

ODIISEY/RICH LEGACY

Obesity **D**eterminants in **I**ndians and **I**ndo-**C**anadians:
Social and **E**nvironmental effects on children & **Y**outh/
Research in **I**nternational **C**ardiovascular **H**ealth:
Lifestyle, **E**nvironment & **G**enetic **A**tttributes in
Children & **Y**outh

A collaboration between Canadians and Indians

Zubin Punthakee

Scott Lear

Katherine Morrison

Clara Chow

Guillaume Pare

Milan Gupta

Janice Pogue

Koon Teo

Salim Yusuf

Mario Vaz

Sumathi Swaminathan

Manu Raj

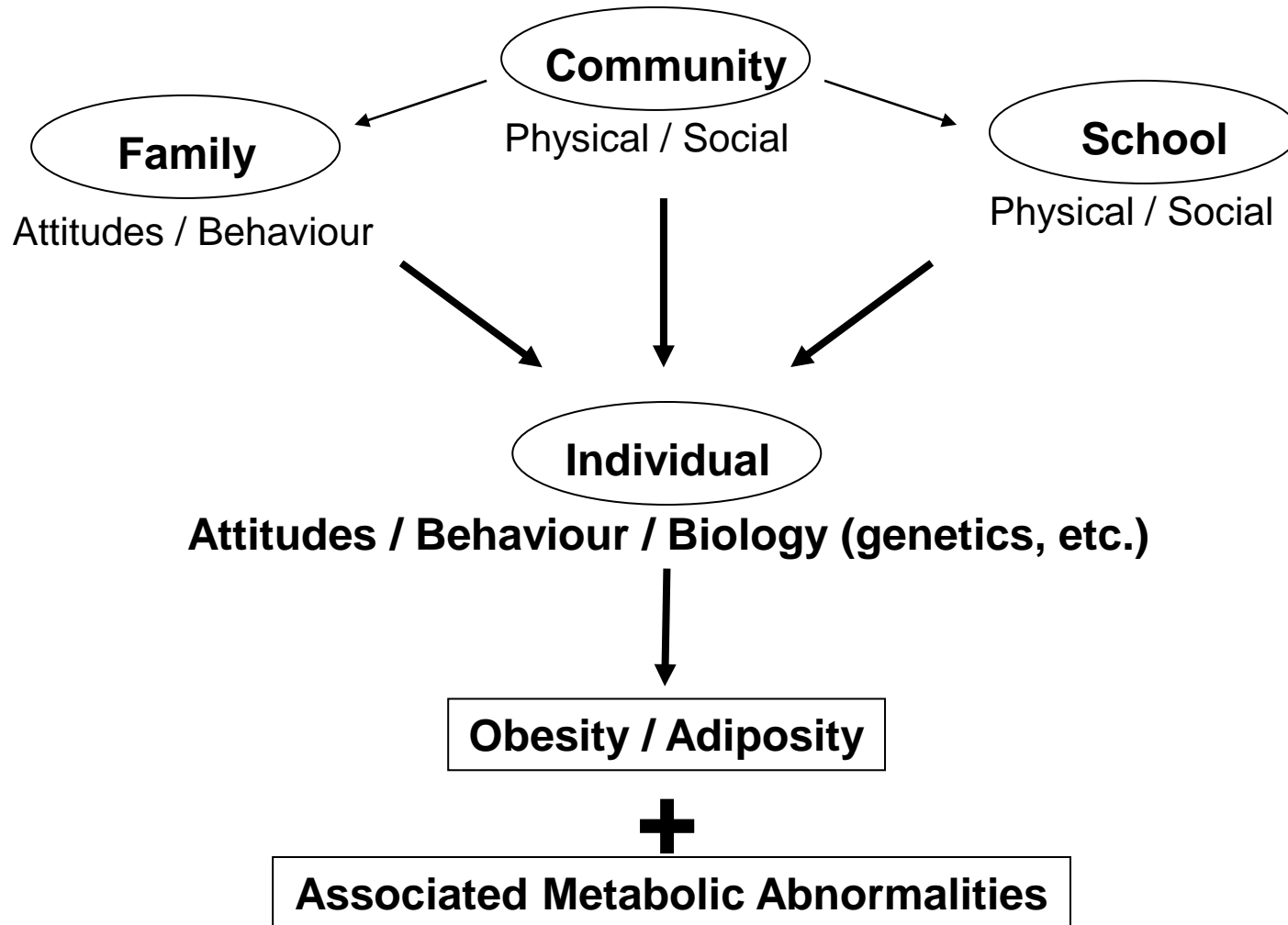
Rebecca Raj

Divya Rajaraman

Tinku Thomas

Kiruba Sankar

Theoretical Model



Hypothesis

Individual, familial, and school characteristics associated with “Westernization” are linked to adiposity and the associated metabolic abnormalities in South Asian children.

