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Arch. Dis. Child. 2008;93:292-296; originally published online 14 Feb 2007;
doi:10.1136/adc.2006.107102

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Does breastfeeding method influence infant weight gain?

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Accepted 6 February 2007
Published Online First
14 February 2007

ABSTRACT

Objective: To compare the effect of traditional and "baby-led" breastfeeding advice on early infant weight gain and exclusive breastfeeding rates.

Design: Longitudinal cohort study: part prospective, part retrospective.

Setting: One UK general practice.

Participants: 63 exclusively breastfed infants in two cohorts: 32 babies born before and 31 babies born after a change in breastfeeding advice.

Intervention: A change from baby-led to traditional breastfeeding advice.

Main outcome measures: Primary analysis: comparison of the effectiveness of the intervention (ie, weight gain expressed as standard deviation score gain (SDSG) between birth and 6–8 weeks) and exclusive breastfeeding rates between babies whose mothers received traditional advice and those whose mothers received baby-led advice. Secondary analysis: relevance of feed length (ie, weight gain expressed as SDSG between birth and 6–8 weeks in babies feeding for 10 min or less from the first breast and those feeding for longer than 10 min).

Results: The two groups were equivalent with respect to birth weight, gestational age, and parity. Primary outcome: babies whose mothers received the traditional advice were more likely to be exclusively breast fed up to 12 weeks (log rank $\chi^2 = 9.68$, $p = 0.002$) and gained more weight up to 6–8 weeks than those given baby-led advice (mean SDSG 0.41 (95% CI 0.13 to 0.69) vs -0.23 (95% CI -0.72 to 0.27)). Secondary outcome: irrespective of feeding advice given, babies feeding for 10 min or less from the first breast gained more weight by 6–8 weeks than babies feeding for longer than 10 min (mean SDSG 0.42 (95% CI 0.11 to 0.73) vs -0.19 (95% CI -0.64 to 0.26)).

Conclusions: In this study, traditional breastfeeding advice resulted in increased weight gain and increased exclusive breastfeeding rates compared with baby-led advice. Exclusively breastfed babies who had shorter feeds (10 min or less from the first breast) gained more weight.

Exclusive breast feeding at the time when traditional breastfeeding advice was given (both breasts used at each feed, up to 10 min per breast) has been shown to be associated with rapid infant weight gain over the first 2 months of life.^{1,2} However, in 1988, one study suggested that such advice may result in "overfeeding", lactose intolerance and inadequate energy intake because of failure to use the fat-rich hind milk, resulting in poor growth.³ Advice to breastfeeding mothers was therefore altered: the feed from the first breast should be unlimited in time ("baby-led" feeding), and both breasts need not be routinely used at each

feed.⁴ It is advised that feeds could last 45–60 min per breast.⁵ Despite this, the physiology of long feeds is not well understood, and there has been no systematic assessment of weight gain in babies who have prolonged feeds from the first breast.

After adoption of this new advice in our practice, we noted concern about infant weight gain. Using a longitudinal model based on routinely collected data, we investigated this by returning to traditional breastfeeding advice for a prospective cohort of mothers, comparing their infants' weight gain with that in a cohort who had received the baby-led advice. Primary outcome measures were: whether traditional or baby-led breastfeeding advice resulted in greater weight gain; the relationship between weight gain and length of feed from the first breast. Secondary outcome measures included comparison of the time to termination of exclusive breast feeding up to 12 weeks and the distribution of length of feed on the first breast.

PATIENTS

The potential study population comprised all babies in one semi-rural West Yorkshire general practice born between 1 November 1995 and 31 January 2000 who were breast feeding at the health visitor's first domiciliary visit (10–14 days post partum). We excluded babies from analyses if there were intractable latching problems or significant medical conditions likely to affect breast feeding or weight gain (table 1).

The babies were put into one of two groups: those whose mothers received baby-led breastfeeding advice (group 1, 32 babies, born 1 November 1995 to 31 October 1997) and those whose mothers received traditional advice (group 2, 31 babies, born 1 February 1998 to 31 January 2000). No babies born during the intervening 3 months were breast fed. Group 1 were studied retrospectively, and group 2 prospectively.

