop Pediatr Env Child Health*, 1974; 20:72-7.
32. Sack DA, Chowdhury AKMK, Esuf A, Islam R. Oral rehydration in rotavirus diarrhoea: a double blind comparison of sucrose with glucose electrolyte solution. *Lancet*, 1978; ii:280-7.
33. Rahman ASMM, Bari A, Molla AM, Greenough WB. III. Mother can prepare and use rice-salt oral rehydration solution in rural Bangladesh. *Lancet*, 1985; ii:539-40.
34. Ismail R, Parded N, Darwin S, Nazir M, Mukti S. Home made rice water salt solution for oral rehydration therapy: a field trial. *J Diar Dis Res*, 1986, Mar; 4(1):20-7.

35. Bari A, Rahman ASMM, Molla AM, Greenough WB III. Rice-based oral rehydration solution shown to be better than glucose-ORS as treatment of non-dysenteric diarrhoea in rural Bangladesh. *J Diar Dis Res*, 1989; 7(1&2):1-7.
36. Molla AM, Bari A. Role of cereal-based oral rehydration therapy in persistent diarrhoea in children. *Acta Paediatr Suppl*, 1982; 381:1-4.
37. Rahman ASMM, Bari A, Molla AM. Relative cost-effectiveness of Rice-ORS and Glucose-ORS to treat childhood diarrhoea in rural Bangladesh. *J Diar Dis Res*, 1989; 9(1):24-7.
38. Molla AM, Ahmed SM, Greenough WB III. Rice-based oral rehydration solution decreases the stool volume in acute diarrhoea. *Bull WHO*, 1985; 63(4):751-6.
39. Mehta MN, Suvramaniam S. Comparison of rice water, rice electrolyte solution and glucose electrolyte solution in the management of infantile diarrhoea. *Lancet*, 1986, Apr 12; 1:843-5.
40. Alam AN, Sarker SA, Molla AM, Rahman MM, Greenough WB III. Hydrolysed wheat based oral rehydration solution for acute diarrhoea. *Arch Dis Child*, 1987; 62:440-4.
41. El-Mmugi M, Hegazi E, Galal O, Akkad NE, El-Akbar A, Noor N, et al. Controlled clinical trial on the efficacy of rice powder-based oral rehydration solution on the outcome of acute diarrhoea in infants. *J Paediatr Gastroenterol Nutr* 1988, Jul-Aug; 7(4):572-6.
42. Molla AM, Molla A, Nath SK, Khatun M. Food based oral rehydration salt solution for acute childhood diarrhoea. *Lancet*, 1989, Aug; 2:429-31.
43. Kenya PR, Molla AM, Odongo K, Juma R. Cereal-based oral rehydration solutions. *Arch Dis Child*, 1989, Jul; 64:(7):1032-5.
44. Alam AN, Ahamed T, Khatun M, Molla AM. Effect of food with two oral rehydration therapies: a randomized controlled clinical trial. *Gut*, 1992; 33:560-4.
45. Razafindrakoto O, Ravelomanana N, Randriamiharisona F, Rasoarivao V, Ramialimanana V, Rakotoarimanana DR, et al. Oral rice-based rehydration solution (SRO), alternative of SRO of WHO in acute diarrhoea in malnourished patients. *Arch Fr Paediatr*, 1993, Feb; 50(2):101-5.

