Vitamin D supplementation strategies for India

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Global status

Vitamin D deficiency/ insufficiency is a big challenge globally

more so in India!

What is the way out??

Is it sunlight?

Is it food- natural or fortified?

Is it supplementation?

Effect of UV light on serum 25(OH)D levels

25-Hydroxyvitamin [25(OH)D] concentrations under sun-rich living conditions

Reference, year, and subjects	Location	25(OH)D
		nmol/L
Haddock et al (23), 1982	Puerto Rico	
Hospital personnel ($n = 26$)		105
Farmers ($n = 18$)		135
Haddad and Kyung (24), 1971	St Louis	
Lifeguards ($n = 9$)		163
Better et al (25), 1980	Israel	
Lifeguards ($n = 34$)		148

Highest individual serum 25(OH)D levels obtained from sunshine: 225 nmol/l

Vitamin D photosynthesis in Indians

- Indian "pigmented" skin is capable of making Vitamin D but requires longer exposure/ greater UV dose.. (Holick)
- Highest levels in unsupplemented adult Indians about 20 ng/ml (in security forces)
- Mean levels vary between 5 to 15 ng/ml.

Fortification???

Many issues..

Choice of vehicle

How much will get in, will it be enough?

Logistics of fortification, monitoring..

Vitamin D intake needed to achieve optimal 25 OH D level (Dawson Hughes et al, 2005)

- Increment inversely related to initial 25OHD level
- 40 IU (1 mcg) daily raises 25OHD by
  - 1.2 nmol (or 0.5 ng/ml) if deficient
  - 0.7 nmol (or 0.3ng/ml) if basal >70nmol

Dose recommended 800 units /day

Is it adequate for Indians???

Vitamin D intake to attain a desired serum 25(OH)D status
Aloia et al, AJCN, 2008, 1952

- 6 month randomized double blind study- n=138
- Dose adjustment every 2 months
- Target 75 nmol/l; max 220 nmol/l
- Dose required 3800-5000 units/day!!

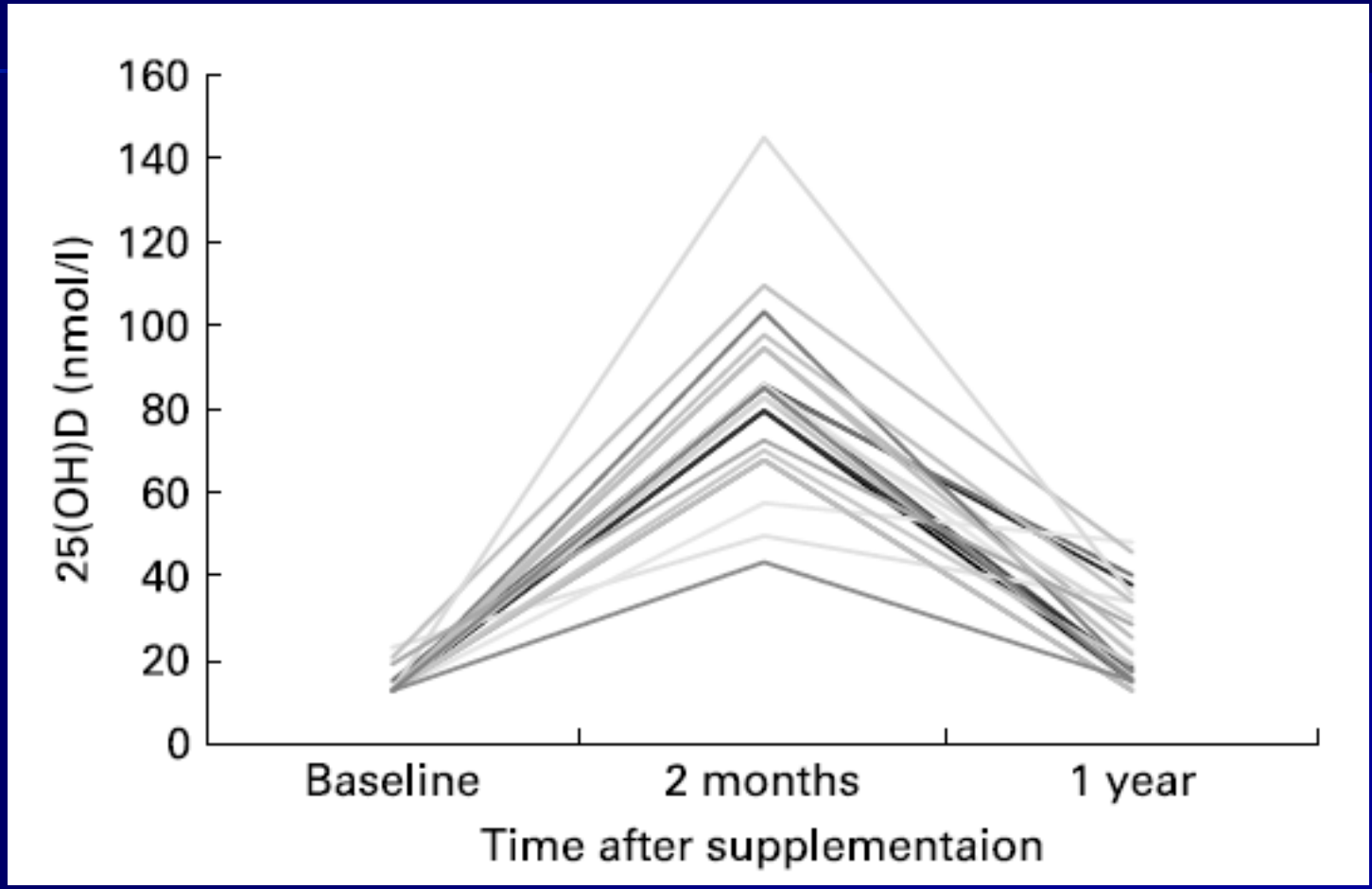
- If the typical serum 25 (OH)D level in Indians is 10 ng/ml…
- And if the target serum 25 (OH)D level is 30 ng/ml…
- ***It would require about 2000 iu/day…..***