METHODS

Mothers in both groups were cared for antenatally and up to 10 days post partum by community midwives, who did not participate in the study but gave the standard baby-led breastfeeding advice to all mothers in both groups. At 10–14 days post partum, postnatal care was taken over by the health visitor who continued with baby-led breastfeeding advice for group 1 but introduced traditional breastfeeding advice for group 2, who were informed that breastfeeding advice had changed. The relevant breastfeeding advice (see below) was reiterated at subsequent health visitor visits, verbally and in writing in the parent-held records. Babies were weighed at the first health

Table 1 Characteristics of the study population

	Group 1	Group 2
Potential study population	40	35
Lost to follow-up	1 baby at 2 days, 1 baby at 16 days	0
Number of babies available	38	35
Medical exclusions	2 babies: 1 (maternal drug addiction), 1 (maternal rheumatoid arthritis and breast surgery)	1 baby (cerebral palsy)
Severe intractable latching problems	1	1
Number of babies after exclusions	35	33
Babies who never exclusively breast fed	3	2
Babies available for analyses		
Numbers of babies exclusively breast fed	32	31
Feed length	31 (1 baby ceased breast feeding at 2 weeks, no data)	30 (inexact data for 1 baby, lost to follow-up at 5 weeks)
Weight gain	29 (2 babies (siblings) excluded because of maternal gestational diabetes; 1 baby ceased breast feeding at 2 weeks)	30 (1 baby lost to follow-up at 5 weeks, no data)
Weight gain (SDSG) at 6–8 weeks	22 (5 babies ceased exclusive breast feeding before 6 weeks of age; 2 babies exclusively breast fed to 6 weeks but were not weighed at this time)	29 (1 baby ceased breast feeding at 3 weeks)

Group 1, mothers received baby-led breastfeeding advice; group 2, mothers received traditional advice.
SDSG, standard deviation score gain.

visitor visit and then weekly until 8 weeks, after which a fortnightly “drop-in” clinic was available to mothers when needed. JMO supervised all mothers in group 2, and 25/32 mothers in group 1.

A questionnaire (online supplementary material) was sent to all mothers who breast fed for longer than 3 weeks. Infant weights and some feeding data were routinely recorded in parent-held records, general practitioner and health visitor records, midwifery records, hospital antenatal and postnatal and inpatient/outpatient records; these were available for scrutiny. No data, including baby weights, were collected specifically for the study.

Breastfeeding advice

General breastfeeding advice was to ensure good positioning and latching at the breast.

Group 1 (baby-led)

Babies should feed on demand: the baby should be allowed to remain on the first breast for an unlimited length of time and relinquish the breast spontaneously; the second breast should only be offered if the baby shows signs of hunger.

Group 2 (traditional)

Babies should feed for up to 10 min from each breast, both breasts at each feed, and have regular feeds approximately every 3 h during the day and “on demand” at night with gaps of no less than 2 h from the beginning of each feed. A stable pattern should be established with the “breakfast” feed at the same time every morning. Each mother could therefore adjust the advice to fit her own circumstances.

Data collection

Data on breastfeeding practice and the time of cessation of exclusive breast feeding were taken from the questionnaires. This information was available from routine clinical records for the two mothers who had left the practice before the questionnaires were sent out. The information in the routine records was also used to confirm the date of cessation of exclusive breast feeding, thereby also defining the weight measurements to be used to calculate the average weights at 6–8 weeks. By this means it was possible to: date the cessation of exclusive breast feeding to earlier than 6–8 weeks for 8/32 babies in group 1 and 1/30 in group 2 (a further baby was lost to follow-up while exclusively breast feeding at 5 weeks); confirm

Table 2 Maternal and baby characteristics

Characteristic	Group 1	Group 2	p Value
Maternal age (years) at delivery	29.8 (18.3–38.6)	28.9 (19.2–38.4)	0.70
Maternal weight (kg) before or in early pregnancy*	66.6 (12.9)	68.3 (14.4)	0.62
Maternal height (m)*	1.65 (0.07)	1.64 (0.06)	0.93
Sex of baby (M:F)	15:17	17:14	
Babies born before 40 weeks	15/32 (47%)	17/31 (55%)	
Gestational age at birth, in days before term for babies born before 40 weeks	−9.7 (6.8)	−8.8 (6.8)	0.73
Birth weight as SDS	0.41 (1.13)	0.34 (0.92)	0.73
Birth weight (kg)	3.53 (0.56)	3.51 (0.43)	0.87
Proportion of maternal partners in social class I or II	15/32 (47%)	11/31 (35%)	
Second or later babies	17	16	
Mothers with previous experience of breastfeeding	16/17	16/16	
Previous breast feeding for ≥6 weeks†	15/16	12/16	