46. Gore SM, Fontain O, Pierce NF. Impact of rice based oral rehydration solution on stool output and duration of diarrhoea: meta-analysis of 13 clinical studies. *Br Med J*, 1992; 1.2 vol. 304:267-71.
47. Bhan-MK, Ghai OP, Khoshoo V, Vasudev VS, Bhatnagar S, Arora NK, Rashmi, et al. Efficacy of mung bean (lentil) and pop rice based rehydration solution in comparison to standard glucose electrolyte solution. *J Pediatr Gastroenterol Nutr*, 1987 May-Jun; 6(3):392-9.
48. Santosham M, Foster S, Reid R, Bartrano R, Yolken R, Burns BA, Hashem M. A comparison of rice-based oral rehydration solution and 'early feeding' for the treatment of acute diarrhoea in infants. *J Pediatr*, 1990 Jun; 16(6):868-75.
49. Daniel GS, Pipop J, Lebenthal E. Hydrolysis and absorption of glucose polymer from rice compared with corn in chronic diarrhoea of infancy. *J Pediatr*, 1990; 116:876-81.
50. Lifschitz CH, Torun B, Chew F, Boutton RW, Garza C & Klein PD. Absorption of carbon 13-labeled rice (precooked rice) in milk by infants during acute gastroenteritis. *J Pediatr*, 1991 Apr; 118(4)(Pt 1):526-30.
51. Quader AKAM. *Precooked Rice-ORS: BUET, 1993*. Department of Chemical Engineering, Bangladesh University of Engineering and Technology, Dhaka, Bangladesh, 1993.
52. Felipe MH, Martinez SH, Mathew P, Pietsching B. Rice solution and World Health Organization solution by gastric infusion in high stool output diarrhoea. *Am J Dis Contr*, 1991, Aug; 145:937-43.
53. Martinez SH, Felipe MH, Pietsching B. Efficacy of a rice-based beverage for the management of dehydration caused by acute diarrhoea in children. *Bol Med Hosp Infant Mex*, 1991, Aug; 48:(8) 544-53.
54. Pietsching B, Velasquez-Jones L, Felipe MH, Martinez SH. Acute diarrhoeal diseases: Treatment with carrot-rice viscous solution is more effective than ORS solution. *Monatsschr-Kinderheilkd*, 1992, Jul; 140 (7):426-30.
55. Khin MU, Nyunt NW, Myo K, Mu MH, Tin U, Thane T. Effect of boiled-rice feeding in childhood cholera on clinical outcomes. *Hum Nut Clin Nutr* 1986, Jul; 40(4): 249-54.

56. Molla AM, Molla A, Rohde J, Greenough WB III. Turning off the diarrhoea: the role of food and ORS. *J Pediatr Gastroenterol Nutr*, 1989 Jan, 8(1):81-4.
57. Bhan MK, Ghai OP, Khoshoo V, Vasudev VS, Bhatnagar S, Arora NK. Increased food intake in children with puffed rice-based ORS. *Indian Pediatr*, 1988, Feb; 25(2):193-5.
58. Molla AM, Molla A, Greenough WB III. Does oral rehydration therapy alter food consumption and absorption of nutrients in children with cholera? *J Trop Med Hyg*, 1986 Jun; 89(3):113-7.
59. Bari A, Murphy H, Molla A, Zaidi A. *Phase II summary report: A comparison of home field trial of wheat salt oral rehydration solution (WSS) among Afghan refugee children*. IRC /AKF/AKU, International Rescue Committee, Peshawar, Pakistan, 1992.
60. Crane PK. Hypothesis for mechanism of intestinal active transport of sugars. *Fed Proc*, 1961; 21:891-5.
61. Schedl HP, Clifton JA. Solute and water absorption by the human small intestine. *Nature*, 1963; 199:1264-7.
62. Schultz SG, Zalusky R. Ion transport in isolated rabbit ileum. II The interaction between active sodium and sugar transport. *J Gen Physiol*, 1964; 47:1043-59.
63. World Health Organization. *Seventh program report. Program for Control of Diarrhoeal Diseases*. 1990, Geneva WHO/CDD.
64. Nalin DR, Cash RA, Rahman MM Yunus M. Effect of glycine and glucose on sodium and water absorption in patient with cholera. *Gut*, 1970; 11:768-72.
65. Patra FC, Mahalanabis D, Banarjee P, Jalan KN, Sen A, Mitra K. In search of a super solution: Controlled trial of glycine-glucose oral rehydration solution in infantile diarrhoea. *Acta Pediatr Scand*, 1984 Jan; 73(1):18-21.
66. Santosham M, Burns B, Reid R, Foster S, Bartrano R. Glycine based oral rehydration solution; Reassessment of safety and efficacy. *J Pediatr*, 1986; 109:795-801.
67. Palmer DL, Koster FT, Islam MR, Rahman ASMM. Comparison of sucrose and glucose in the oral electrolyte therapy of cholera and other severe diarrhoea. *N Engl J Med*, 1977; 297:1107-10.

