



Early Childhood Vegetable, Fruit, and Discretionary Food Intakes Do Not Meet Dietary Guidelines, but Do Show Socioeconomic Differences and Tracking over Time

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ABSTRACT

Background Dietary intakes of young children are likely to be important determinants of their short- and long-term health, yet there are few longitudinal dietary studies of this age group, and no previous assessments of diets before age 2 years compared with national dietary guidelines.

Objective This study aimed to compare vegetable, fruit, and discretionary food intakes of children aged 9 months to 5 years to dietary guidelines, and to assess differences in intakes by socioeconomic status and tracking of intakes across early childhood.

Design This study analyzed longitudinal data from the Melbourne Infant Feeding Activity and Nutrition Trial Program early childhood lifestyle intervention trial, and is the first study to compare diets of children younger than age 2 years to national dietary guidelines.

Participants/setting Participants were 467 children in Melbourne, Australia, aged 4 months at baseline (study conducted 2008-2015).

Main outcome measures Multiple 24-hour recalls with parents were conducted at child ages 9 months, 1.5 years, 3.5 years, and 5 years.

Statistical analyses performed Intakes of vegetables, fruits, and discretionary foods were compared with Australian Dietary Guidelines. Differences by socioeconomic status and tracking of intakes of each food group were assessed by multivariable linear regression.

Results Few children (<10%) met guidelines for discretionary food intakes at any age. Most children (≥90%) met vegetable and fruit guidelines at 9 months, but thereafter rates of adequate intakes reduced substantially. Children of higher socioeconomic status consumed diets closer to guidelines for most food groups at most ages. Tracking of intakes was apparent across ages, with the strongest and most consistent tracking for discretionary foods.

Conclusions This study shows that diets of Australian children participating in this lifestyle intervention trial were suboptimal from early life. The evidence of differences by socioeconomic status and tracking from age 9 months, particularly for discretionary foods, highlights the importance of research and action to support appropriate introduction of complementary foods during the first year of life, and of focusing these efforts on disadvantaged groups.

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DIETARY INTAKE DURING EARLY CHILDHOOD (BIRTH to age 5 years) is a key influence on short-term health, and likely to influence diet, weight, and health into later childhood and adulthood.¹⁻⁴ The high prevalence of child overweight and obesity^{5,6} suggests that child dietary intakes are suboptimal. The World Health Organization identifies early childhood as a key life stage for strategies to improve nutrition and prevent obesity.⁶ The first 1,000 days (the period from conception to age 2 years) is suggested as a particularly crucial time for influencing life-long health.⁷ The period of complementary feeding, from about age 6 months, encompasses half of this critical

window; however, food intakes during this period have not been well studied.

Vegetables, fruits, and discretionary foods (energy-dense, nutrient-poor foods)^{*} are among the food groups most strongly associated with obesity risk,⁹ and eaten in

**According to the Australian Dietary Guidelines, discretionary foods are those that are not an essential or necessary part of healthy dietary patterns, being high in kilojoules (kilocalories), saturated fat, added sugars, and/or salt or alcohol.⁸*

inappropriate quantities by older children internationally.¹⁰⁻¹² Relatively few studies have assessed diets of children younger than age 2 years. Key nationally representative studies are the US Feeding Infants and Toddlers Study (ages 0 to 3 years),¹³ the UK Diet and Nutrition Survey of Infants and Young Children (ages 4 to 18 months),¹⁴ and the UK National Diet and Nutrition Survey (includes children aged from 1.5 years but grouped with children ages 2 to 3 years).^{11,15} However, none of those studies report discretionary foods as a food group, and none are longitudinal. Assessing discretionary foods as one food group is relevant because it is the total contribution of these foods to the diet that is most important when considering nutritional adequacy, rather than, for example, whether those foods are savory or sweet. Australian national dietary surveys do not include children younger than age 2 years,^{12,16} so nationally representative Australian data are not available.

