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SHORT REPORT

Child-care environment and dietary intake of 2- and 3-year-old children

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Keywords

child, child-care, day care, dietary intake, meals, social environment.

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Abstract

Background: Previous research has shown that children in child-care do not comply with dietary intake recommendations (i.e. either exceeding or not meeting recommendations), which may be attributable to specific features of the child-care environment. The present study explored the relationship between the social and physical child-care (day-care) environment and dietary intake of 2- and 3-year-olds in Dutch child-care centres.

Methods: The dietary intake of 135 children, aged 2 and 3 years, who were in child-care was assessed by observing randomly selected children at three meals (morning snack, lunch and afternoon snack) to determine dietary intake (i.e. saturated fat, dietary fibre and energy intake). The environment was observed using the Environment and Policy Assessment and Observation checklist, a structured instrument assessing the physical and social environment.

Results: Children consumed a mean of 486 kJ (116 kcal) during the morning snack, 2043 kJ (488 kcal) during lunch and 708 kJ (169 kcal) during the afternoon snack. There were some gender and age differences in dietary intake. Several environmental factors (e.g. serving style and staff's model dietary behaviour) were significantly associated with the children's dietary intake.

Conclusions: Overall, energy intake was in the upper range of recommended intake for children in child-care. The associations of several environmental factors with dietary intake stress the importance of the child-care environment for children's dietary behaviour. Intervening in this setting could possibly contribute to the comprehensive prevention of childhood obesity.

Introduction

The childhood prevalence of being overweight is increasing worldwide (WHO, 2006), with dietary intake playing a crucial role (Rennie *et al.*, 2005). Moreover, eating habits are often established at a young age (Savage *et al.*, 2007) and maintained throughout life (Kelder *et al.*, 1994).

Child-care attendance is increasing (Portegijs *et al.*, 2006), implying a potentially large influence of this setting on children's development. It has been recommended that a child who spends a full day (i.e. 8 h or

more) in child-care should consume one-half to two-thirds of his or her daily dietary intake when in child-care (American Dietetic Association, 1994). Various studies in the USA have shown that children in child-care do not meet dietary intake recommendations (Bollella *et al.*, 1999; Briley *et al.*, 1999; Padgett & Briley, 2005; Ball *et al.*, 2008). Specific features of the child-care environment may underlie such findings. Hughes *et al.* (2007), for example, found that indulgent and authoritative feeding styles of child-care staff were positively associated with vegetable and dairy consumption. In addition, just as par-

ents can apply certain parenting practices to influence their child's dietary intake (e.g. Gubbels *et al.*, 2009), child-care staff also apply specific supervision practices.

The present study explored dietary intakes (i.e. saturated fat, dietary fibre and energy intake) and the presence of various environmental factors (i.e. physical environment, food serving style, supervision practices and staff behaviour) in Dutch child-care centres. Observations were executed during the three meals that children in the Netherlands usually receive when in child-care: a morning snack, lunch and an afternoon snack. In addition, the associations between these variables were explored.

Materials and methods

Participants and setting

The study complied with the Dutch 'Medical Research Involving Humans Act'. All nine child-care centres of the coordinating organisation MIK (Maastricht, the Netherlands) were contacted and agreed to participate. MIK provided consent for the study. Parents were informed in a letter; none refused participation.

Assessment of dietary intake and child-care environment

Observations took place in May and June 2008. Children were observed during their morning snack and lunch on 1 day, and during their afternoon snack on a second day, in a nonconsecutive week. At each meal, five children were randomly selected, resulting in a total of 135 observations (nine centres, three meals per centre, five children per meal). The intake and environment were observed for each child separately, and recorded simultaneously by two observers, who did not interact with each other and were trained in the use of the observation protocol.

Dietary intake was estimated in standard food units (e.g. cups, pieces) and recorded on a structured form developed for the present study, listing common food items and their type (e.g. whether milk was skimmed, semi-skimmed or whole). Only actually consumed foods were recorded, and not leftovers and spoiled foods.

The child-care environment was assessed using items from the Environment and Policy Assessment and Observation instrument (Ball *et al.*, 2005), which were selected, translated and adjusted to fit the Dutch child-care system. Table 1 lists the environmental factors assessed. In addition, children's gender and age were assessed by asking staff after the observations.

Statistical analysis

Dietary intake was calculated as the mean of the observations by the two observers, after converting standard food

units into grams and, subsequently, into intake of energy, saturated fat and dietary fibre (Stichting NEVO, 2006). Cohen's kappa was 0.84 (SD 0.15), intra-class correlation was 0.91 (SD 0.14), with both indicating good inter-observer agreement (Field, 2005). Total mean intake was calculated as the sum of the mean intakes at each meal per child-care centre. Associations between intake and environment were explored using Point biserial correlations. $P < 0.05$ was considered statistically significant.