Objectives

- To characterize differences in body composition (BMI, W/HtR, %fat) of South Asian children in progressively Westernized settings (rural & urban India and in Canada)
 - To analyze whether individual-, family-, and school-level determinants of body composition are determined by the degree of Westernization
 - To explore the degree to which the relationship between body composition and metabolic health markers (glucose, IR, lipids and BP) are determined by the degree of Westernization
-

Participants & Recruitment

- Multistage convenience sampling
 - Schools, classes, all students**
 - Informed consent
- Sampling frame
 - 7-8 and 14-15 year olds of South Asian origin
 - Broad range of SES and geography

 - Students were drawn from:
 - 27 schools in Canada, 23 schools in India

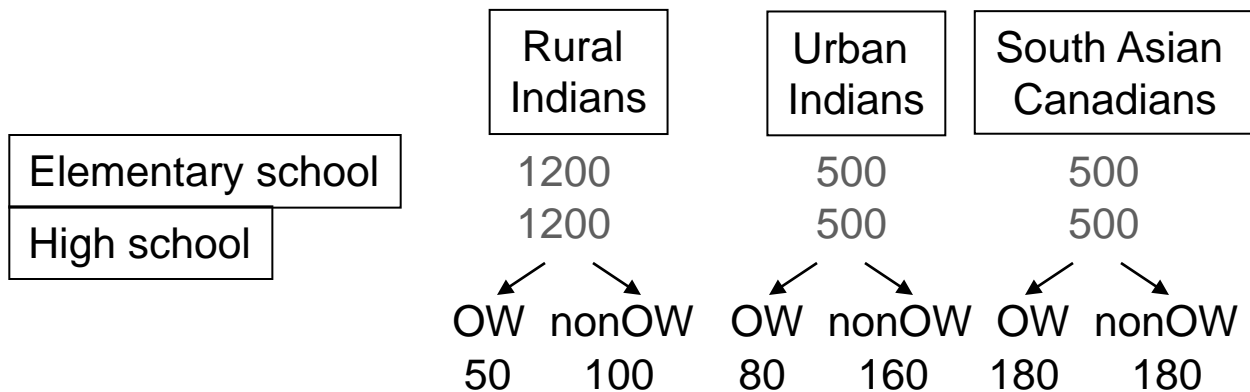
** Due to school strikes in BC: Temples, community centres, fairs

Step 1: Cross-sectional school-based study

	Rural Indians (near Bangalore)	Urban Indians (Bangalore)	South Asian Canadians (Brampton & Vancouver)	
Elementary school (7-8 y)	1200	500	500	Σ 4400
High school (14-15 years)	1200	500	500	

- Interview questionnaires:
 - Diet, activity, acculturation, body image, tobacco in 14-15 y/o
- Physical exam:
 - BMI, BIA %fat, waist circ., arm circ., grip strength, BP
- Saliva for genetics
- Objective community assessments:
 - School (policies, facilities, practices)
 - Community surrounding school (0.5km walk – food & activity opportunities, safety)

Step 2: Detailed subset study



Σ 1110

- Interview questionnaires:
 - Child: Perceptions & attitudes, peer influence, food security, access
 - Parent: SES, feeding practices, parental diet & activity, household structure & amenities, child's activity temperament
- Blood test:
 - Fasting glucose, insulin, lipid profile
- Detailed tests in a subset:
 - DEXA for regional fat distribution; accelerometry

Study Outcomes (dependent variables)

- Primary outcome
 - BMI Z-score (Age- Sex-specific, WHO reference)
 - Secondary outcomes
 - Waist/Height ratio, % body fat,
 - BP, fasting glucose, insulin, LDL, HDL, TG
-

Analysis

- Univariate & multivariable association of determinants with BMI, WHtR, %fat
 - Exploring effect modification by setting
 - Accounting for school-level clustering
 - Explore how the effects of determinants are related to one another
 - Using Structural Equation Modelling
-