Despite the recognized importance of early childhood diets, many international food-based dietary guidelines and eating pattern recommendations do not yet include children younger than age 2 years.¹⁷⁻¹⁹ This is currently being addressed in some countries, namely the United States and Australia,^{8,20} and the 2013 Australian Dietary Guidelines (ADGs) include food group recommendations for this age group for the first time,⁸ representing a key advancement in this field internationally. The ADGs for children younger than age 2 years include recommended daily servings of vegetables, fruit, grain foods, meats and alternatives, and dairy and alternatives (with discretionary foods not recommended).⁸ With such recommendations in place, it is essential to assess compliance to inform strategies to improve nutrition. Of the Australian dietary studies of children younger than age 2 years,²¹⁻²⁷ one has assessed tracking of vegetable and fruit intakes longitudinally (from age 9 to 18 months),²² and one other has reported food group intake quantities within the past decade,²³ but none have compared intakes to national dietary guidelines. This article focuses on the vegetable, fruit, and discretionary food groups because these are most strongly associated with obesity risk.⁹

Socioeconomic differences in many health behaviors, including diet and eating behaviors, are well established in older children and adults.²⁸⁻³¹ Internationally, evidence suggests these differences are already present in early childhood.^{14,32-35} This includes evidence from large samples across countries; for example, >9,000 European children in the Identification and Prevention of Dietary and Lifestyle-induced Health Effects in Children and Infants Study,³⁵ and >5,000 children in the UK Avon Longitudinal Study of Parents and Children.³³ However, most studies have assessed dietary patterns, with few assessing whether there are differences for food groups in a way that allows comparison with dietary guidelines. Two Australian studies have reported differences in child dietary patterns by sociodemographic factors at age 9 months,³⁶ 14 months, and 24 months,²⁴ but none have assessed socioeconomic differences in intakes compared with dietary guidelines, or whether differences persist across early childhood. Identifying differences in intakes of food groups is important to help target efforts to reduce disparities on the dietary aspects that show the greatest socioeconomic patterning.

Evidence suggests that dietary behaviors and food preferences are likely to track across life stages.^{37,38} Dietary tracking

refers to the maintenance of eating habits or intakes over time,³⁸ and tracking of dietary habits from early childhood (age 2 years and younger) has been reported for energy and nutrients,^{22,39,40} dietary patterns,^{32,34} and fruits and vegetables.^{22,41} Tracking has also been shown for specific subgroups of the discretionary foods group (ie, sweet energy-dense snacks and sweetened beverages).²² However, no studies in children younger than age 2 years have assessed tracking of discretionary foods over a period as long as 4 years, or considered them combined as one food group. Assessing tracking of dietary intakes from early childhood informs understanding of the importance of early diet in influencing subsequent food intakes, and hence informs efforts to improve nutrition in this age group.

The aims of this article are therefore to compare vegetable, fruit, and discretionary food intakes of Australian children aged 9 months, 18 months, 3.5 years, and 5 years to the ADGs⁸; to assess socioeconomic differences in intakes at these ages; and to assess tracking of intakes from ages 9 months to 5 years.

METHODS

Data were provided by a sample of volunteers within a lifestyle intervention: the Melbourne Infant Feeding Activity and Nutrition Trial Program. This was a randomized controlled trial to assess the efficacy of a low-dose education intervention to improve nutrition and physical activity and to reduce sedentary behavior (ISRCTN81847050).^{42,43} Parents were recruited via their first-time parents' groups, which are run in local areas across Victoria, Australia, by maternal and child health nurses.⁴⁴ Parents gave informed written consent to provide data about themselves and their child. A total of 62 groups, including 542 families, were recruited from across Melbourne in 2008, as has been described elsewhere.^{42,43} The intervention involved quarterly group sessions with a dietitian from child age 3 months to 1.5 years (2008-2010). Follow-up assessments post-intervention were conducted at 3.5 and 5 years (2012-2015).⁴⁵ The nutrition component of the intervention focused on discussing healthy foods for young children, appropriate feeding practices, and the importance of healthy parental role-modeling. Ethics approval was granted by the Deakin University Ethics Committee (identification no. EC 175-2007) and by the Victorian Office for Children (reference no. CDF/07/1138).

Demographic data were collected via parent-completed questionnaires at baseline. Maternal education level was assessed and used as the measure of socioeconomic status (SES), dichotomized to university or less than university education. Further information collected included child and maternal ages, maternal prepregnancy height and weight (used to calculate body mass index), and whether the child was ever breastfed.

Dietary Intake

Child dietary intakes were assessed at child ages 9 months, 1.5 years, 3.5 years, and 5 years, commencing in 2008 and concluding in 2013. Dietary data were provided for 467 children (86% response rate) for at least 1 time point. At each time point, child diets were assessed via 3 telephone-administered 24-hour recalls with parents.⁴⁶ Recalls were on nonconsecutive days, including 2 weekdays and 1

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