68. Field M. New strategies for treating watery diarrhoea. *N Engl J Med*, 1977; 297:1121-2.
69. Islam MR, Greenough WB III, Rahman MM, Palmer DL. Laban-gur (common salt & brown sugar) oral rehydration solution in the treatment of diarrhoea in adults. *J Trop Med Hyg*, 1980; 83:41-5.
70. Chakraborty J, Eunos M, Sarder A, Rahman ASMM. *Bari mothers: home based 'experts' for home prepared oral rehydration solution*. Report of ICDDR,B, 1982.
71. Faruque ASG, Khaleque AKM. Young childhood diarrhoea management by mothers and village practitioners in rural Bangladesh, *Trop Geogr Med*, 1985, Sep; 37 (3):223-6.
72. Chowdhury AM, Abed FH. Use and safety of home-made oral rehydration solution: An epidemiological evaluation from Bangladesh. *Int J Epidemiol*, 1988, Sep; 17(3): 655-65.
73. Wong HB. Rice water in the management of infantile gastroenteritis in Singapore. *J Singapore Pediatr Soc*, 1981; 23(3-4):113-7.
74. Mohan M, Sethi JS, Daral TS, Mamta S, Bhargava SK, Sachdev HOS. Controlled trial of rice powder and glucose rehydration solution as oral therapy for acute dehydrating diarrhoea in infants. *J Pediatr Gastroenterol Nutr*, 1986, May-Jun; 5(3):423-7.
75. Majumder A, Desai M, Agwanda R. The effectiveness of Wheat-flour based oral rehydration fluid in the early treatment of infantile diarrhoea in Ethiopia. *Ethiopian Med J*, 1986, Apr; 25(2):59-63.
76. Kinoty SN, Wasunna A, Turkish J, Gateere R, Desai M, Agwanda R, et al. A comparison of the efficacy of maize-based ORS and WHO ORS in the treatment of acute childhood diarrhoea at Kenyatta National Hospital Nairobi, Kenya. *East Afr Med J*, 1986, Mar; 63(3):168-75.
77. Kenya PR, Molla AM. *Reports on 'Efficacy of Maize-Salt Solutions for the treatment of childhood diarrhoea'*. Kenyan Medical Research Institute. Cereal based ORT project. 1986, Nairobi, Kenya.
78. Lepage P. Food based oral rehydration salt solution for acute childhood diarrhoea. *Lancet*, 1989 Oct; 2:868-9.

79. Ho TF, Wong HB. Osmolarity of rice water, dextrose-saline solution and formula milk implication in the management of infantile gastroenteritis. *J. Trop Pediatr*, 1986, Apr; 31(12):89-92.
80. Lebenthal E, Lu RB. Glucose polymer in diarrhoea-high calori density nutrients with low osmolality. Editorial. *Pediatr Gastro Nutr*, 1990, Jul;11(1):1-4.
81. Velasquez-Jones L, Becerra FC, Faure A, de Leon M, Koreno H, Maulen I, et al. Clinical experience in Mexico with a new oral rehydration solution with low osmolality. *Clin Therap*, 1990; 12(supp A):85-103.
82. Chowdhury AM, Vaughan JP, Abed FH. Mothers learn to save the lives of children. *World Health Forum*, 1988; 9:239-44.
83. Kenya PR, Bari A, Molla AM. *Reports on the 'Effectiveness of maize-salt solution: A community study in rural kenya'*. KEMRI, Cereal based ORT project. 1989, Nairobi, Kenya.
84. Bari A, Murphy H, Molla A, Zaidi A. *Phase III summary report: Field application of wheat salt oral rehydration solution (WSS) among Afghan refugee population Dec 1992 - Mar 1993*. IRC /AKF/AKU, International Rescue Committee, Peshawar, Pakistan, 1993, March.
85. Tanjin Mirza. *Communication activities in the control of diarrhoeal diseases*. UNICEF, Dhaka, Sep. 1992.
86. Molla AM. *Annual report on 'Rice-ORS: International Centre for Diarrhoeal Diseases Research, Bangladesh'*, Dhaka, 1985.
87. Lwanga SK, Lemeshow S. *Sample size determination in health studies: Practical manual*. World Health Organization, Geneva, 1991.
88. Lachin JM. Introduction of Sample Size Determination and Power Analysis for Clinical Trials. *Controlled Clin Trial*, 1981; 2:93-113.
89. Levin DL, Morris FC. *Essentials of Pediatric Intensive Care*. QMP Inc, St. Louis Missouri, USA22, 1990.
90. Leslie GP, Mary PW. *Foundation of Clinical Research Application to Practice*. Appleton & Lange, Norwalk, Connecticut, 1993; 26:509-14.