Summary of Recruitment & Data

	India Rural	India Urban	Canada South Asian	Canada Non-South Asian
Overall study				
Planned	2400	1000	1000	1000
Amended	750	750	750	0 (no grant \$)
Completed	771	716	762 482/280	89
BMI, WC, HC, %fat, BP	100%	100%	100%	
Diet, activity, SES, attitudes	100%	100%	100%	
School food & activity env't	100%	100%	~85%	
Voluntary subset	153 (20%)	220 (31%)	296 (39%)	
Home food & activity env't	100%	100%	100%	
Lipids, glucose, insulin	~80%	~80%	34%	

Participation Rates

	Identified	Contacted	Completed
India	3858	2185 (57%)	1491 (39%)
Canada (Peel)	~4150*	1664 (25%)	555 (13%)

* Estimated South Asians from 6679 total identified and 57% of Peel students have home language other than English

Comparison of Indians & Canadians

	Rural India N=771	Urban India N=716	Canadian SA N=702
Age group - 7-8 years	55%	65%	77%
Sex - Female	39%	50%	52%
Mom College/Univ	9%	29%	71%
Dad College/Univ	18%	35%	67%
Sleep time (h/day)	9.0 (8.3, 9.5)	9.6 (8.8, 10.4)	10.0 (9.4, 10.6)
Screen time (min/day)	60 (47, 90)	60 (45, 120)	137 (86, 191)
PA out of school (min/day)	21 (9, 34)	30 (11, 51)	4 (0, 21)
PA in school (min/day)	36 (30, 43)	32 (28, 48)	26 (20, 43)
Intake (daily median)			
Sweets	1.2 (0.7, 2.2)	3.0 (1.7, 7.2)	7.0 (3.5, 11.0)
Juice & sugared drinks	0.2 (0.2, 1.0)	1.0 (0.46, 1.0)	7.0 (2.0, 7.0)
Fast food	0.5 (0.2, 1.0)	1.0 (0.2, 1.0)	0.7 (0.2, 1.0)
Vegetables	5.0 (4.2, 6.5)	11.0 (8.0, 17.0)	12.0 (7.0, 17.0)
Fruits	2.0 (1.0, 3.0)	4.0 (1.0, 7.0)	7.0 (7.0, 14.0)

Comparison of Indians & Canadians

	Rural India N=771	Urban India N=716	Canadian SA N=702
Height (cm)	139 ± 19	136 ± 18	137 ± 16
Weight (kg)	32 ± 14	33 ± 14	36 ± 15
BMI (kg/m ²)			18.1 ± 4
BMI Z-score	-1.07 ± 1.30	-0.46 ± 1.36	0.5 ± 1.4
OW/Obese	7%	15%	37%
Waist circ (cm)	55 ± 9	56 ± 9	63 ± 11
Hip circ. (cm)	69 ± 12	71 ± 13	74 ± 12
Waist/Hip ratio	0.80 ± 0.05	0.79 ± 0.06	0.8 ± 0.1
Waist/Height ratio	0.40 ± 0.04	0.41 ± 0.04	0.5 ± 0.1
SBP (mmHg)	103 ± 12	100 ± 12	109 ± 11
DBP (mmHg)	67 ± 8	65 ± 9	65 ± 8
Grip Strength (kg)	12.4 ± 10.3	11.6 ± 8.8	13.9 ± 7.6

Limitations

- Volunteers for main study from schools
 - Volunteers for subset from main study
 - Volunteers for blood sampling from subset
-

Comparison with what is published

Study	RICH LEGACY	CHBSAC*	Peel Public Health
Year(s)	2011-2015	2010	2011
Population	Peel & Vancouver South Asian	Canada South Asian	Peel (22% South Asian)
Ages (y)	7,8,14,15	10-15	12-17
Response rate (%)	~13%	39%	58%
Method	Measured	Self-report	Measured
BMI Z-score	0.45 [0.34-0.56]	0.05 [0.04-0.06]	
% Ow/Ob	36.4% [32.7-40.2]		32.1%

*Canadian Health Behaviour in School-Aged Children study

Comparing START & RICH LEGACY

	START 1y	START 2y	START 3y	RL 7-8y	RL 14-15y
N	1002	1002	1002	590	172
WHtR	0.58 (0.04)		0.50 (0.04)	0.46 (0.06)	0.45 (0.07)
WHtR >0.5	95.9%		46.1%	20.2%	27.7%
BIA %fat			23.4 (8.3)	23.5 (7.3)	24.2 (8.8)
High S Bev >5/w	22.3%	32.2%		65.6%	49.7%
Sleep (hr/night)		9.8 (1.1)	10.1 (1.1)	10.2 (.5)	11.6 (3.8)
PA (min/d)		205 (97)	204 (90)	50 (39)	101 (64)
Screen (min/d)		93 (72)	131 (73)	144 (84)	186 (138)
Moms (n)	1012			220	76
High S Bev >5/w	39.9%			20.6%	18.0%
High S Treat >5/w	80.8%			27.4%	32.0%

