

# An Investigation of Macronutrient Intakes among Infants in Saudi Arabia

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## Abstract

Toddlerhood is a vital phase of early life, during which long-term dietary habits are established. The aim of this study was to evaluate changes in dietary intake during the transition from baby food to table food in Saudi Arabia. A three-day food diary was used to record food and beverage intake data, which was then analysed using Weighed Intake Software Program (WISP). The main finding of study was that there was a rapid increase in protein intake during the transition towards a family food diet. However, this was not the case with the intakes of carbohydrate and fat.

**Keywords:** Macronutrient intake; Protein; Toddler

## Introduction

Nutrition in early life can have long-term effects on health in adulthood. There is now strong evidence that toddlerhood is a vital phase of early life, in which a person's long-term dietary habits are established. This potentially means that life-long levels of appetite, the likelihood of obesity, and other risk factors for cardiovascular diseases (CVD) are partly established at an early age [1]. It has been observed that scarce information is available on the impact of the transition from infant foods to table foods in terms of nutrient intake [2].

The main purpose of this study was to address this issue, by evaluating the changes in dietary intake during the early development stage of between 6 and 12 months in Saudi Arabia.

## Methods

### Recruitment

The study was done at the King Faisal Specialist Hospital, in Riyadh, Saudi Arabia. Its participants were 41 parents/caretakers of infants aged between 6 and 12 months. The fieldwork for the study was carried out between July 2011 and February 2012. Ethical approval was granted by King Faisal Specialist Hospital's Research Ethics Committee.

### Dietary records

A three-day diet diary format was developed by the research team for use by the parents/caretakers of the infants and toddlers aged between six to 12 months. The types and amounts of drinks, the types of food (including the ingredients of homemade meals and the brand names of processed foods) and the amounts offered to and left by the child. At the end of the recording period, the researchers visited the homes to collect the records and check their completeness.

### Dietary calculations

Each completed diary was transformed into weights and codes corresponding to each of the foods or beverages taken, using Weighed Intake Software Program (WISP) (Tinuviel Software, Anglesey, UK). The data entry procedure involved entering food codes with weights in grams, adding new codes for foods which were not already in the database. Homemade foods were sometimes reported in the diet diaries; in such instances, the recipe entry requested from the parent was used to determine their ingredients, after which these foods were added to the database. WISP also allowed the entry of the nutrient data of commercially manufactured products, based on information

which was obtained from the product labels available online. Once all the foods and their weights were entered, the nutrient data were then imported into the SPSS for statistical analysis [3].

The volume of breast milk consumed was estimated for infants reported as breast feeding, using an approach recently used in the Diet and Nutrition Survey of Infants and Young Children, 2011 [4]. This estimated the amounts of breast milk consumed as 470 g and 400 g, for infants aged 6 months and 12 months respectively.

### Statistical analysis

Statistical analysis was performed using the SPSS for Windows statistical package (18.0; SPSS Inc., Chicago, IL., USA). All p-values were two-tailed, and statistical significance was considered to exist for p-values of <0.05. Continuous variables (macronutrient intakes) were presented as mean and standard deviation (SD) and categorical variables were presented only as frequencies. An independent samples t-test evaluated changes in diet among infants.

## Results

Figure 1 shows the differences in macronutrient intakes between 6 and 12 months. It is evident that the total energy intake (EI) and intakes of protein and carbohydrate (both in grams and as a percentage of total EI) increased with increasing age from 6 months to 12 months. Conversely, and as expected, Fat intake did not increase between the two ages, but instead decreased as a percentage of total EI (Figure 1).

