Outline of Paper #01 (2012-10-31)

Rationale

* In India, it is estimated that 25 million people are affected by osteoporosis 1 Fractures due to reduced bone strengths and mass is a major cause of morbidity and mortality 2 .
* A significant portion of bone development occurs before the age of 20. Therefore, it is essential to provide interventions from early on in life, so that optimal peak bone mass is achieved as young adults.
* Past nutritional interventions have consistently shown differential effects on total body, lumbar spine, or hip bones. Some studies have also reported differences in BMD and BMC at these sites 3 4 5 and BMC is more appropriate for developmental studies 6 .
* While numerous studies have focused on the effects of early life calcium and vitamin D intake on bone mass, there are very few longitudinal studies focusing on early life protein-energy supplementation and BMD/BMC 7 .
* Our study will examine the association between fetal and early life protein-calorie supplementation and bone health as young adults in India while at the same time examining whether there is a differential effect on total body, lumbar spine, or hip BMD or BMC.

Objectives

<u>General Objectives:</u>

* To examine whether fetal and early life nutritional supplementation have an effect on bone health in young adults in India.

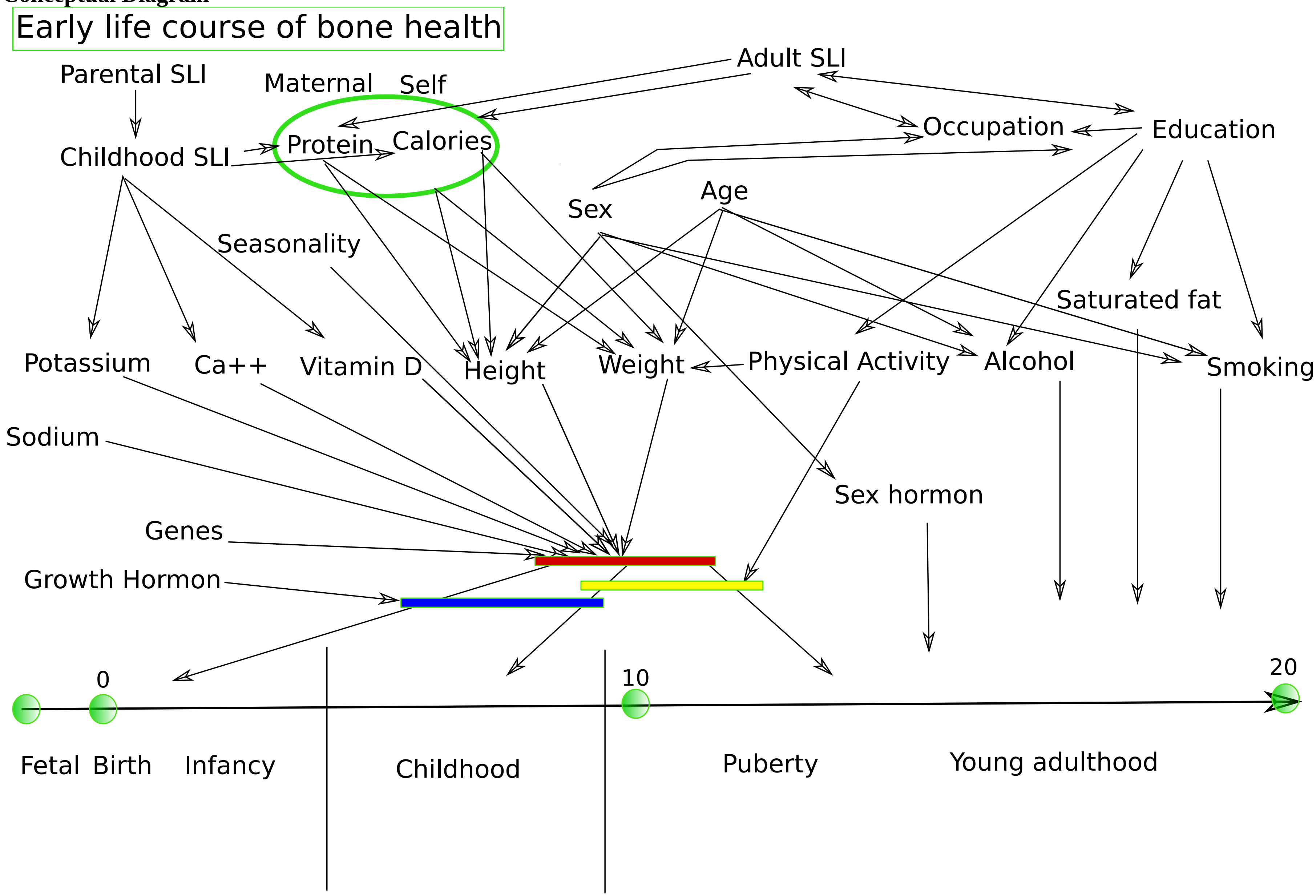
<u>Specific Objectives:</u>

* To examine whether early life supplemental nutrition has an effect on bone mineral density and bone mineral content in young adults, controlling for age, sex, socioeconomic status, education level, occupation, calcium level (and/or vitamin D intake), dietary energy intake, smoking, physical activities, and heights.
* To examine whether these is a difference between hip and spinal bone density or mass.