- The usual calcium pill has 200 iu of vitamin D
- 2 pills a day equals 400 iu/day
- Grossly inadequate!!

- Studies underway with calcium pills containing 500 iu vit D (1000 iu/day)

Indian studies

Pattern of 25-hydroxy vitamin D response at short (2 month) and long (1 year) interval after 8 weeks of oral supplementation with cholecalciferol in Asian Indians with chronic hypovitaminosis D



Goswami et al, BJN, 2008

Pattern of 25-hydroxy vitamin D response at short (2 month) and long (1 year) interval after 8 weeks of oral supplementation with cholecalciferol in Asian Indians with chronic hypovitaminosis D

- Supplemented with 60,000 IU weekly + 1 g elemental calcium daily for 8 weeks

Table 1. Change in serum Ca, 25-hydroxy vitamin D (25(OH)D) and intact PTH (iPTH) after cholecalciferol (1500 μg (60 000 IU)/week) and Ca (1g/d) supplementation*

(Mean values and standard deviations)

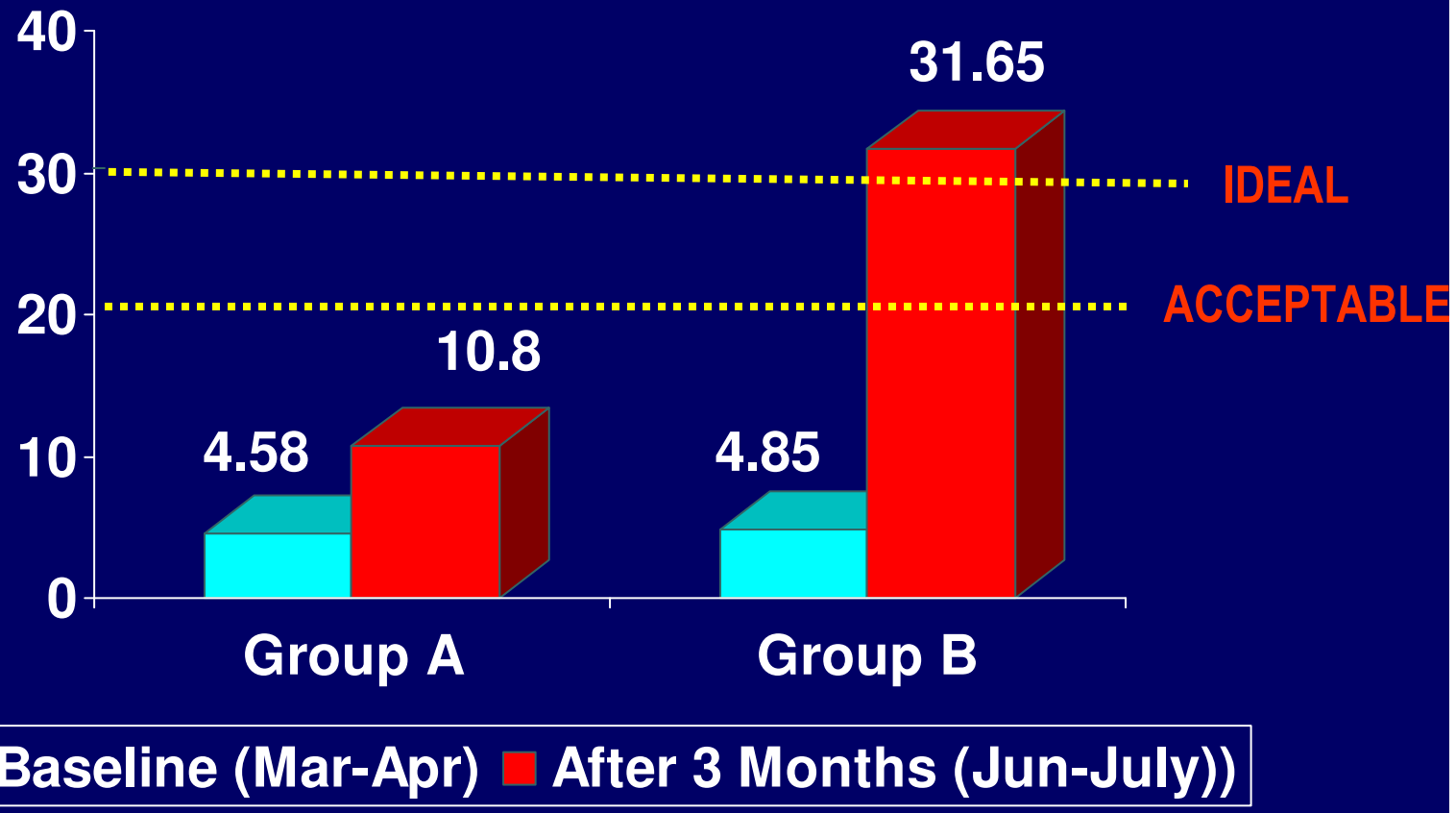
	Baseline (pre-supplementation)		After 8 weeks of supplementation			
			8 weeks		12 months	
Parameters	Mean	SD	Mean	SD	Mean	SD
Serum total Ca (mmol/l)	2·27	0·22	2·22	0·17	2·34	0·17
Serum inorganic P (mg/dl)	1·32	0·13	1·42[a]	0·13	1·29[b]	0·13
Serum alkaline phosphatase (IU/l)	300	118	253	78	252	100
25(OH)D (nmol/l)	13·5[a]	3·0	82·4[b]	20·7	24·7[c]	10·9
Serum iPTH(ng/l)	54[a]	40	29[b]	20	72[a]	32
Supranormal PTH (*n*, %)	7 out of 23 (30·4 %)		0 out of 23 (nil)		14 out of 23 (60·1 %)	

- At 8 weeks. 22 of 23 subjects had 25(OH)D values ≥ 50 nmol/l
- At 1 year all subjects were vitamin D deficient

