

**Published in Journal of Paediatrics and Child Health (2010) – Revised version.**

**Modern and Traditional Diets for Noongar Infants**

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## **Abstract**

**Aim** – Describe breast- and bottle- feeding patterns and the introduction of solid feeds and sugar containing drinks to the dietary intake of a cohort of urban Aboriginal infants in the first year of life.

**Methods** – 274 infants were recruited to a cohort study and information about infant nutrition was collected from their mothers during face to face interviews when the infants were aged 6-12 weeks, 7-8 months and 12 months old.

**Results** – 88.3% of mothers initiated breast feeding, but only 43.8% of infants were exclusively breast fed at 6-12 weeks. By 12 months of age 69.8% of babies had received fruit juice in their bottles, 59.8% received cordial. 64.5% of infants were given water in their bottles. The majority of infants had received ‘fast foods’ by 12 months of age with 56.2% had been given coca cola, 68% lemonade and 78% fried chips.

**Conclusions** - This study highlights areas in which nutrition health promotion can be targeted to prevent common childhood health problems including promoting and supporting mothers to sustain breastfeeding and opportunities to reduce the sugar and fat intake among infants.

What is already known:

1. Aboriginal mothers initiate breast feeding at high levels but there is a rapid decline in rates of exclusive breast feeding.
2. Early inappropriate initiation of first feeds and the use of cows’ milk as opposed to infant formula when bottle feeding.

What this paper adds:

1. The majority of infants were sometimes given water to drink, but most infants also received drinks with a high sugar content in the first year of life.
2. Most infants had received fast foods containing saturated fats in the first year of life.

3. Comparison of the modern diet of these urban infants and the traditional infant diet from this region highlight opportunities for nutrition health interventions in the current setting.

## **Background**

Infant and childhood nutrition is implicated in the causal chain to common health problems experienced by Indigenous children. For example recent studies show that Indigenous children are more likely to be obese or overweight compared to non-Indigenous children(1). A major consequence of childhood obesity is that incidence rates for type 2 diabetes in childhood have been shown to be higher for Indigenous children in Western Australia and New South Wales(2, 3). Early nutrition is also implicated in the development of dental caries(4).

Dietary guidelines(5, 6) for infants note that Infants and young children are unique and have special needs with regard to their nutritional requirements. During the first months of life babies require only human milk or infant formula, which provides 40-50% of calories from fat and energy to support rapid infant metabolism, growth and development. Throughout the first year of life, infant nutrition requirements change and other foods need to be gradually added to their diets as they move from the early months of nursing with milk only, to a transitional period. At this time parents need to slowly build dietary variety by choosing foods from each of the basic groups to offer their infant, as dictated by individual growth and development.

Infant diet has a primary relationship to dental caries caused primarily by inappropriate feeding practices (propping bottles) and poor dental hygiene(5, 6). Human milk and infant formula provide 40% of their caloric value as carbohydrate in the form of lactose and other sugars. However, any fermentable carbohydrate, including those found in

human milk and infant formula, that stays in contact with the teeth and gums for a significant period of time can promote tooth decay.

It is also known that infants need food with iron, zinc and calcium, as intakes of these minerals are sometimes low in the diets of children under two years of age. Iron deficiency anaemia is a risk factor for abnormal cognitive and social development, and iron is readily available in breast milk, iron enriched infant formula, iron fortified infant cereals, meats and poultry, organ meats, peas, lentils and soybeans. Cows' milk has a negative impact on iron status as the concentration and bioavailability of iron are low, and it has high protein and calcium concentrations which reduce absorption. Intakes of cows' milk have been shown to be significantly higher in children with iron deficiency(7).

## **Methods**

Bibbulung Gnarneep was a prospective cohort study of 274 Aboriginal infants residing in Perth WA. Infants were recruited at 6-12 weeks of age in the mid 1990s. Perth and South West WA are the traditional lands of the Noongar people. This was a total population study conducted using the WA midwives notification systems to obtain the name and addresses of all Aboriginal women who resided in a Perth metropolitan postcode and who gave birth to a live born infant over an 18 month time period. The methods for this cohort study have been reported in previous publications(8, 9). Data was collected via face to face interviews with the mothers and all interviews were conducted by trained Aboriginal health workers.