Null hypotheses

* There is no difference between those who received interventions and those who did not receive interventions.
* There is no difference between the effects of intervention on BMD and BMC.
* There is no difference between the effects of intervention on hip and spine.
* There is no difference between this population's BMD or BMC distribution and that of developed countries.

Conceptual Diagram



Dummy Tables

Table 1

Distribution of key exposures in participants who completed clinic questionnaires for the follow-up Hyderabad Nutrition Trial Study. Values are numbers (percentages) of participants unless stated otherwise.

	Intervention area (n=)	Control area (n=)	p-value
Mean age (years):	( )	( )	
Male			
Education No formal education			
Primary (1–4)			
Secondary (5–12)			
Beyond secondary (>12)			
Occupation:			
Housework			
Unemployed			
Manual			
Skilled manual			
Non-manual or professional			
Standard of living index*:			
Low (0–7)			
Middle (8–13)			
High (14–36)			
Tobacco use in any form†:			
Smoked			
Chewed			
Alcohol use‡			
Dietary calcium intake^			

	Intervention area (n=)	Control area (n=)	p-value

*Based on subset of questions from the standard of living index.
†Used on a daily basis any time in past 6 months.

‡Consumed on ≥10 days/month any time in the past 6 months.

^Based on Food Frequency Questionnaire of the participants

Table 2				
Distribution of outcome variables by area of intervention at follow-up in Hyderbad nutrition trial.				
		Mean (SD)		
Body size and composition	No	Intervention	Control	Mean difference* (95% CI) (control minus intervention)
Height				## ( ); p=
Weight				
Body Mass Index (kg/m^2)				
Spinal BMD^				
Hip BMD^				
Spinal BMC^				
Hip BMC^				

* Based on linear regression models with robust standard errors.
^ BMD = Bone Mineral Density; BMC = Bone Mineral Content

Table 3				
Summary of multiple regression models between supplemental nutrition and spinal bone mineral density in the grown up adults. β coefficient (95% CI).				
	Model 1^	Model^	Model 3^	Model 4^
Independent variables				
intervention	x	x	x	x
villages	x	x	x	x
siblings	x	x	x	x
age	x	x	x	x
sex	x	x	x	x
SLI	x	x	x	x
BMI (kg/m^2)	x	x	x	x
calcium intake (unit)			x	x
vitamin D intake (unit)			x	x
physical activities				x
Sample size: n = for XXXX; n = for XXXX * significant at p < .05; ** p < .01; *** p < .001 ^ Outcome measures: bone mineral density for spine or hip (unit).				

Table 4				
Summary of multiple regression models between supplemental nutrition and spinal bone mineral content in the grown up adults. β coefficient (95% CI).				
	Model 1^	Model^	Model 3^	Model 4^
Independent variables				
intervention	x	x	x	x
villages	x	x	x	x
siblings	x	x	x	x
age	x	x	x	x
sex	x	x	x	x
SLI	x	x	x	x
BMI (kg/m^2)	x	x	x	x
calcium intake (unit)			x	x
vitamin D intake (unit)				x
physical activities			x	x
Sample size: n = for XXXX; n = for XXXX * significant at p < .05; ** p < .01; *** p < .001 ^ Outcome measures: bone mineral density for spine or hip (unit).				

Table 3 and 4 in alternative format:

Table ¾ in alternative format

Summary of multiple regression models between supplemental nutrition and spinal bone mineral density (BMD) and bone mineral content (BMC) in the grown up adults. All models included intervention, villages, and siblings. Values are β coefficients (95% CI) for intervention and control groups.

	Model 1[^]	Model[†]	Model 3[‡]	Model 4[•]
Outcome predictors				
Spinal BMD	x	x	x	x
Spinal BMC	x	x	x	x
Hip BMD	x	x	x	x
Hip BMD	x	x	x	x

Sample size: n = for XXXX; n = for XXXX

* significant at p < .05; ** p < .01; *** p < .001

[^] Model 1 controls for age, sex, BMI

[†] Model 2 controls for age, sex, BMI, SLI

[‡] Model 3 controls for age, sex, BMI, SLI, calcium intake as estimated by FFQ, and blood vitamin D level

[•] Model 4 controls for age, sex, BMI, SLI, calcium intake as estimated by FFQ, blood vitamin D level, and physical activities.