Goswami et al, 2008

Effect of vitamin D supplementation in young Indian women

60000- 120000 units cholecalciferol/month



Malhotra N ,, Mithal A, Arch Osteoporosis 2009

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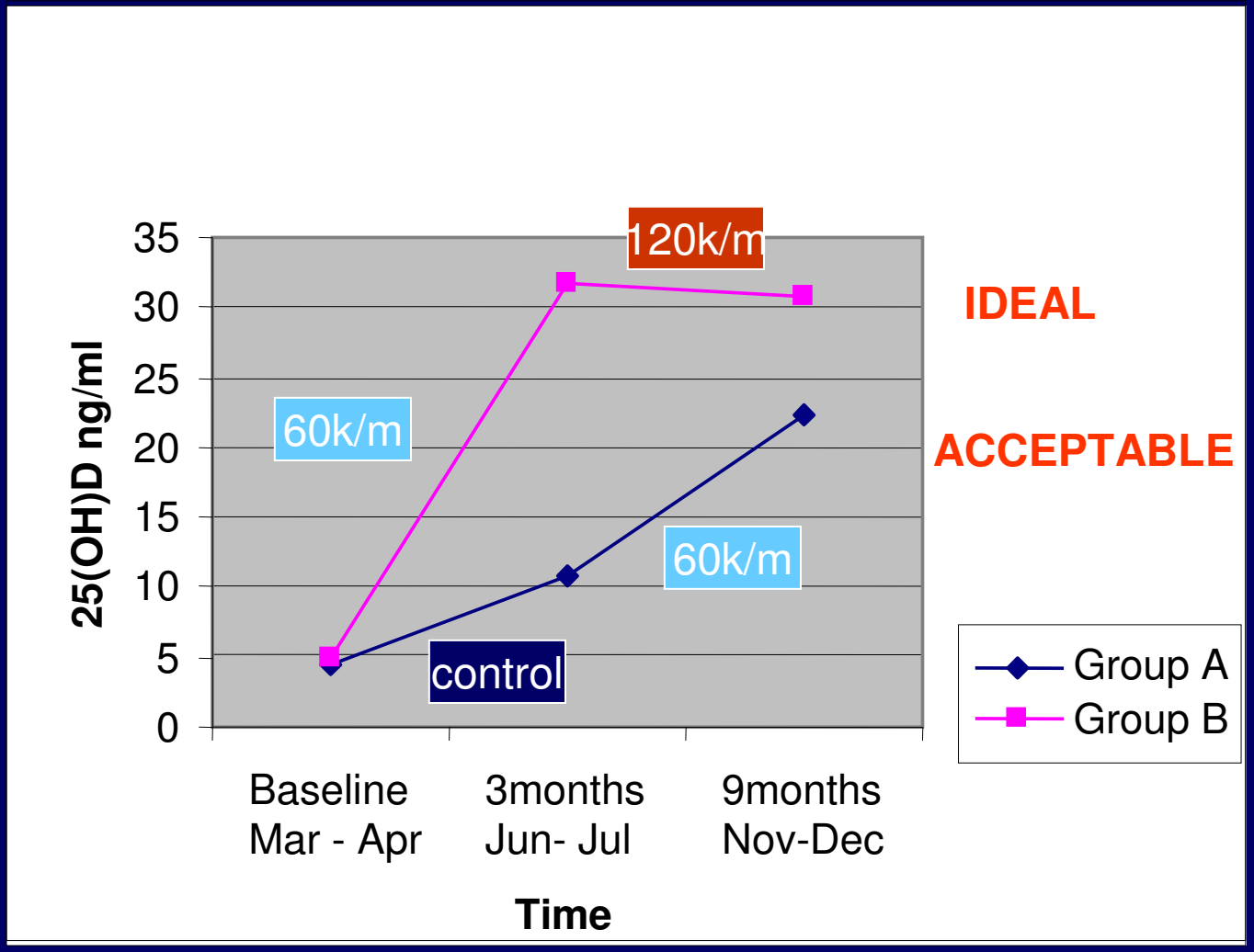