**Nutritional data** – Questions on nutrition were included in each of the questionnaires developed for interviews with mothers. At the 6-12 week interview these questions focused on breast feeding. The questions specifically asked if ‘when baby was born did you begin breast feeding’ and what statement best describes the way your baby is fed now (breast fed only, breast fed mainly, bottle fed mainly, bottle fed only). At each interview for babies who received bottle feeds, further questions asked ‘do you add sugar to any of the drinks in the bottle’ and ‘is baby usually put down to sleep sucking a bottle’. The interview schedule at 7-8 months and 12 months asked ‘which does your baby drink ‘most of the time’/‘some times’ in his/her bottle with check list responses. At 7-8 months a question asked ‘at what age were solids first given to your baby’ and ‘what were the first solids that you fed your baby’. At 7-8 months and 12 months a food table was used to ask women ‘what does your baby drink and eat on a usual day’. At 12 months a check list table with yes/no responses was used to ask women ‘has your baby had ever eaten any of the following foods’. The proportion of infants who had ever had specific fast foods and sugar containing beverages was calculated using responses to those sections of this table.

**Analyses** - SAS (Statistical Analysis Software, Version 6.09 SAS Institute Inc.) was used for data entry, manipulation and analysis. Basic descriptive frequencies and percentages were calculated for nutritional outcomes. Chi-square tests were used to test for significant differences between the women who completed all three interviews versus those who completed less than three interviews.

## **Results**

Nutritional data is available for infants of the 274 mothers who were recruited and completed the baseline interview at 6-12 weeks, and 166 and 169 mothers who completed the 7-8 month and 12 month follow up interviews respectively. Complete data was available to allow comparison between 133 mothers who completed all three interviews and 272 of the mothers who completed the 6-12 week interview. The 139 women who did not complete all three interviews were more likely to be teenagers (20% versus 10.7%,  $p=0.03$ ), parity 0 on the midwives birth record (25.2% versus 15.3%,  $p = 0.04$ ) and to not receive income primarily from full time employment (12.2% versus 27%,  $p=0.002$ ). They had the same likelihood of having a low birth weight and/or preterm baby (11.5% versus 14.4%,  $p=0.47$ ).

**Breastfeeding and bottle feeding at birth and at 6-12 weeks** – 242 mothers (88.3%) commenced breast feeding from the time of birth. At the 6-12 week interview 120 (43.8%) were exclusively breast feeding, 70 (25.5%) were giving breast and bottle feeds, and 84 (30.7%) were exclusively bottle feeding.

**Sugar added to infants' bottle drinks** - In relation to the practice of adding sugar to drinks from the bottle, in the period between birth and 6-12 weeks, 46 mothers (16.8%) used this practice. Of these mothers, 34 (12.4%) added sugar to water and 10 (3.6%) added sugar to formula. By 6 months of age 40 (24.1% of the six month sample) mothers added sugar to drinks in the bottle. By 12 months of age 53 mothers (31.4%) added sugar to drinks in the bottle. In relation to the practice of putting babies down to sleep sucking their bottles, this was the case for 57 babies (20.8%) at 6-12 weeks, 95 babies (57.2%) at 6 months and 77 babies (45.6%) at 12 months.

**Drinks mostly and sometimes given to infants in their bottle at 7-8 months and 12**

**months** – Table 1 shows drinks given to babies in the bottle. Of note more than 60% of infants were sometimes given water to drink. However, many infants were given drinks with a high sugar content and 16% of infants at 7-8 months and 50% at 12 months were given fresh cows milk in their bottles (at least sometimes).

**Introduction of solid foods** - At the 7-8 month visit mothers reported the age at which solids were introduced to the infant's diet. The cumulative total of infants who were given solid feeds were 14 (8.4%) at 2 months, 47 (28.3%) at 3 months, 109 (65.7%) at 4 months, 136 (81.9%) at 5 months, 154 (92.8%) at 6 months, 163 (98.2%) at 7 months and 165 (99.4%) at 8 months. The foods that infants were initially given included ground cereal in the bottle (31.9%), mashed vegetable/fruit (30.7%), tinned baby food (32.5%), dairy products (17.5%), weetbix type cereals (12.0%) and baby biscuits (10.8%).

**Food combinations** - At 12 months of age mothers reported non-mutually exclusive food combinations given to infants. At breakfast 105 (62.1%) were given weetbix, 7.1% were given cereal with sugar, 26.6% were given toast/bread and 11.8% were given egg. In the afternoon 33.1% were given a sandwich, 31.4% fruit, 8.9% toast/vegemite, 8.3% jar/tin baby food, 7.7% pasta, 5.9% vegetables, 5.3% vegetables/meat. In the evening 56.2% were given vegetables with meat and 16% were given vegetables alone.