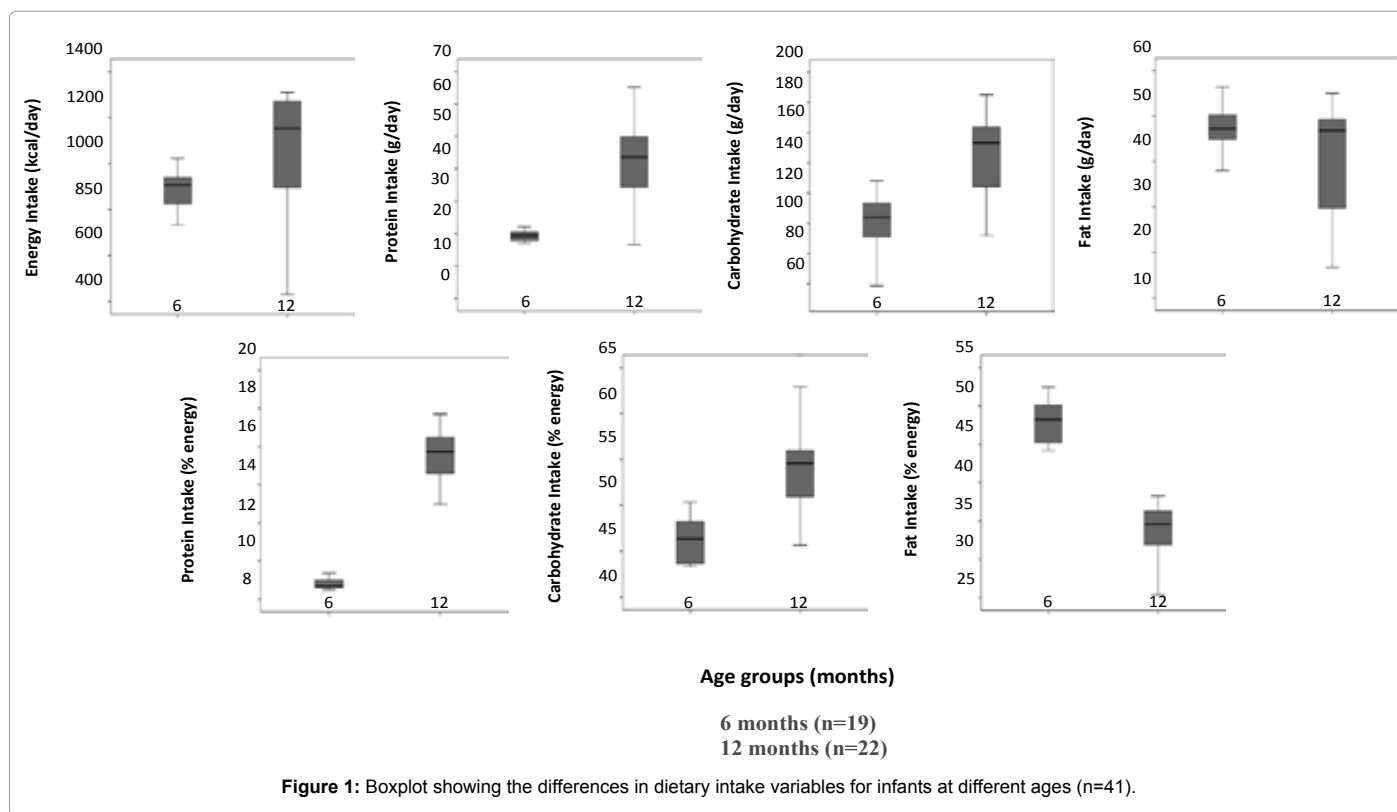
Table 1 shows the differences in dietary intakes between the two age groups. From an intake of  $848 \pm 177$  kcal/day at 6 months, EI had significantly increased by 12 months of age ( $1066 \pm 249$  kcal/day). It is also apparent that the absolute intakes of protein and carbohydrate followed a similar pattern, as they rose significantly between 6 and 12 months of age (for 6 and 12 months of age, respectively, the figures were:  $19.5 \pm 6.7$  g/day and  $42.5 \pm 11.7$  g/day for protein,  $98.2 \pm 21.8$  g/

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	Age groups		P
	6months (n=19)	12 months (n=22)	
<b>EI (kcal/day)</b>	848 ± 177	1066 ± 249	.002
<b>Absolute intake<sup>1</sup></b>			
Protein (g)	19.5 ± 6.7	42.5 ± 11.7	< .0001
Carbohydrate (g)	98.2 ± 21.8	144.6 ± 30.8	< .0001
Fat (g)	45.1 ± 8.9	40.2 ± 12.0	.145
<b>Relative intake<sup>2</sup></b>			
Protein (%)	9.1 ± 1.5	15.9 ± 1.8	< .0001
Carbohydrate (%)	46.3 ± 2.5	54.7 ± 4.7	< .0001
Fat (%)	48.0 ± 2.7	33.5 ± 3.9	< .0001

Abbreviation: EI: Energy Intake.  
All values Mean ± SD.  
The independent samples t-test.  
<sup>1</sup>Expressed as grams per day.  
<sup>2</sup>Expressed as a percentage of total energy intakes.