Results

In total, 135 children were observed. Five children (during lunch) were excluded from the analyses because they were not simultaneously observed by both observers. Forty-three percent of children were 2 years old, and the remaining 57% were 3 years old. Fifty-four percent were male.

There were a mean (SD) of 11.5 (2.3) children and 2.2 (0.5) staff members (all female) present at the meals. In most cases, staff ate together with the children, and they mostly ate the same food (Table 1). More than half of the children were stimulated to eat more than they wanted to (e.g. 'Finish your sandwich!'), for an average of 1.8 times, but ranging up to 10 times per child during one meal. Children were encouraged to try an alternative option at most once per meal (e.g. 'We're out of apples, don't you want to try this tasty pear?'), whereas punishment by (temporarily) taking food away happened twice per meal at most.

Children's dietary intake

The children generally consumed fruit in the morning, sandwiches at lunch and snacks (e.g. biscuits) during the afternoon. Total mean energy intake during a full day in child-care was 3237 kJ (773 kcal) (Table 2). Three-year-olds had higher saturated fat intakes at lunch than 2-year-olds (8.6 versus 6.7 g; $P = 0.04$); boys consumed more energy than girls during the afternoon [770 versus 628 kJ (184 versus 150 kcal); $P = 0.04$].

Environmental factors and background characteristics

Staff were less inclined to encourage girls to try new things ($r = -0.20$, $P < 0.05$) and more often used food to control girls' behaviour ($r = 0.19$, $P < 0.05$). Staff more often talked about healthy foods to older children ($r = 0.18$, $P < 0.05$). Staff at larger centres less often used food to control behaviour ($r = -0.43$, $P < 0.01$), but more often ate unhealthy foods in front of the children ($r = 0.47$, $P < 0.01$). When more children were present, staff were more likely to decide how much a child should eat ($r = 0.49$, $P < 0.01$), instead of deciding together with the child or applying a family style ($r = -0.18$, $P < 0.05$).

Table 1 Content of the environmental factors measured in the current study

Category	Concept	Content	Percentage*
Physical environment	Number of children present	Number of children present during the observed meal	–
	Number of staff present	Number of staff present during the observed meal	–
	Water availability	Is a drinking water tap available in the room where the meal takes place (yes/no)	100
	Water accessibility	Is the drinking water accessible to the child during the meal (yes/no)	0
Food serving style	Family style	Child can take food for itself and decides how much it wants to eat (yes/no)	41.5
	Staff decides	Staff decides how much child should eat (yes/no)	15.4
	Staff and child decide together	Staff and child discuss how much the child should eat, and decide together (e.g. staff offers food, but asks if the child wants it; yes/no)	43.1
Supervision practices	Times staff encourage child to overeat	How many times was the child pressured or encouraged to eat more than it wanted to	52.3
	Times staff gives child food without asking	How many times was the child provided with extra food without the child asking for it	16.9
	Times staff encourage to try new foods	How many times did staff encourage the child to try new foods	5.6
	Times food is used to control behaviour	How many times did staff use food to control the child's behaviour (e.g. taking food away as punishment)	8.5
Staff behaviour	Staff eat together with children	Do staff eat together with the children (yes/no)	76.9
	Staff eat the same food as the children	Do staff eat the same food as the children (e.g. also preparing sandwich at lunch; yes/no)	50.0
	Times staff eat unhealthy foods	How many times do staff eat unhealthy foods (e.g. snacks) in front of children	33.6
	Times staff talk about healthy foods	How many times do staff talk about healthy foods (e.g. fruit, wholemeal bread)	23.1

*Percentage, percentage of cases in which the concept was applicable (i.e. 'yes') for the yes/no concepts, and the % of cases in which the concept was observed at least once for the frequency concepts.

Table 2 Intake of 2- and 3-year-old children in child-care centres

	Dietary intake mean (SD)		
	Energy (kJ)	Saturated fat (g)	Dietary fibre (g)
Morning snack (<i>n</i> = 45)	486 (239)	0.2 (0.7)	1.9 (0.8)
Lunch (<i>n</i> = 40)	2043 (615)	7.8 (2.8)	5.9 (2.1)
Afternoon snack (<i>n</i> = 45)	708 (234)	1.0 (1.1)	0.8 (0.9)

for both variables), and were also more likely to eat the same food as the children ($r = 0.19$, $P < 0.05$).