**Fast foods and drinks given to infants** - At 12 months of age mothers also reported 'fast foods' they had ever given to their infants. In relation to foods 78.1% of infants had been given fried chips, 67.4% pies, 65.7% fried chicken, 62.7% hamburgers, pasties 46.7%, and 16.6% chico rolls. In relation to drinks 78.1% had had cordial, 68%



lemonade, 56.2% coca cola, 22.5% pepsi cola and 29.0% other fizzy drinks. Data was not collected on how frequently these foods were consumed.

## **Discussion**

Although these data were collected in the middle and late 1990s, they do represent nutrition during infancy for a representative group of urban Aboriginal children. This is important as these children are now in their early teenage years and some are likely to be experiencing conditions such as obesity and diabetes(2, 3). These data also provide baseline information which can be used for monitoring and comparing future research. There are no other published studies that outline positive and negative aspects of infant nutrition for Aboriginal infants in an urban setting. Nutrition during the first year of life has importance to health at that period, and to the nutritional patterns that are established for life with commensurate health benefits and risks. This study outlines a range of nutritional practices of study infants: breast and bottle feeding patterns during the first year of life; addition of sugar to infant drinks; the proportion of infants who received sugar containing drinks during the first year of life; introduction of solid foods into the infant's diet; the food composition of meals given to study infants in the first year of life; and the proportion of study infants who were given a range of 'fast' foods in the first year of life.

### **Healthy aspects of infants' diets**

This study highlights a number of positive attributes of infant diets in line with recommended practices. First, breastfeeding was initiated for 88.3% of infants and at 6-12 weeks of age 69.3% were still receiving some breast milk, with 43.8% exclusively breast fed. At 7-8 months 50.6% of infants were receiving breast milk (32.5% breast

only, 18.1% breast milk and bottle feeds), and at 12 months 40.8% of infants were receiving breast milk (20.1% breast milk only and 20.7% breast milk and bottle feeds). These rates are similar to the national rates described by the 1995 National Health Survey, with 81.8% breastfed at discharge from hospital, and 62.6% fully or partially breastfed at 3 months, including 57.1% exclusively breast fed at this time(10). Second, solid feeds were introduced at an appropriate age between four and six months of age for the majority of infants. By six months of age 92.8% of infants had commenced solid feeds. A further positive feature of diets, were the food combinations fed to infants by 12 months of age. This is in keeping with the requirement for infants to have commenced eating a range of fruits, vegetables and grains so that when infants outgrow the nutrition content of the all milk diet they are able to enjoy food high in complex carbohydrates. Finally, the finding that more than 60% of infants were sometimes given water to drink in their bottles at 7-8 months and 12 months is a positive finding. Drinking water is important in the prevention of dental caries at all ages and is the most healthy form of hydration.

### **Adverse health aspects of infants' diets**

A number of opportunities for nutrition health intervention have been highlighted in this study. First, a large proportion of infants had sugar added to drinks they were given in their bottles. At the 6-12 week visit, 7-8 months and 12 month visits 16.8%, 24.1% and 31.4% of infants had sugar added to drinks from their bottle. In addition 20.8%, 57.2% and 45.6% of babies were put down to sleep while sucking their bottles at these same visits. Both these practices increase the risk of early dental decay among infants who have their first teeth erupting in infancy. Furthermore, when we look at the drinks infants were given in their bottles 'sometimes or usually', a number of drinks with high sugar

content including flavoured milk, cool drink, fruit juice and cordial were given to a high proportion of infants. Fruit juice has a high sugar content and, although mothers may have a perception that giving fruit juice to their infants is a healthy choice, they may be increasing the risk of early dental decay and reducing the infants' appetite for healthier foods. Related to these findings was the additional finding that very large numbers of infants had ever been given a range of carbonated sugar containing drinks in the first year of life. Of note lemonade was given to 68% of infants, followed by coca cola and pepsi cola. It is possible that one of the explanations for the large proportion of infants receiving lemonade is the advice parents received from health care providers to give clear fluids, such as juice, cordial or soft drink diluted when children are sick(11). Finally, this study indicates that high fat 'fast foods' are a component of the diets of Aboriginal infants. This study enumerated whether these foods were 'ever' given to infants, and, although high proportions had received fried chips and chicken from various food outlets, it is unclear whether this was a regular or rare occurrence. However, these data do suggest that patterns of eating diets high in saturated fats and refined carbohydrates may be an early feature of the diets of Aboriginal children.