## APPENDIX

22.1. Figure 5. TIME SCHEDULE

ACTIVITIES	TIME 1995.....96
	JUL-AUG-SEP-OCT-NOV-DEC-JAN-FEB-MAR-APR-MAY-JUN-
Approval of Protocol in Bangladesh	XXXXXXXXXXXXXXXXXXXX
Setup of study	XXXX
Case selection & Data collection	XXXXXXXXXXXX
Data analysis	XXXXXXXX
Review of Result & Thesis drafting	XXI
Review of thesis by Advisor and Co-advisor	XXXXX
Final thesis preparation and Submission	XXXX

ศูนย์วิทยทรัพยากร  
 จุฬาลงกรณ์มหาวิทยาลัย

22.2.

## FORM 3: DATA FOR STUDY OF EFFICACY OF Pc.R-ORS AND G-ORS

## ADMINISTRATIVE VARIABLES:

Registration No: \_\_\_\_\_

Name \_\_\_\_\_ Location \_\_\_\_\_

SL#	DETAIL VARIABLES	CODE /	RANGE	VAR	VALUE
<u>ON ADMISSION:</u> (00 hour)					
1.	IDentification No		1-160	IDN	_ _ _
2.	AGE of subject in months		1-59	AGE	_ _
3.	SEX:	1=Male		SEX	_
4.	Onset of Diarrhoea-Date	YY MM DD		OSD	_ _ _ _
5.	OnSet of Diarrhoea-Time in h		1-24	ODT	_ _
6.	Admission of Subject-Date	YY MM DD		ASD	_ _ _ _
7.	Admission of Subject-Time in h		1-24	AST	_ _
8.	OnSet of Diarrhoea in h		24-72	OSH	_ _
9.	Last Watery Motion-Time in h		1-24	LWM	_ _
10.	FreQuency of Motion		3 to more	AFQM	_ _
11.	Stool ConsistenCy:	1=Formed 2=Watery		ASCC	_
12.	DeHyDration:	1=No 2=Some		ADHD	_
13.	WeighT in Gram		2500-20000	AWTG	_ _ _ _
14.	WT. / HT % of median of NCHS		71 - 1005%	WPH	_
15.	Stool for MicrosCopy:	1=Yes 2=No		SMC	_
16.	INterVention:	1=R-ORS 2=G-ORS		INV	_
<u>DAY ONE:</u> (24 h)					
17.	Data of Record	YY MM DD		ODR	_ _ _ _
18.	Amount of ORT in 24 h in ml			OAO	_ _ _ _
19.	Amount of Stool in 24 h in ml			OAS	_ _ _ _
20.	FreQuency of Motion			OFQM	_ _
21.	Stool ConsistenCy:	1=Formed/No 2=Watery		OSCC	_

SL#	DETAIL VARIABLES	CODE / RANGE	VAR	VALUE
22.	Time of Diarrhoea recover	h (00=not recover)	OTD	_ _
23.	Amount of Vomitus in 24 h	in ml	OAV	_ _ _ _
24.	Amount of Urine in 24 h	in ml	OAU	_ _ _ _
25.	Amount of Food in take in 24	in g	OAF	_ _ _ _
26.	Onset of Food intake in hour	(00=No onset)	OOF	_ _
27.	DeHyDratIon:	1=No 2=Some 3=Severe	ODHD	_
28.	WeighT in Gram		OWTG	_ _ _ _ _
29.	CAUse of Diarrhoea:	1=Non specific 2=E.coli 3=Camphylo 4=Rotavirus 5=Other	CAD	_
30.	OutCoMes:	1=Recover 2=Non-Compliance 3=IV use for Sev. Dehydration/Acidosis/Vomiting 4=Side effect 5=Death related to ORT 6=Continues 7=Drop-out due to Dysentery/Disease/Non-cooperation	OOCM	_
<u>DAY TWO:</u> (48 h)				
31.	Data of Record	YY MM DD	BDR	_ _ _ _
32.	Amount of ORT in 24 h	in ml	BAO	_ _ _ _
33.	Amount of Stool in 24 h	in ml	BAS	_ _ _ _
34.	FreQuency of Motion		BFQM	_ _
35.	Stool ConsistenCy:	1=Formed/No 2=Watery	BSCC	_
36.	Time of Diarrhoea recover	h (00=not recover)	BTD	_ _
37.	Amount of Vomitus in 24 h	in ml	BAV	_ _ _ _
38.	Amount of Urine in 24 h	in ml	BAU	_ _ _ _
39.	Amount of Food in take in 24	in g	BAF	_ _ _ _
40.	Onset of Food intake in hour	(00=No onset)	BOF	_ _
41.	DeHyDratIon:	1=No 2=Some 3=Severe	BDHD	_
42.	WeighT in Gram		BWTG	_ _ _ _ _
43.	OutCoMes:	1=Recover 2=Non-Compliance 3=IV use for Sev. Dehydration/Acidosis/Vomiting 4=Side effect 5=Death related to ORT 6=Continues 7=Drop-out due to Dysentery/Disease/Non-cooperation	BOCM	_

