ORIGINAL ARTICLE

Growth Faltering of Preschool-Aged Children with Poor Appetite Is Associated with Snacking Behaviors

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Abstract

Background: The association between snacking patterns, sleep hours, and physical activity with growth status and appetite of preschool children was investigated.

Methods: Sixty three children aged 3-7 years with low appetite and weight for age ratio below the 25th percentile were enrolled from those referring to Nader Kazemi Polyclinic in Shiraz. Information regarding the parents' education, sleep hours, physical activity, appetite, and snacking patterns was obtained by interview. Height and weight were measured and energy intake was estimated by 2-day food recall. Appetite was rated on a 5-point scale based on the maternal report.

Results: Mother's education, the number of children in the household, and physical activity were not associated with either growth failure, energy intake, or appetite, but the fathers' education more than Diploma was associated with higher energy intake in children (P=0.015). Children who slept <11 hours a day had higher energy intake (P=0.026) but worse weight status (P=0.015). Children who always ate snacks close to the main meals had significantly higher energy intake but more severe growth failure. High consumption of fruit drinks, cakes, and potato chips was associated with exacerbated growth faltering whereas nuts consumption was related to better height status. None of the evaluated parameters was associated with children's appetite.

Conclusion: Overall, the results suggest the importance of sufficient sleep, limited consumption of snacks, and the type and time of snack consumption in growth of children with poor appetite. Nutritious snacks such as nuts may be more beneficial than nutrient-poor snacks for growth of children.

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Introduction

In order to grow sufficiently, children are at especial need for nutrients. If sufficient quantities of nutrients are not supplied by food or supplements, they may easily suffer from growth retardation. Poor appetite is one of the most common nutritional problems among pre-school children. Children with poor appetite usually have low consumption of food and as a consequence experience deficiencies of energy, protein, vitamins and minerals, all of which are necessary for their growth and development.[1] On the other hand, decrease of food consumption following poor appetite may impair the immune function and increase susceptibility to infections, a condition that intensify nutrition deficiency and growth failure.

Nutritional deficiency is not only a consequence of poor appetite, but also a cause. Deficiencies of energy, protein, iron, zinc, folic acid and other B vitamins may contribute to loss of appetite and subsequent growth failure.[2] In addition to nutritional deficiencies, loss of appetite may be initiated by other factors such as abnormal levels of hormones, specific drugs, diseases, infections, psychological stress such as depression and anxiety, and improper dietary habits.[3] The dietary habits which negatively affect appetite are preferring drinks to foods, faddiness (pickiness), high consumption of milk, and eating less variable foods.[4] Studies have shown that consuming nutritious snacks increases energy intake, improves growth,[5] and decreases the morbidity.[6] In contrast, excessive intake of energy from non-nutritious sources (i.e. low quality snacks) may cause morbidity and poor weight gain probably by stimulating false satiety and disrupting hunger-meal satiety cycle.[7]

The aim of the present study was to investigate the association between the parents' education and sleep hours, physical activity, and snacking habits of children with growth status, appetite, and energy intake in children aged 3-7 years with poor appetite and growth faltering.

Methods

Subjects

This cross-sectional study was performed on 63 children (29 boys and 34 girls) aged 3-7 years with low appetite and weight for age ratio below the 25th percentile in 2012. The 25th percentile has been used by a number of investigators as a cut-off point for distinguishing mildly malnourished children.[8,9] The children were referred to Nader Kazemi health center in Shiraz, Iran. Children with metabolic, congenital, and chronic diseases with impact on growth and appetite, and those taking supplements were not included in the study. Informed consent was obtained from the parents before participation of their children in the study.

Data Collection

Data on demographic characteristics of the families, and physical activity, sleep hours, and snacking habits of children were collected using a questionnaire. For two consecutive days, the mothers were asked to recall all the food and drinks consumed by the child for the previous 24 hours. Energy requirements were determined by trained dieticians using estimated energy requirement equations developed by the Institute of Medicine, Food and Nutrition Board.[10]

For evaluating appetite, the mothers were asked to rank their child's appetite as "very good", "good", "moderate", "bad", and "very bad". These ranks were scored from 5 to 1, respectively. This method of assessing appetite has been validated for infants under the age of 1 year[11] and examined for preschool children.[12] Low appetite was also ascertained by daily energy intake of 80% or less of estimated energy requirements, as determined by two day 24-hour food recall. Children with an appetite score of one to three and energy intake of ≤80% of their energy requirement were included in the study.