### **Transition away from traditional diets to poor quality western diets**

This study conducted in an urbanized population of Aboriginal infants' highlights a significant transition away from traditional diets to poor quality western diets. Historical records document traditional Noongar family land holdings that gave access to an environment that was rich and varied for hunters and gatherers(12). Aboriginal elder informants(13) from this region indicated that sustained breast feeding was a feature of traditional diets for Noongar people. If a mother had problems with her breast milk supply or her own health it was usual for other lactating mothers in the clan to breast

feed the infant rather than early cessation of breast feeding. Infants were fed whatever the adults were eating. Adults would chew up the food until it was soft and then feed it to infants as they were gradually introduced to a non milk diet. The timing of introduction to adult foods coincided with infants getting their first teeth and demanding foods eaten by adults around them as their breast milk intakes failed to satisfy their appetites. A traditional diet was still widely eaten by Noongar people of this region in the 1940s and 1950s, however a transition to western diets increasingly occurred from the 1960s onward. The infants in this study were born in the mid 1990s'. Traditional foods from this region varied but included emu, kangaroo, possum, goanna, fresh water crustaceans (maron and gilgies), bardi grubs from under the bark of eucalyptus trees or in the roots of mallee trees, wild duck, mallee hen eggs taken from the mound where multiple eggs were found and fish for people who lived on the coast permanently or in different seasons. Everything edible on an animal carcass was consumed, including organs such as the liver, kidney, brain and intestines.

An example of traditional cooking was for elders to wash clean with water the intestines of the kangaroo and stuff the intestines with liver, kidney, muscle meat and fat of the animal and slowly cook the 'intestinal pudding' in the ashes of the fire. The fat would soak through all of the food during cooking. When cooked the 'pudding' would have the ashes dusted off with eucalyptus branches and be shared among the clan. Cooking in the ashes was a common method of cooking. A goanna would have its legs broken and a stick put a slit in its throat to remove the intestine prior to cooking in the ashes. The possum was cooked whole in its skin in the ashes. The eggs of the mallee fowl were a delicacy eaten only occasionally. The eggs were cooked standing up in the warm coals with the top of the shell removed. The tail of the kangaroo was cooked in its skin in the

ashes. The head of the kangaroo was cooked whole in the ashes and the tongue, brain and other meat were eaten. Brain was a rich component of the traditional diet eaten weekly whenever kangaroos were caught and eaten. Wild duck was opened up and cooked on the coals. Freshwater crustaceans were cooked whole on the coals. A limited supply of carbohydrates came from honey and the sap of white gum trees (manigum)(14). Bee hives were smoked to rid them of bees before the nest was robbed of honey for the clan's consumption. Plants foods were a part of the diet in relatively smaller quantities on a seasonal basis. They included wild mushrooms, tuberous roots, the 'wild peach or quandong fruit', berries from small shrubs called 'mulls' and other small pod like fruit on native shrubs.

### **Nutritional features of the traditional infant diet compared with the contemporary infant diet**

Available evidence suggests that the traditional diet of Aboriginal infants was high quality nutritionally. As noted above infants were breast fed for extended periods, and solid foods were introduced when infants got their first teeth at around 6 months of age. Wild animals have a very different composition to animals domesticated for human consumption, due in particular to their leanness(15).. Because muscle, fat and organs were all consumed, animals provided a rich source of long chain omega-3 polyunsaturated fats. Liver, for example, is also an excellent source of important nutrients including iron, zinc, vitamins A, D, and C (stable in cooked liver) and folate(16). Brain is a very rich source of DHA which is so important for development of the brain and nervous system. Carbohydrate foods such as yams contained complex carbohydrate which was slowly digested and absorbed (low GI)(17). Fruits and honey would have been a good source of readily digestible simple sugars – and in the case of

fruits also of fibre, K, Mg, and many other valuable bioactive phytochemicals with anti oxidant and anti-inflammatory actions.

The current study does not detail the specific nutrient content of the infants' diet. Meat, fruit and vegetable were part of the diets of most of the infants by 12 months of age, but the high proportions of infants who were given sugared drinks and fed fast-food within the first twelve months of life is disturbing. Diets that are rich in refined carbohydrates and saturated fats are likely to be deplete of many essential nutrients which are important for optimal infant growth.

The traditional diet provides a benchmark against which contemporary infant feeding practices generally compare very unfavourably. The wider community has much to learn from these traditional practices which are consistent with the dietary guidelines for children and adolescents in Australia(6). These guidelines promote a diet that includes plenty of vegetables, legumes and fruits and wholegrain cereals. These guidelines also suggest the inclusion of lean meat, fish, poultry, milks, yoghurts, cheese and the promotion of water as a drink. Care should be taken to limit saturated fat intake and to moderate overall fat intake, to choose foods low in salt and to consume only moderate amounts of sugar and foods containing added sugars.

