*Archives of Disease in Childhood*, 1978, **53**, 749–760

# *Short reports*

## Growth and milk intake of normal infants

Until recently, most British infants had been fed either by breast or on one of the traditional 'full cream' milks. Since the publicity given to the recommendations of the Department of Health and Social Security in its report *Present Day Practice in Infant Feeding* (1974) and the advice in 1976 to the general public via television, radio, and the newspapers, full cream milks have mainly been abandoned. The modified formulae which have taken their place, although superficially similar, may be fundamentally different, particularly regarding the fat used in their formulation (Widdowson *et al.*, 1974; Mettler, 1976). The growth rates of infants fed 3 modified formulae were studied and a comparison was made with a group of infants fed at the breast.

### Subjects and methods

94 normal term infants were studied. The mothers were interviewed antenatally, and consent obtained to study the infants. Mothers not wishing to breast feed were randomly allocated to one of 3 bottle milk groups before delivery of the infant.

*Group A.* Breast fed (33 infants—18 boys and 15 girls).

*Group B.* Cow and Gate V formula, skimmed milk with added vegetable oils and lactose (16 infants—9 boys and 7 girls).

*Group C.* Cow and Gate Premium, cows' milk whey, lactose, vegetable oils, and cream (27 infants—16 boys and 11 girls).

*Group D.* Cow and Gate Baby Milk Plus, cows' milk with additional cream and lactose (18 infants—10 boys and 8 girls).

The concentrations of the principal nutrients of the 3 bottle milks and values for human milk from Cardiff women are shown in Table 1.

Table 1 *Principal nutrients of milks (per 100 ml)*

| *Group* | *Protein (g)* | *Fat (g)* | *Lactose (g)* | *Kcal* | *MJ* |
|---|---|---|---|---|---|
| A | 1·4 | 3·8 | 7·0 | 68 | 0·28 |
| B | 1·8 | 3·2 | 7·0 | 63 | 0·26 |
| C | 1·8 | 3·4 | 6·9 | 64 | 0·27 |
| D | 1·8 | 3·4 | 7·0 | 63 | 0·26 |

Infants were seen at birth, and again at 1, 2, 3, and 6 months. Weight was measured with an Avery beam balance (to the nearest 10 g), length with a neonatometer (Davies and Holding, 1972), and occipito frontal circumference with a steel tape (to the nearest 1 mm). Skinfold thickness was estimated using a Harpenden caliper (Tanner and Whitehouse, 1975) at subscapular and triceps sites. The measurements at each site were combined for analysis. All measurements, except birthweight, were made with the same set of instruments by one observer.

The mothers were advised to feed their infants *ad libitum* but to avoid weaning until at least 4 months of age. Breast-fed infants were excluded if given more than the occasional bottle feed. All the mothers were given specifically designed forms on which to record information about feeds once every 14 days.

Statistical analysis of difference between means was by Student's *t* test. The skinfold measurements were subjected to a log transformation (Tanner and Whitehouse, 1975) before *t* testing.

### Results

**Growth data** (Table 2). There was no significant difference between the groups at birth.

The weekly weight gains of the 4 groups were similar for the 4 age intervals, apart from a significantly greater velocity between 2 and 3 months for group A and group D infants. When the weight velocity for the interval 0 to 3 months was calculated no significant difference was found between the mean weight gains of the 4 groups.

The mean crown-heel length velocities showed no significant difference either for each one-month interval from birth to 3 months or for the whole period, and the same uniformity in head growth (OFC) was found.

The increments in skinfold showed a pattern similar to the changes in weight, group A infants making the most rapid gain in the first month but groups B, C, and D infants making an acceleration by the 3rd month.

**Milk intake** (Table 3). The volume of milk consumed per day at approximately 1, 2, and 3 months was divided by the baby's weight to give volume in ml/kg per day, and the mean results for the 3 bottle-fed groups are shown in Table 3. At each age the milk consumed per kg was greatest for group B,