Dietary intake and environmental factors

A family serving style was associated with higher saturated fat and dietary fibre intake (Table 3). Children ate more when staff ate together with them, regardless of whether they were eating the same or unhealthy foods. Talking about healthy foods was associated with higher fibre intake. Encouragement to overeat was associated with lower intakes during lunch. Giving a child food without asking was associated with higher dietary fibre intake.

Using food to control behaviour was associated with lower fibre intake.

Discussion

Total mean energy intake in the current sample (3237 kJ, 773 kcal) was in the upper range of the recommended intake [2512–3349 kJ (600–800 kcal)]; saturated fat and fibre intake complied with recommendations (American Dietetic Association., 1994; Voedingscentrum, 2007). Note that, these mean intakes merely provide an indication of total intake: they reflect a summed total of the means per meal, incorporating intakes of different children, though from the same centre.

As far we are aware, this is the first study to examine dietary intake and environment at European child-care centres, and the first to describe associations between distinct environmental characteristics and intake. The results obtained extend those found by Hughes *et al.* (2007), who examined the association between feeding style and dietary intake. Note, however, that the current research was explorative. The findings need to be confirmed in larger samples, allow-

Table 3 Correlates of energy intake, saturated fat intake, dietary fibre intake and quality of food intake by 2- and 3-year-old children in child-care centres (point biserial correlations)

	Energy intake (kJ)			Saturated fat intake (g)			Dietary fibre intake (g)		
	Morning (n = 45)	Lunch (n = 40)	Afternoon (n = 45)	Morning (n = 45)	Lunch (n = 40)	Afternoon (n = 45)	Morning (n = 45)	Lunch (n = 40)	Afternoon (n = 45)
Family serving style			0.25			0.74**		0.17	0.71**
Staff decides serving style						-0.24		-0.17	-0.28
Decide together serving style									-0.25
Staff eat together with children (no/yes)	0.27		0.43**	0.16		0.27	0.26		0.30*
Staff eat the same as the children (no/yes)					0.21		0.40*	-0.14	0.27
Times staff eat unhealthy foods		0.15	0.34*	0.13		0.58**	-0.19	0.42**	0.51**
Times staff talk about healthy foods		0.17	0.18			0.11	-0.19	0.42**	-0.11
Times staff encourage child to overeat	-0.25	-0.57**		-0.12	-0.39*	0.28		-0.53**	0.20
Times staff give child food without asking		0.24				-0.15	0.35*	0.19	
Times staff encourage to try new foods						0.18	0.16		
Times food is used to control behaviour		-0.27			-0.30	-0.13		-0.33*	

* $P < 0.05$; ** $P < 0.01$; only correlations with at least a small effect size ($|r| \geq 0.10$) are included.Absolute correlations 0.1–0.3 were considered small; 0.3–0.5 as medium; and ≥ 0.5 as large (Cohen, 1988).

ing correction for potential bias introduced by the multilevel design. Strong points were the validated observation protocol (Ball *et al.*, 2005) and high inter-observer reliability.

The family serving style appeared to induce children to eat more, regardless of the food served, which is interesting. Previous research indicated that a family style, in which children can respond to satiation cues and are less likely to overeat, is best for the child's eating habits development (Johnson & Birch, 1994; Fisher *et al.*, 2003). The children in the present study might have been too young to regulate their own intake. Further research should examine at what age the family style would be desirable. Encouragement to overeat was associated with lower intakes, probably indicating that picky or slow eaters were encouraged to eat more.

Staff appeared to function as role models, with higher intake by children when staff ate together with them. This is inconsistent with earlier findings showing that teacher modelling was unrelated to preschool children's intake. Enthusiastic modelling (i.e. promoting food after eating it), however, was reported to be effective (Hendy & Raudenbush, 2000), which is in line with the current findings.

The present study underlines the importance of child-care in determining children's dietary intake. However, more research is needed to examine the mechanisms underlying the association between child-care environment and children's dietary intake. In addition, cultural differences warrant caution when generalising the results of US studies to the European context. In summary, intervening in the child-care setting, with special attention to staff behaviour, could help children to establish healthier eating habits and prevent them becoming overweight.

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Conflict of interest, source of funding and authorship

The authors declare that they have no conflicts of interest.

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Observations were performed by JSG and Dave H. H. van Kann. JSG and SPJK were involved in the conception and design of the study. All authors were involved in the analysis and interpretation of the data. JSG wrote draft versions of the report. SPJK contributed to writing the report, and all authors were involved in critical revision. All authors have seen and approved the final version. All authors critically reviewed the manuscript and approved the final version submitted for publication.

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