**Table 1:** Significant differences in dietary intakes at 6 and 12 months (n=41).

day and 144.6 ± 30.8 g/day for carbohydrate). The fat intake differed, as it shows a non-statistically significant decrease between the two ages. However, when intakes of the macronutrients are expressed as a percentage of EI, only protein and carbohydrate showed increases with increasing age from 6 to 12 months, while in contrast, fat showed a significant decrease (for 6 and 12 months, respectively, the figures were: 9.1% and 15.9% for protein, 46.3% and 54.7% for carbohydrate and 48.0% and 33.5% for fat) (Table 1).

When comparing mean protein intake with the WHO average requirements and safe levels for protein [5], Figure 2 demonstrates that the average daily intake of protein exceeded requirements for the two age groups. Specifically, infants aged 6 months and 12 months respectively consumed about 2.0 and 3.9 times more protein relative to the WHO requirements (Figure 2).

## Discussion

The main findings of the Saudi study were as follows. When macronutrient intakes were expressed as absolute amounts, the mean intakes of energy, protein and carbohydrate rose significantly between 6 and 12 months of age. However, when intakes of the macronutrients were expressed as a percentage of EI, protein and carbohydrate showed increases with increasing age. These findings can be compared with a study by [2] which also collected information on actual dietary intake in order to evaluate changes in the mean intakes of nutrients during the transition from baby food to table food, for older infants and toddlers aged between nine to 11 months (n=679), 12 to 14 months (n=374), 15 to 18 months (n=308), and 19 to 24 months (n=316). They found that the mean intakes of energy, protein, carbohydrate and total fat increased with age.

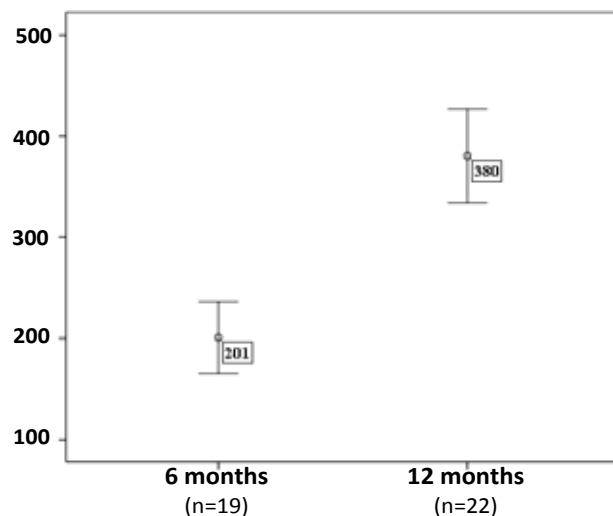


Figure 2: Mean protein intakes (with 95% confidence limits) as a percentage of the World Health Organization (WHO) requirements (n=41).

The findings of the study also show that there was a rapid increase in protein intake with increasing age not only when the intake of protein was measured in absolute terms as grams but also when the intake was measured as a percentage of the total EI. These findings are consistent with a number of other follow-up studies which have reported that it is common for infants to experience a rapid rise in their protein intake during the introduction of solid foods and during the transition towards a family food diet [5,6]. For example, a follow-up study conducted by Gunther et al. in Germany found that for infants of 6 months, 12 months, and toddlers of 18–24 months of age, the mean daily protein intakes were 11.9 g/day, 29.7 g/day and 33.8 g/day respectively. The mean percentages of energy from protein were 7.8%, 14.7% and 14.8% respectively.

Continuing the consideration of the context of the study in relation to the research in the field, a number of prior longitudinal studies have also shown a positive association between a high protein intake during infancy and early childhood and a higher BMI in later childhood [5,7-12]. For example, a recent follow-up study observed that a higher protein intake at an age of 18 months was positively associated with a higher BMI at 8 years of age [7].

A number of limitations are inherent in the study, and these should be acknowledged. The first limitation is that the data gathered were cross-sectional in design and therefore did not follow the same children's intakes at different stages in their development. The second limitation of the study was the non-representativeness of the investigated samples as the sample was relatively small. Given the above-mentioned shortcomings, caution should be exercised in drawing definitive conclusions and in generalising the results of the Scottish or Saudi studies to the wider populations.

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