### **Previous Reviews of Aboriginal and Torres Strait Islander Breast feeding and Infant Nutrition**

The findings of this study are consistent with the outcomes of a previous major review of breast feeding and infant nutrition among Aboriginal and Torres Strait Islander communities. The Commonwealth Government in Australia conducted a review(18) of

interventions and identification of best practice currently used by community based Aboriginal and Torres Strait Islander health service providers in promoting and supporting breast feeding and appropriate infant nutrition. One key initial finding of the report was that not all providers perceive breast feeding and infant nutrition as a priority within their Aboriginal and Torres Strait Islander catchment populations. Other services highlighted the issues of early inappropriate introduction of first foods and the use of powdered milk as opposed to infant formula when bottle feeding. The report highlighted the reliance of urban Aboriginal women on breast feeding advice from a small number of family members and often ill informed health professionals. In such settings, problems with breast feeding can escalate quickly and lead to premature cessation of breast feeding. The report notes further that there appears to be a significant decline in breast feeding rates in the first few months, compounded by the early introduction of solid foods, and sometimes inappropriate fluids.

## **Conclusion**

The results of this study highlight positive and negative aspects of infant feeding practices in a group of urban Aboriginal infants. Poor feeding practices such as the early introduction of solids, sugary drinks and fast food are likely to extend well beyond the Aboriginal community. There is potential to draw on aspects of traditional infant feeding practices, including the importance of extended breast feeding, and the introduction of a wide variety unprocessed foods from around 6 months as a model for improving the nutritional health of infants in Aboriginal communities and more widely. There is a need for ongoing research to monitor the dietary intake of Aboriginal infants and future studies could compare the diet of Aboriginal and non-Aboriginal infants.

## **Acknowledgements**

We thank all the families that participated in the study and all the Bibbulung Gnarneep supporters. Special thanks to project workers Joan Fraser, Myrtle Mullaly, Kerry Hunt and members of the Community Reference Group. Financial assistance for the project was given by the National SIDS Council of Australia, National Health and Medical Research Council, WA Health Promotion Foundation, Australian Institute for Aboriginal and Torres Strait Islander Studies, Office of Aboriginal Health (Health Department of WA), Aboriginal Affairs Department of WA, Olive Anstey Nursing Fund inc., Nurses Memorial Centre inc., and the Harcourt and Daisy Harper Trust. Dr Louisa Alessandri a Co-investigator on the Bibbulung Gnarneep study died suddenly during the course of the project.



**Table 1**

Drinks infants were given in their bottles at 7-8 months and 12 months of age				
FREQUENCY	7-8 months (N=166)		12 months (N=169)	
	Mostly <sup>1</sup>	Sometimes <sup>2</sup>	Mostly <sup>1</sup>	Sometimes <sup>2</sup>
TYPE	n (%)	n (%)	n (%)	n (%)
Breast milk	54 (32.5)	0	38 (22.5)	0 -
Infant formula	77 (46.4)	2 (1.2)	30 (17.7)	0 -
Powder cows' milk	18 (10.8)	3 (1.8)	34 (20.1)	4 (2.4)
Fresh cows' milk	17 (10.2)	10 (6)	62 (36.7)	22 (13)
Soy milk	0 -	1 (0.6)	0 -	3 (1.8)
Flavoured milk	0 -	25 (15.1)	0 -	55 (32.5)
Cool drink	0 -	20 (12.1)	0 -	56 (33.1)
Fruit Juice	0 -	88 (53)	0 -	118 (69.8)
Cordial	0 -	61 (36.8)	0 -	101 (59.8)
Tea or coffee	0 -	9 (5.4)	0 -	29 (17.2)
Water	0 -	101 (60.8)	0 -	109 (64.5)
Other	0 -	7 (4.2)	4 (2.4)	12 (7.1)
No bottles/milk	0 -	0 -	1 (0.6)	0 -
Total	166		169	

<sup>1</sup>mutually exclusive<sup>2</sup>not mutually exclusive

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**Title:**

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**Date:**

2010-07-01

**Citation:**

Eades, S. J., Read, A. W., McAullay, D., McNamara, B., O'Dea, K. & Stanley, F. J. (2010). Modern and traditional diets for Noongar infants. *JOURNAL OF PAEDIATRICS AND CHILD HEALTH*, 46 (7-8), pp.398-403. <https://doi.org/10.1111/j.1440-1754.2010.01752.x>.

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