<u>SL#</u>	<u>DETAIL VARIABLES</u>	<u>CODE /</u>	<u>RANGE</u>	<u>VAR</u>	<u>VALUE</u>
	DAY Three: (72 h)				
44.	Data of Record	YY MM DD		TDR	_ _ _ _
45.	Amount of ORT in 24 h		in ml	TAO	_ _ _ _
46.	Amount of Stool in 24 h		in ml	TAS	_ _ _ _
47.	FreQuency of Motion			TFQM	_ _
48.	Stool ConsistenCy:	1=Formed/No	2=Watery	TSCC	_
49.	Time of Diarrhoea recover		h (00=not recover)	TTD	_ _
50.	Amount of Vomitus in 24 h		in ml	TAV	_ _ _ _
51.	Amount of Urine in 24 h		in ml	TAU	_ _ _ _
52.	Amount of Food in take in 24		in g	TAF	_ _ _ _
53.	Onset of Food intake in hour		(00=No onset)	TOF	_ _
54.	DeHyDration:	1=No	2=Some 3=Severe	TDHD	_
55.	WeighT in Gram			TWTG	_ _ _ _ _
56.	OutCoMes:	1=Recover	2=Non-Compliance	TOCM	_
		3=IV use for Sev. Dehydration/Acidosis/Vomiting			
		4=Side effect 5=Death related to ORT 6=Continues			
		7=Drop-out due to Dysentery/Disease/Non-cooperation			
57.	Duration of Diarrhoea in Hour			DDH	_ _

ศูนย์วิทยทรัพยากร  
จุฬาลงกรณ์มหาวิทยาลัย

## VITAE

Dr. Abdul Bari was borne in april 1, 1950 in Bangladesh. He was graduated in Medicine from the University of Dhaka in 1974. He did PGT at Mitford hospital, Dhaka in 1975. He was health administrator under the Government of Bangladesh (1976-78).

He is interested in child health research specially on diarrhoea & ORT and worked under ICDDR,B (1979-89). He was Co-Investigator of Sugar Salt Solution study, Anthropological study of R-ORS, Measles associated diarrhoea, Feasibility of rice salt solution, Cost-effectiveness of R-ORS. He was PI. of Effectiveness of R-ORS, Nutritional impact and Safety of R-ORS. He was Co-Investigator of PhD thesis data collection on Breast feeding, infant growth and maternal nutrition under Prof. David Morley, University of London (1985-86). He was Visiting Research Fellow of Child Survival Project of IPDP in Australian National University (1986-87). He was Collaborative Investigator of Maize-salt sol. study in Kenyan Medical Research Institute (KEMRI) (1987-90). He was Consultant for Cereal based ORT data analysis in the Aga Khan University, Karachi, Pakistan (1989). He was Project Director of Wheat-salt solution study program for Afghan refugees, sponsored by IRC, AKF & AKU (1991-93).

He developed protocol on Logistic constraints of R-ORS under UNICEF (1993). He gave technical support to the department of Chemical Engineering, BUET Dhaka to develop a precooked Rice-ORS with low GP (1990). He joined Master's Program in Health Develoment under Thai CERTC Consortium (1993) and developed thesis proposal entitled efficacy of precooked Rice-ORS. He tested the precooked R-ORS concerning the shelf life and safety on healthy adult volunteers (1995). He has several publications in indexed medical journals. He joined many national and international seminar and conference on child survival program.