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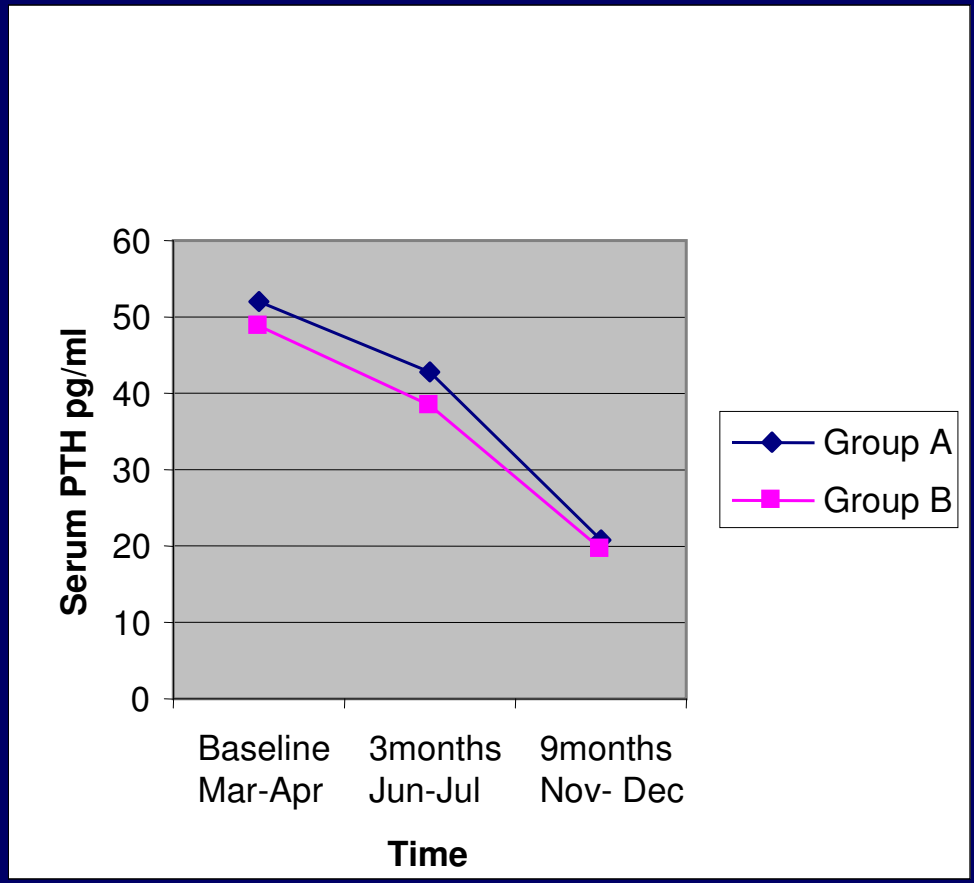
Change in PTH levels