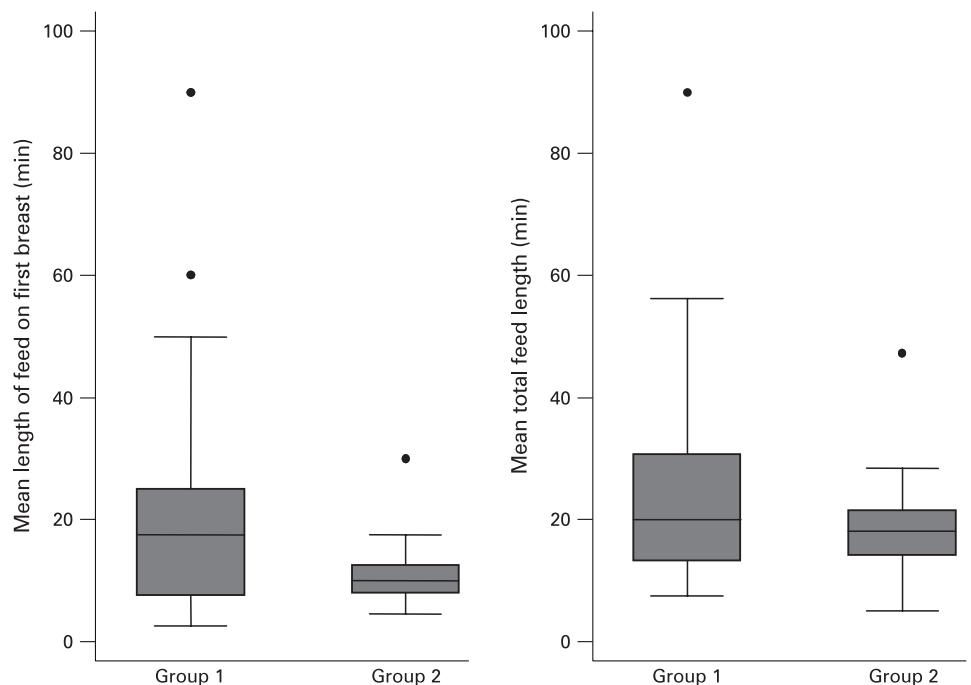
Unless otherwise indicated, values are median (range) or mean (SD). Group 1, mothers received baby-led breastfeeding advice; group 2, mothers received traditional advice.

*No weight or height data for one mother and no weight data for one mother in group 1; no height data for one mother in group 2.

†Length of previous breastfeeding experience unknown for one mother in group 1.

SDS, standard deviation score calculated using the 1995 British Growth Reference.

Figure 1 Box plots of mean length of feed on the first breast and mean total feed length, by group.



continuation of exclusive breast feeding to at least 6–8 weeks for 20/24 babies in group 1 and 27/29 babies in group 2; and assess the time of cessation of exclusive breast feeding at 6–12 weeks for 8/24 babies in group 1 and 13/29 babies in group 2. Where no data were available to confirm exclusive breast feeding after 6–8 weeks, routine records showed that the baby was still breast feeding over the time stated by the mother (for exclusive breast feeding) in the questionnaire for 14/16 babies in group 1 and 14/16 babies in group 2.

Questionnaire (online supplement)

This was sent to group 1 at a mean of 79 weeks (range 37–132) post partum, and group 2 at 65 weeks (range 15–112). There was no difference in the time at which the survey was sent to the two groups. Data were available for all mothers who exclusively breast fed: all in group 1 responded, and contemporaneous data from clinical records were used for the two in group 2 who had left the area. Thirteen babies were still breast feeding at the time the questionnaire was sent (five in group 1, eight in group 2).

Mothers were asked about: infant latching; the length of the shortest feeds, most feeds and the longest feeds from both the first and (if relevant) the second breast (the mean length of most feeds was used to assess feed length; where other questionnaire evidence was available to more precisely define feed length, this was used); whether there was any change in the length of feeds as the baby grew older; feed frequency and timing; whether the baby fed from one or both breasts; the proportion of feeds a day that were from one or two breasts, and whether there was any change in feeding pattern. Information on feeding behaviour from the age of 10 days to 3 months was used, where appropriate. Mothers were also asked about the timing of the introduction of formula milk feeds or weaning, and the age of cessation of all breast feeding.

Weight

Babies were weighed with portable Seca scales 724 and 835, calibrated and serviced by the local district general hospital.

Gestational age was assessed from pregnancy dating scans. Using the 1995 British Growth Reference (standardised for gender and gestational age), birth weight was converted into a standard deviation score (SDS).⁶ The SDSGAIN function, which enables a conditional weight gain (SDSG) to be calculated allowing for regression to the mean, was used to show weight gain from birth to 6–8 weeks (the time of maximum relative weight for breastfed babies)^{2 6}; SDSG = 0 indicates the expected weight gain. Available weight measurements per baby were: group 1, mean 1.8 (range 1–3); group 2, 2.6 (range 1–4). Group 2 babies continued exclusive breast feeding for longer than group 1 and therefore more readings were available.