Table 2 *Growth data of 4 feeding groups*

| Group | No. of infants | 0–1 month | 1–2 months | 2–3 months | 3–6 months |
|---|---|---|---|---|---|
| *(Weight gain (g/week) (mean values ±SE)* | | | | | |
| A | 33 | 175±14·9 | 178± 8·77 | 145±12·58 | 118±9·24 |
| B | 16 | 144±13·99 | 190±19·65 | 176±19·75 | 122±8·82 |
| C | 27 | 172±11·58 | 202±11·82 | 176± 8·47 | 131±4·86 |
| D | 18 | 151±13·81 | 206±12·78 | 187±12·59 | 132±6·01 |
| No significant difference between the groups except D/A 2–3 months $P<0·05$ | | | | | |
| *Linear growth velocity (mm/week) (mean values ±SE)* | | | | | |
| A | 33 | 9·34±0·45 | 7·8 ±0·51 | 5·47±0·49 | 3·92±1·74 |
| B | 16 | 9·86±0·93 | 8·1 ±0·58 | 6·83±0·72 | 4·32±2·17 |
| C | 27 | 8·51±0·48 | 8·47±0·54 | 5·35±0·41 | 4·16±1·79 |
| D | 18 | 8·83±0·52 | 8·03±0·64 | 6·03±0·6 | 4·12±2·83 |
| No significant difference between groups | | | | | |
| *Head circumference growth (cm/week) (mean values ±SE)* | | | | | |
| A | 33 | 0·58±0·002 | 0·40±0·02 | 0·27±0·02 | 0·22±0·09 |
| B | 16 | 0·54±0·04 | 0·39±0·03 | 0·34±0·02 | 0·22±0·14 |
| C | 27 | 0·55±0·03 | 0·41±0·03 | 0·35±0·02 | 0·22±0·09 |
| D | 18 | 0·56±0·02 | 0·38±0·03 | 0·31±0·03 | 0·23±0·15 |
| No significant difference between the groups except A/C 2–3 months $P<0·02$ | | | | | |
| *Combined skinfold thickness (triceps and subscapular) mm/week* | | | | | |
| A | 32 | 0·60±0·078 | 0·22±0·062 | 0·15±0·068 | |
| B | 13 | 0·40±0·081 | 0·23±0·070 | 0·46±0·073 | |
| C | 26 | 0·51±0·107 | 0·35±0·070 | 0·21±0·078 | |
| D | 18 | 0·40±0·08 | 0·30±0·089 | 0·38±0·144 | |
| No significant difference between groups | | | | | |

Table 3 *Milk intake (ml/kg per 24 h). (Mean values ±SE)*

| Group | No. of infants | 1 month | 2 months | 3 months |
|---|---|---|---|---|
| B | 14 | 200·9 ±6·82 | 187·21±8·71 | 182 ±8·44 |
| C | 26 | 188·16±5·75 | 176·5 ±3·86 | 157 ±7·36 |
| D | 15 | 192·4 ±8·15 | 185·1 ±9·58 | 169·46±8·77 |

(Group B/C at 3 months $P<0·05$).

least for group C, and intermediate for group D, although only at 3 months did a significant difference exist.

## Discussion

Breast-fed infants are usually thought to gain less weight than bottle-fed infants (Fomon *et al.*, 1971). However, in this study, weight velocities were similar in the breast- and in the 3 different bottle-fed groups. An earlier study of infants in South Wales found a much greater weight gain, 230 to 279 g per week, from birth to 3 months (Davies *et al.*, 1977). However, the infants in this study, unlike those studied by Davies *et al.*, were not given solids and were fed either by breast or on a modified low-solute formula which may account for the differences.

Although the differences were small, it is interesting to note that the breast-fed infants made the most rapid gain during the 1st month but the least during the 3rd month, for both weight gain and skinfold thickness.

Formulae—such as Baby Milk Plus—which use only butter fat as a source of lipid have been criticised because of their low linoleic acid content compared with breast milk. Nevertheless no adverse effect was noted in this study on the head or linear growth of infants in group D. The differing fatty acid content of the milks may however have an important effect on lipid absorption. Human milk fat is relatively well absorbed (5% excretion) compared with butter fat (14% excretion) (Southgate and Barrett, 1966). Milner *et al.* (1975) found a mean faecal fat excretion of 28% for infants fed on Cow and Gate V formula, but the infants studied were all preterm. No comparative studies for Cow and Gate Premium are available but a consideration of the fat used in its manufacture and its fatty composition would suggest a fat absorption better than either Cow and Gate V formula or Baby Milk Plus. Fomon (1974) has postulated and presented some proof that infants are able to regulate their calorie intake by increasing the volume of milk consumed if given a 'diluted' formula. Loss of calories as unabsorbed fat probably accounted for the persistently larger milk intake of the babies fed V formula despite their relatively lower weight gains. The infants in this study were fed *ad libitum* but if a rigid rule of 150 ml/gk had been adhered to it seems likely that a suboptimal weight gain and hungry infants would have resulted, or the mothers resorted to the use of solids.