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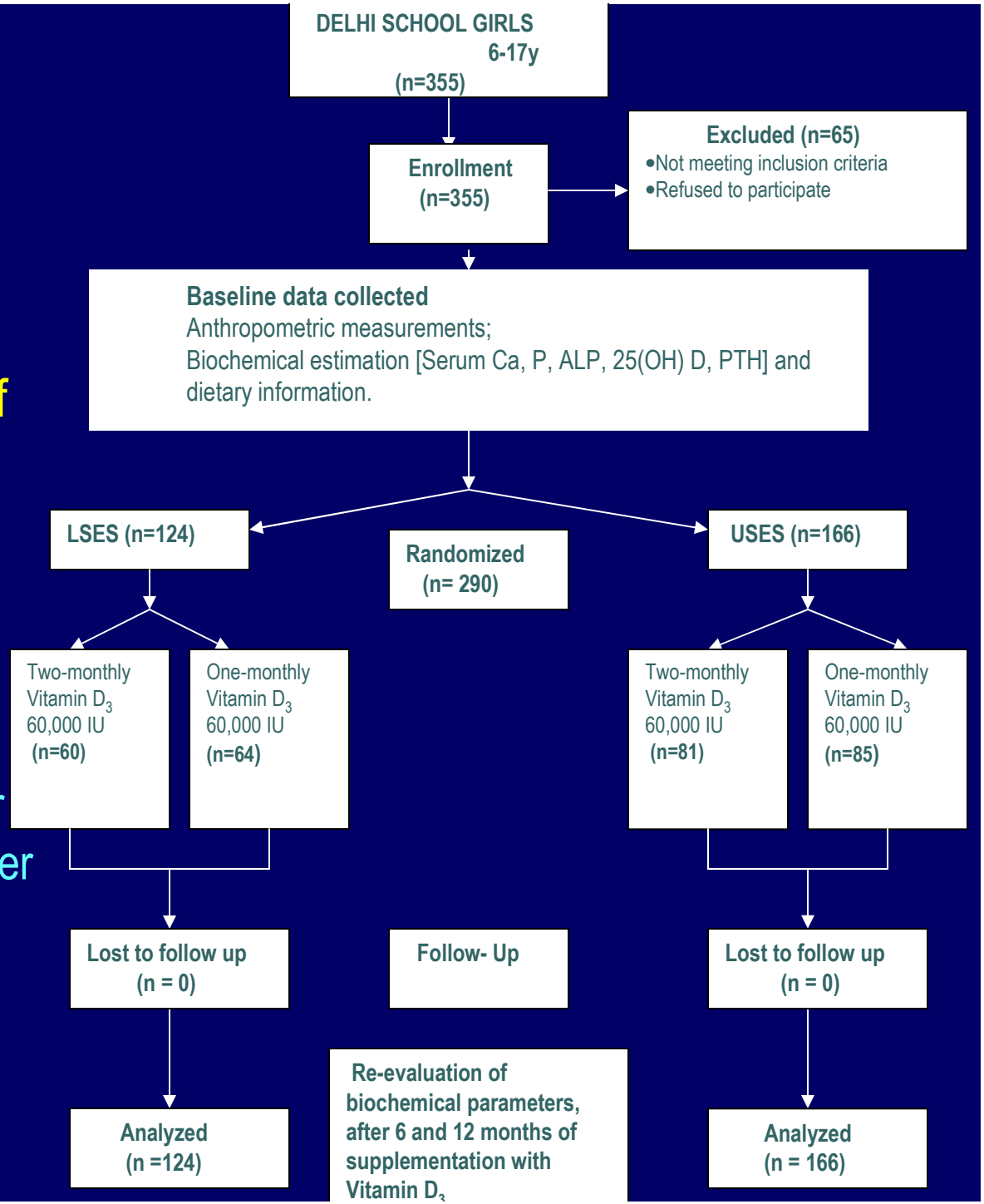
A comparison of 2 regimens of Vitamin D supplementation