Weight and height were measured by trained researchers. Weight was recorded with minimal clothing to the nearest 0.1 kg using a weighing scale (Seca, Germany) and height was measured without shoes to the nearest 0.1 cm with a non-stretchable tape.

Statistical Analysis

Data were analyzed using SPSS software version 16.0. Food recalls were analyzed with Nutrition IV software to obtain energy intake. Weight for age and height for age Z-scores were calculated with Epi-Info software according to standards of the Centers for Disease Control and Prevention (CDC) and World Health Organization (WHO).[13] For statistical evaluation of the associations of growth indices, appetite, and caloric intake with parents' literacy, level of physical activity, sleep hours, and custom of eating snacks, Mann-Whitney test, and for the number of children in the household correlation test was used. For the associations of total consumption of snacks, Kruskal-Wallis test was used. Statistical significance was set at $P<0.05$.

Results

Of a total of 63 participants, 29 were males and 34 females. Table 1 displays weight for age (WAZ) and height for age (HAZ) Z-scores, appetite, and energy intake of participants in two sexes.

Evaluating the associations between the parents' literacy and growth status, appetite, and energy intake of children an association was revealed between the father's education and children's energy intake; fathers with an education level of Diploma and higher had children with higher energy intake, whereas no association was found between the mother's education and the aforementioned variables (Table 2). There was no significant correlation between the number of children in the household and the measured variables (Table 2).

No association was found between the level of physical activity and liveliness of children and the examined variables (Table 3). Children who slept less than 11 hours a day had greater energy intake

Table 1: WAZ and HAZ scores, appetite, and energy intake of participants, separated by sex[1]

Variables	Males	Females	Total
WAZ score	-1.6±0.7	-1.4±0.8	-1.5±0.7
HAZ score	-0.8±0.9	-0.6±1.4	-0.7±1.2
Appetite	2.2±0.9	2.4±0.8	2.3±0.8
Energy intake (kcal)	937±284	1008±320	976±304

[1]Values are means±SD. No significant difference was found between variables of two sexes.

Table 2: Associations between the parents' education and number of children with growth status, appetite, and energy intake[1]

Family characteristics		WAZ score	HAZ score	Appetite	Energy intake (kcal)
Father education	<Diploma	-1.5±0.8	-0.66±1.3	2.3±0.8	913±287
	≥Diploma	-1.5±0.8	-0.66±1.0	2.4±0.8	1084±295*
	P value	0.7	0.9	0.8	0.015
Mother education	<Diploma	-1.5±0.8	-0.62±1.4	2.2±0.9	965±320
	≥Diploma	-1.4±0.6	-0.74±0.8	2.5±0.6	994±282
	P value	0.9	0.6	0.2	0.6
Number of children		0.19	0.18	-0.02	-0.1
	P value	0.14	0.15	0.9	0.5

[1]Values are means±SD. *Shows significant difference at P<0.05.

Table 3: Associations between some of habitual behaviors and growth status, appetite, and energy intake[1]

Habitual behaviours		WAZ score	HAZ score	Appetite	Energy intake (kcal)
	Moderate & low	-1.5±0.7	-0.6±1.1	2.5±0.8	968±321
Physical activity	High	-1.5±0.8	-0.7±1.2	2.3±0.8	979±303
	P value	0.8	0.6	0.4	0.9
	<11	-1.7±0.7	-0.8±1.1	2.5±0.8	1065±308
Sleep hours	≥11	-1.3±0.7*	-0.5±1.3	2.2±0.8	901±283*
	P value	0.015	0.13	0.17	0.026
	Never	-1.1±0.6	-0.04±1.1	2.1±0.7	770±202
Snack before meals	Always-Sometimes	-1.6±0.7*	-0.8±1.2*	2.4±0.8	1027±305*
	P value	0.046	0.03	0.15	0.008

[1]Values are means±SD. * shows significant difference at P<0.05.

and lower WAZ score compared to those who slept more (P<0.05) (Table 3). There was no significant association between sleep hours and HAZ score and appetite. Children accustomed to eating snacks in a short time interval before meals had significantly lower WAZ and HAZ scores and higher energy intake than those who did not eat snacks before meals, but the association with appetite was not significant (Table 3).