## Summary

The growth of 94 normal term infants was studied from birth to 6 months. 33 infants were breast fed and the others randomly allocated to one of 3 bottle feeds—Cow and Gate V formula, Baby Milk Plus, and Premium. The weight, length, and head growth velocities were similar in all 4 groups. The infants fed Cow and Gate V formula consumed a larger volume of feed at 3 months than the infants fed the 2 other formulae despite a slower weight gain. It is suggested that this is related to loss of calories in unabsorbed fat.

The weight gains of all 4 groups in this study were considerably less than infants fed unmodified milks and early solids, studied in the same region several years earlier.

I thank Professor O. P. Gray, Dr J. A. Dodge, Mrs T. Keogh, and Miss H. Bleach for advice and

assistance throughout this work, the Welsh National School of Medicine and Cow and Gate Baby Foods for financial support and the infants' mothers for their time and co-operation.

**References**

Davies, D. P., Gray, O. P., Elwood, P. C., Hopkinson, C., and Smith, S. (1977). Effects of solid foods on growth of bottle fed infants in first three months of life. *British Medical Journal*, **2**, 7–8.

Davies, D. P., and Holding, R. E. (1972). Neonatometer: a new infant length measurer. *Archives of Disease in Childhood*, **47**, 938–940.

Department of Health and Social Security (1974). *Present Day Practice in Infant Feeding*, Report on Health and Social Subjects, No. 9. DHSS: London.

Fomon, S. J. (1974). *Infant Nutrition*, second edition, pp. 27–31. Saunders: Philadelphia.

Fomon, S. J., Thomas, L. N., Filer, L. J., Ziegler, E. E., and Leonard, M. T. (1971). Food consumption and growth of normal infants fed milk-based formulas. *Acta paediatrica Scandinavica*, 223, Supplement, 1–36.

Mettler, A. E. (1976). Infant milk powder feeds compared on a common basis. *Post-Graduate Medical Journal*, **52**, Supplement 8, 3–20.

Milner, R. D. G., Deodhar, Y., Chard, C. R., and Grout, R. M. (1975). Fat absorption by small babies fed two filled milk formulae. *Archives of Disease in Childhood*, **50**, 654–656.

Southgate, D. A. T., and Barrett, I. M. (1966). The intake and excretion of calorific constituents of milk by babies. *British Journal of Nutrition*, **20**, 363–372.

Tanner, J. M., and Whitehouse, R. H. (1975). Revised standards for triceps and subscapular skinfolds in British children. *Archives of Disease in Childhood*, **50**, 142–145.

Widdowson, E. M., Southgate, D. A. T., and Schutz, Y. (1974). Comparison of dried milk preparations for babies on sale in 7 European countries. I. Protein, fat, carbohydrate, and inorganic constituents. *Archives of Disease in Childhood*, **49**, 867–873.

T. J. EVANS

*Department of Child Health, Welsh National School of Medicine, Heath Park, Cardiff CF4 4XN*

# 5-α-Reductase deficiency causing male pseudohermaphroditism

Growth of the phallus, fusion of the labia, and formation of the scrotum in males require the conversion of testosterone to 5-α-dihydrotestosterone (DHT) at tissue level. The enzyme required for this conversion is 5-α-reductase which is found in high concentration in fetal urogenital tissue (Wilson, 1975). Testosterone itself brings about obliteration of the lower part of the vagina and descent of the testis. Lack of 5-α-reductase produces a form of fetal androgen insensitivity which has specific clinical features (Peterson *et al.*, 1977). Recognition of the condition is crucial to deciding on the sex of rearing.

**Case history**

The baby was born at term by normal delivery in Lahore, West Pakistan. Birthweight was 3·5 kg. The pregnancy was uneventful and no drugs were ingested. The parents were unrelated and there was no relevant family history.

Ambiguous genitalia were noted at birth. At age 2½ years the patient was brought to the UK for investigation. Physical development and milestones were normal. Length was on the 50th centile. Examination of the external genitalia (Figure) revealed two palpable testes in labial folds and a slightly enlarged clitoris with an urethral opening at its base. There was no vaginal opening.

Investigations showed normal male karyotype. Diurnal values of plasma cortisol and ACTH were normal. After 3 injections of human chorionic gonadotrophin 750 units on alternate days, plasma testosterone rose from 0·8 to 15·8 and 17·8 nmol/l (0·2 to 4·6 and 5·2 ng/ml) on days 4 and 6. Testicular biopsies showed seminiferous

Fig. *Age 2½ years, ambiguous external genitalia.*