- Baseline assessment in summer
- Initiated supplementation in winter
- 6 m re-assessment in summer
- 1 year re-assessment in winter



Indian Pediatrics, accepted

Effect of Vitamin D supplementation on serum 25(OH)D (nmol/l) in LSES and USES subjects, at different time points

	0 (Summer)	6 months (S)	12 months (W)
LSES			
2 monthly D3	31.2 ±1.68	39.5 ±2.01*	53.0 ±3.05#,$
1 monthly D3	32.9 ±1.37	43.9 ±1.5*	59.3 ±2.64 #,$
USES@			
2 monthly D3	29.1 ±1.54	39.5±1.24*	38.2 ±2.13 #
1 monthly D3	30.8 ±1.39	46.8 ±1.45*	49.9 ±2.01 #

@ Mean diff between 2 monthly and 1 monthly groups statistically significant

Maalouf et al, 2008:
14,000 IU
weekly resulted in
increase
from 32 to 95 nmol/l

* = P<0.05 for baseline vs. 6 month; # = P<0.05 for baseline vs. 12 month;
$ = P<0.05 for 6 months vs. 12 month

Indian Pediatrics, accepted

Effect of Vitamin D supplementation on serum 25(OH) D in LSES and USES subjects

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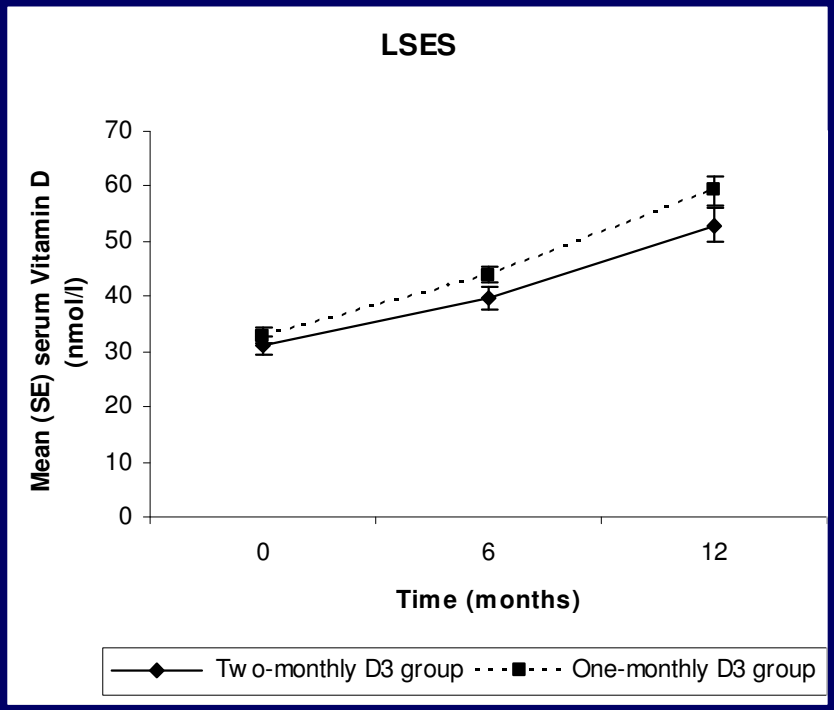