Evaluation of the associations between consumption of snacks and growth status, appetite, and energy intake showed that children with a high consumption of snacks such as cakes, ice creams, potato chips, fruit drinks, and colas had lower WAZ and HAZ scores although only in some cases the associations were significant, i.e. HAZ score for cakes and both WAZ and HAZ scores for potato chips and fruit drinks (Table 4). Consumption of ice cream and colas was not significantly associated with either scores. For nuts, the reverse was true; those who consumed nuts had greater WAZ and HAZ scores although only for HAZ score such an association was statistically significant. None of the snacks had significantly affected appetite. The impact on energy intake was only significant for ice cream; those with higher consumption of ice cream had higher energy intake (Table 4). When associations of the examined variables were evaluated with total consumption of snacks, there was a decreased trend in WAZ and HAZ scores associated with an increase of snack consumption (Table 4).

Discussion

Results of the present study demonstrated the association between snacking behaviors and children's food intake and growth status. The habit of eating snacks near the meal time was associated with increased caloric intake but exacerbated growth failure. Likewise, children who highly consumed snacks had generally higher energy intake but lower WAZ and HAZ scores, although such effects were only significant for some of the snacks. This paradox that taking higher energy was not associated with better growth status may be because of the fact that eating snacks especially close to main meals

Table 4: Associations between consumption of various snacks and growth status, appetite, and energy intake[1]

Snacks		WAZ score	HAZ score	Appetite	Energy intake (kcal)
Cake	Low	-1.4±0.6	-0.1±1.3	2.1±0.8	975±348
	High	-1.5±0.8	-0.9±1.0*	2.4±0.8	977±390
	P value	0.5	0.049	0.16	0.9
Ice cream	Low	-1.2±0.7	-0.6±1.1	2.4±0.7	854±265
	High	-1.6±0.7	-0.7±1.2	2.3±0.9	1032±307*
	P value	0.07	0.6	0.7	0.03
Fruit drink	Low	-1.3±0.7	-0.4±1.2	2.4±0.8	1011±337
	High	-1.7±0.8*	-1.1±1.0*	2.4±0.8	914±228
	P value	0.02	0.04	0.9	0.3
Cola	Low	-1.3±0.6	-0.6±1.0	2.4±0.8	933±292
	High	-1.7±0.9	-0.8±1.4	2.3±0.9	1047±316
	P value	0.09	0.8	0.8	0.14
Potato chips	Low	-1.4±0.7	-0.4±1.1	2.4±0.8	953±340
	High	-1.7±0.8*	-1.1±1.2*	2.3±0.9	1024±210
	P value	0.04	0.03	0.8	0.13
Nuts	Low	-1.6±0.8	-1.1±1.2	2.4±0.8	931±321
	High	-1.3±0.6	-0.3±1.1*	2.3±0.8	1022±290
	P value	0.15	0.01	0.3	0.17
Total snacks	Low	-1.2±0.6	-0.2±1.0	2.3±0.8	825±285
	Moderate	-1.5±0.8	-0.8±1.2	2.5±0.7	1018±319
	High	-1.8±0.8*	-1.1±1.2	2.2±0.9	1091±245*
	P value	0.03	0.07	0.5	0.004

[1] Values are means±SD. * shows significant difference at P<0.05.

may decrease the appetite for the following meal[14]. Moreover, snacks are usually less nutritious than meals, so substituting snacks for meals can negatively affect children's health[15,16] and growth.