Barriers

% very often		7-8y	14-15y	% very often		7-8y	14-15y
What makes you eat unhealthy foods?			What stops you from being more physically active?				
Eating with friends	0.7%	9.3%	No time due to homework	2.4%	8.1%		
Eating at home	5%	10%	No time due to household work	0.3%	0.6%		
Eating at school	1.7%	8%	Prefer TV/computer/videogames	6%	11%		
Eating outside	6%	16%	No convenient space to play	1.0%	1.7%		
Unhealthy food tastes good	17%	25%	Not safe to play outside	1.9%	1.2%		
Tempted by TV and ads	7%	5%	No friends to play with	2.7%	2.9%		
Parents time constraints	1.0%	1.7%	No interest/lazy	1.2%	6.4%		
My time constraints	0.7%	3.5%	No energy	1.2%	2.3%		
Other	2.4%	4.7%	Too tiring	1.4%	2.9%		
			Bad weather	7.3%	7.0%		
			Parents/relatives discourage	1.5%	0.0%		
			Other	2.4%	1.7%		

Acculturation and Diet

Modified ARIMSA II Acculturation questionnaire
Modified INTERHEART FFQ

N= 762

From Brampton	63%
Postsecondary Education	
Mother	70%
Father	65%
Western culture score	35 ± 4.7
Traditional culture score	27 ± 4.4
Length of Residency (years)	8.4 ± 3.3
Generation	
1 st	24%
2 nd	76%
3 rd	1%

Vegetarians	24%
Non-Vegetarians	76%
Daily servings:	
Fruit and Veg	3.2 ± 1.9
Dairy	2.0 ± 1.1
Whole Grains	1.3 ± 1.1
Refined Grains	0.7 ± 0.7
Meats	0.9 ± 0.9
Fast foods	0.9 ± 0.8
Sweets	1.2 ± 1.2
Sugared drinks	1.0 ± 0.9

Acculturation and Diet

Pearson r (p-value)	Whole Grains	Dairy	Fruit & Veg	Sugared drinks	Sweets	Fast foods	Meats	Refined Grains
Whole Grains								
Dairy	0.22 (<0.001)							
Fruit & Veg	0.21 (<0.001)	0.17 (<0.001)						
Sugared drinks	-0.03 (0.47)	0.05 (0.20)	0.03 (0.40)					
Sweets	-0.001 (0.10)	-0.003 (0.94)	-0.01 (0.76)	0.17 (<0.001)				
Fast foods	-0.05 (0.20)	0.02 (0.56)	0.04 (0.32)	0.25 (<0.001)	0.38 (<0.001)			
Meats	-0.01 (0.89)	-0.001 (0.98)	0.10 (0.01)	0.05 (0.17)	-0.02 (0.51)	0.24 (<0.001)		
Refined Grains	-0.23 (<0.001)	0.04 (0.25)	0.03 (0.43)	0.01 (0.75)	0.02 (0.57)	0.07 (0.05)	0.14 (<0.001)	



Figure 1. Relationship between intakes from different food categories.
 Bolded text indicates significant correlations (Bonferroni $p < 0.002$)

Acculturation and Diet

	Traditional Score		Western Score		Length of Residency		Generation	
	Pearson partial r	p	Pearson partial r	p	Pearson partial r	p	Spearman partial r	p
Whole grains	0.12	0.001	-0.1	0.008	-0.07	0.07	-0.09	0.02
Dairy	-0.06	0.15	0.06	0.14	0.09	0.02	0.11	0.006
Fruits and Veg	0.1	0.008	0.02	0.57	-0.05	0.24	-0.02	0.59
Sugared drinks	0.02	0.49	0.04	0.37	0.009	0.81	0.07	0.06
Sweets	-0.04	0.31	0.14	<0.001	0.03	0.46	0.01	0.79
Fast foods	0.07	0.07	0.14	<0.001	-0.02	0.67	0.07	0.06
Meats	-0.14	<0.001	0.23	<0.001	-0.02	0.54	-0.07	0.07
Refined grains	-0.05	0.23	0.07	0.07	0.009	0.81	0.05	0.18

Adjusted for age, sex, site of enrolment (Surrey or Brampton) and maternal and paternal education (post-secondary or not). Bolded text indicates significant correlations (Bonferroni $p < 0.002$)