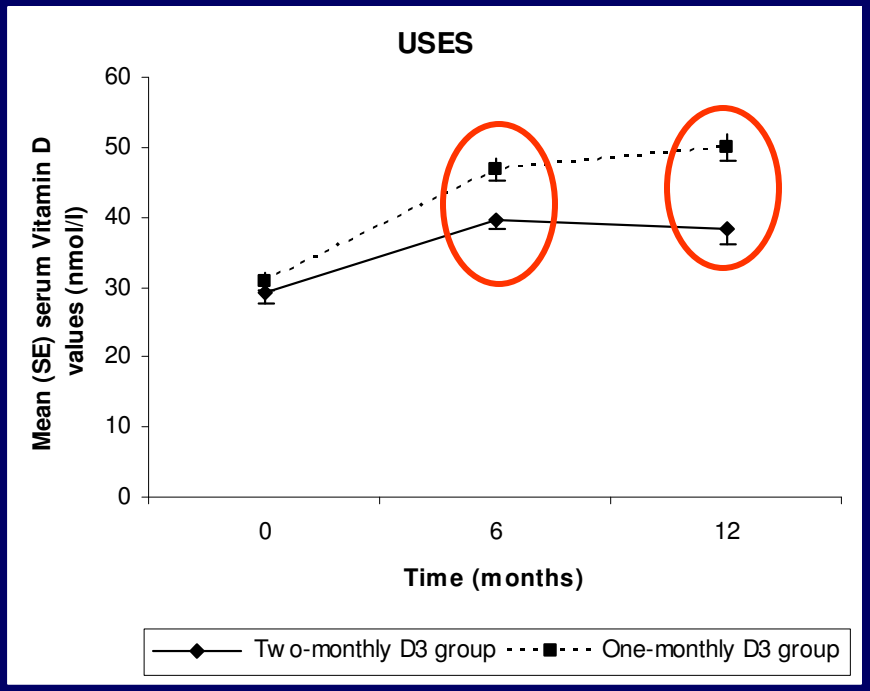

Baseline: 93.7 % school girls were vitamin D deficient [25 (OH) D < 50 nmol/L].

Despite supplementation with 60,000 IU of Vitamin D3 (monthly or two-monthly) only 67.8% LSES and 31.9% USES were vitamin D sufficient at the end of one year.

Supplementation - effect on maternal vitamin D, neonatal anthropometry and Ca

	Group A (no vitamin D) (n = 14)	Group B (one dose of 60 000 U vitamin D) (n = 35)	Group C (two doses of 120 000 U vitamin D each) (n = 35)	P-value
Baseline 25OHD (nmol/l)	25.8 (18.9–30.7)*	33.4 (22.6–47.7)	40.1 (26.9–58.4)	< 0.01
25OHD at delivery (nmol/l)	23.8 (17.2–32.6)	30.9 (24.8–48.1)	53.4 (41.2–88.0)†	< 0.001
Serum calcium at delivery (mmol/l)	2.31 ± 0.18	2.28 ± 0.27	2.29 ± 0.21	0.41
Increment of 25OHD (nmol/l)	0.4 (−6.5–16.8)	−2.1 (−10.7–13.1)	13.4 (0.2–42.0)‡	< 0.01
25OHD > 80 nmol/l at delivery (nmol/l)	1/14 (7%)	2/35 (5.7%)	12/35§ (34.2%)	0.003
25OHD at delivery conducted in winter (nmol/l)	14.9 (n = 1)	26.9 (22.9–33.3) (n = 11)	43.7 (35.3–62.0) (n = 14)	< 0.01§
25OHD > 80 nmol/l at delivery in winter	0/1	0/11	3/14 (21%)	0.23§

Anthropometric indices: Differences persisted at 9 months

Parameter	Group A	Group B	Group C	p
Head circ (cm)	33.6 ± 0.8	34.4 ± 0.6	34.5 ± 0.9	0.000
Length (cm)	49.4 ± 2.4	50.1 ± 0.9	50.3 ± 0.9	0.000
Weight (kg)	2.8 ± 0.4	3.0± 0.4	3.1± 0.4	0.003

Sahu et al, EJCN, 2009

Conclusions

- ***Starvation amidst plenty-***
  abundant sunshine , low 25 OHD levels!!
- Can sunshine be enough for high risk groups ?? Probably not!!
- Fortification ???
- More widespread advocacy of supplemenation???
- Need about 2000 units/day in susceptible groups…