In agreement with our results, Sekiyama and colleagues[17] investigated the effect of snack consumption on the growth of Indonesian children and found that school children with higher consumption of snacks obtained lower HAZ scores.[17] There are also reports indicating snacking as a risk factor for adiposity and overweight,[18] although the majority of studies have reasoned that snacking may not predispose children and adolescents to overweight and obesity;[19,20] rather, individuals who snack throughout the day may better control their weight over those who follow a rigid pattern of three meals a day (as reviewed by Larson & Story[19] and Drummond *et al.*[21]). As an example, O'Connor and colleagues reported that high consumption of fruit drinks by preschool children was associated with increased total energy intake but not with increased body mass index (BMI).[22] Also, Villa and coworkers found that energy consumption from sweets and sugar was negatively associated with BMI of adolescents.[23] One explanation for such contradictions could be increased level of physical activity following consumption of snacks. It has been shown that children who got more than 15-20% of their daily calorie intake from snacks were engaged in more social and sport activities.[24] If such an effect is translated into the case of malnourished low-appetite children, then the inclusion of abundant snacks in their diet could result in exacerbation of growth retardation.

Another issue is the type of snacks. Consumption of nutrient-rich snacks has no conflict with a healthy diet and does not lead to children's overweight.[16] If nutritious snacks are consumed in appropriate time and sufficient intervals to the main meals, they can help children's growth and development. Excessive consumption of non-nutritious snacks, however, especially if consumed closely to the main meals, can negatively affect the appetite and compromise the intake of sufficient amounts of nutrients required for growth.[7] Murphy *et al.* showed that depending on the type, snacks may either improve or impair appetite.[5] Some of snacks (e.g. meat-containing snacks or nuts like our study) may simultaneously increase energy intake, improve appetite, and provide beneficial nutrients for growth while others may provide empty energy and suppress appetite.

In our study, nuts were the only type of snacks that were associated with better growth status. Nuts are good sources of energy (550-650 kcal/100 g), fat (50-65 g/100 g) and essential fatty acids in particular linoleic acid,[25] protein (15-25 g/100 g),[26] and minerals such as calcium, zinc, and iron, all of which are necessary for growth of children.[27] Although nuts are highly energetic foods, evidence shows that they hardly contribute to obesity.[28] Grant *et al.* reported that adolescents who consumed nuts more than once a week possessed lower scores of BMI.[29]

Apart from snacks, sleeping was also associated with children's energy intake. Children who slept more than 11 hours a day had significantly lower energy intake than children who slept less than that.

This is reasonable as spending more time on sleep means that the child gets less time to eat. However, despite the lower energy intake, children who slept more than 11 hours/day had higher WAZ and HAZ scores, although this elevation was only statistically significant for WAZ. This paradox may have resulted from the difference in energy expenditure between sleep and waking. The metabolic rate of sleep is 10% lower than that of waking.[30] Additionally, the child who sleeps longer is supposed to expend less time for playing, and therefore spares his/her energy. So, for those children who sleep less, the increase of energy intake in waking hours may not have been sufficient to compensate for the increase of energy expenditure. This suggests that getting enough sleep is essential for the growth of children. For normal children, the condition may be opposite as studies have shown that children who do not get enough sleep have more time to eat, get more energy-dense nutrient-poor foods,[31] and subsequently gain more weight and body mass index.[32]

Overall, the results of the present study indicate the importance of snacks in the growth of children. Consumption of low-quality snacks such as cakes and potato chips by children may be associated with impaired growth, while that of nutritious snacks such as nuts may be associated with improved growth. Since dietary patterns of childhood have a profound impact on evolution of dietary habits of adulthood, it is important to govern children's dietary behaviors to prevent developing unhealthy dietary habits.

Limitations

An important limitation of the current study was small sample size, which makes reaching firm conclusions difficult. Moreover, although the method of evaluating the appetite used herein has been numerously utilized for children[9,12,33] and validated for infants[11], the results of this study suggest that this method may not be efficient enough to be utilized solely for evaluating appetite. Employing complementary methods such as measuring the amount of food that can be eaten from a provided meal could better evaluate the appetite.

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