



Nutritional Supplementation, Sleep Patterns and Growth in Short and Lean Prepubertal Children

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BACKGROUND

Growth hormone secretion is affected by duration and quality of sleep. Studies examining the connection between sleep and linear growth have reported conflicting results. Recently, we reported that nutritional supplementation was effective in promoting growth in children [1].

In the present study, we extended our evaluation of the nutritional supplement to assess the association between nutrition, sleep and growth.

OBJECTIVE

To examine whether nutritional supplementation affects sleep patterns and growth.

STUDY DESIGN, PATIENTS & METHODS

Study design Prospective randomized, double-blinded, placebo-controlled study of nutritional supplementation.

Setting Endocrinology Department of a tertiary Pediatric Medical Center

Study cohort 164 healthy, short and lean, pre-pubertal children of middle class families referred to our clinic for growth assessment.

- Formula group – 83 children (66)
- Placebo group – 81 children (61)

Inclusion criteria

- age 3-9 years
- height and weight < 10th percentile for age and gender
- weight percentile ≤ height percentile for age and sex (according to 2000 CDC growth charts).

Exclusion criteria - chronic or gastrointestinal disease, including malabsorption, genetic syndromes, malignancy and any chronic medical treatment.

Main outcome measures Anthropometric measurements (Height-SDS, Weight-SDS and BMI-SDS), sleep pattern [sleep-schedule time questionnaire (SSTQ)] and nutritional intake (3-day food diaries), were assessed at entry and after 6 months intervention.

Methods

Nutritional supplement - formula containing 25% of recommended DRI for calories, high protein (whey protein, 28% of calories), 25% fat (canola oil), 47% carbohydrates, vitamins and minerals.

Placebo - a low-caloric, low-protein formula, without added vitamins and minerals.

Participants were instructed to consume 1 sachet of formula/placebo (4 tablespoons of powder) mixed with 200 ml of water at dinner in addition to their regular diet.

Dietary intake assessment

Parents were asked to record the volume of nutritional supplement the child consumed each day.

- 'Good' consumption = intake of ≥50% of the recommended dose
- 'Poor' consumption = intake of <50%.

All participants' parents were asked to record in a diary, in as much detail as possible, all food and beverages, including portion sizes, consumed over a 3-day period (2 weekdays and 1 weekend) over the week before each clinical visit.

Sleep-schedule time questionnaire (SSTQ)

Self-constructed questionnaire which assesses wake up time, get up time, bedtime, time of lights off, sleep latency, and potential nap duration [2].

Time to sleep, the length of time the child was in bed before falling asleep, was categorized as either 'fast' (up to 15 minutes) or 'slow' (over 15 minutes) [3].

RESULTS

Baseline characteristics were similar in the formula and placebo groups

	Formula, n=83	Placebo, n=81	P
Demographic characteristics			
Gender, male (%)	66 (79.5)	61 (75.3)	NS
Age, years	5.6 ± 1.5	5.6 ± 1.5	NS
Age of mothers, years	35.7 ± 4.6	36.9 ± 4.8	NS
Age of father, years	38.9 ± 5.8	39.4 ± 5.2	NS
No. of children per family, median (IQR)	3 (2,3)	2 (2,3)	NS
Birth order of child studied, median (IQR)	2 (1,3)	2 (1,3)	NS
Anthropometric characteristics			
Height-SDS	-2.01 ± 0.45	-2.02 ± 0.40	NS
Weight-SDS	-2.50 ± 0.56	-2.59 ± 0.68	NS
BMI-SDS	-1.48 ± 0.64	-1.60 ± 0.77	NS
Sleep pattern characteristics			
Sleep duration per day, hours, median (IQR)	10.0 (9.7, 10.6)	10.4 (9.9, 10.8)	NS
Time to sleep, hours, median (IQR)	0.25 (0.08, 0.5)	0.25 (0.08, 0.5)	NS

- In the formula group 'good' consumers (intake of ≥ 50% of the recommended dose) had a shorter sleep latency ($P = 0.046$) compared with 'poor' consumers (intake of < 50%).
- Children with 'fast' time to sleep (< 15 min) improved weight-SDS (0.25 0.34 vs. 0.07 0.36, $P = 0.044$), and tended to improve height-SDS (0.09 0.13 vs. 0.03 0.13, $P = 0.057$) as compared to 'slow' time to sleep.
- In the placebo group, differences in sleep latency and growth measurements were not found.
- Positive correlations were found between mean sleep duration and caloric intake/kg, protein/kg, carbohydrate/kg and fat/kg both, at baseline and after 6 months of intervention.

CONCLUSIONS

Our data suggests that in short and lean pre-pubertal children, better sleep patterns are associated with improved nutritional intake.

Yet to be elucidated are the mechanisms linking between nutritional intake, sleep patterns, and linear growth.

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