Statistical analysis

All analyses were conducted using Stata Release 9 (StataCorp, College Station, Texas, USA). The length of feed from the first breast was dichotomised (up to and including 10 min or greater than 10 min), irrespective of breastfeeding advice and weight

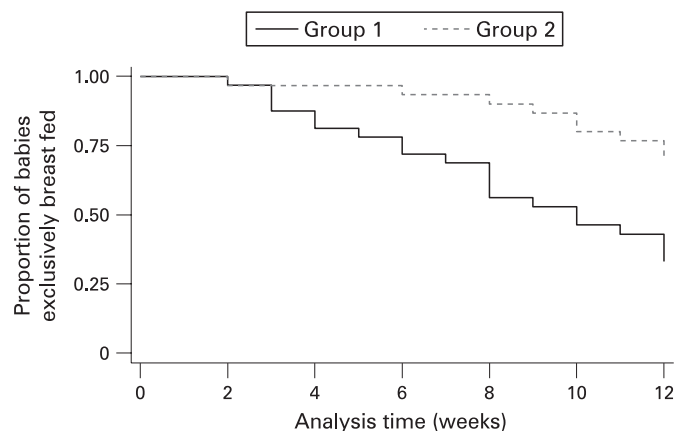


Figure 2 Kaplan–Meier plot showing continuation of exclusive breast feeding up to 12 weeks, by group. Log rank test: $p = 0.002$. HR = 0.32 (95% CI 0.14 to 0.69).

gain compared with an independent samples t test, assuming equal variances. A similar comparison was performed for the two advice groups, irrespective of first-breast feed length. A Kaplan–Meier plot and the log rank test were used to compare the time to termination of exclusive breast feeding between the two advice groups. The distribution of length of feed from the first breast was compared between the groups using an independent samples t test and a test of equality of variances.

Ethics approval

Local research ethics committee approval was obtained from Airedale NHS Trust before the start of the study. Patient consent was not sought: only anonymised routinely collected data were used.

RESULTS

There were no differences in maternal and infant characteristics between the two groups (table 2).

Breastfeeding

In keeping with the advice given, babies in group 1 were more likely to be fed from a single breast at each feed than those in group 2 (12/31 vs 1/31; Fisher's exact test: $p < 0.001$), and the length of their feed from the first breast was much longer (mean 20.0 min (95% CI 13.6 to 26.4) vs 10.9 (95% CI 9.1 to 12.7), $p = 0.009$) (fig 1), with a greater variance (SD 17.6 vs 4.8, $p < 0.001$). Also, babies in group 1 were more likely to be fed for more than 10 min on the first breast than those in group 2 (23/31 vs 9/30 respectively, $\chi^2 = 11.94$, $p = 0.001$). Babies in group 2 were more likely to be exclusively breast fed up to 12 weeks (log rank $\chi^2 = 9.68$, $p = 0.002$) (fig 2). There was also a trend for mothers given baby-led advice to have longer total feed lengths than the remainder (mean total length of feed: group 1, 25.6 min (95% CI 18.1 to 33.1); group 2, 18.5 (95% CI 15.7 to 21.3), $p = 0.076$), but no difference in the number of feeds per day (group 1, mean 7.6 (SD 1.6, range 4.5–9.5); group 2, 6.9 (SD 1.7, range 4–9.5)).

Weight gain

Of the 59 babies for which data were available for weight gain analysis, 51 (86%, 22 in group 1) had sufficient timely measurements to calculate SDSG at 6–8 weeks. Babies in group 2 gained more weight at this time (0.41; 95% CI 0.13 to 0.69) than babies in group 1 (SDSG -0.23 ; 95% CI -0.72 to 0.27) ($p = 0.019$). Babies fed for 10 min or less on the first breast had gained more weight by 6–8 weeks (SDSG 0.42; 95% CI 0.11 to 0.73) than those having longer feeds (-0.19 ; 95% CI -0.64 to 0.26) ($p = 0.023$), irrespective of the breastfeeding advice given.

DISCUSSION

Our results show that, in exclusively breastfed babies, feeds exceeding 10 min from the first breast are associated with poor weight gain measured at 6–8 weeks. Furthermore, babies gained more weight and were more likely to be exclusively breast fed to at least 12 weeks when traditional rather than baby-led breastfeeding advice was given.

WHO and UK guidelines recommend exclusive breast feeding up to 6 months,^{7 8} although only 2% of UK mothers do so.⁹ Exclusively breastfed babies gain weight more quickly than expected over the first 2 months,² when cessation of breast feeding is most often attributed to “insufficient milk”.¹⁰ Strategies encouraging breast feeding must therefore heed lactation physiology to ensure a plentiful milk supply.

Briefly, in response to suckling, pulsatile posterior pituitary oxytocin release causes rhythmical alveolar myoepithelial cell contraction and milk duct dilation (the “let-down” reflex).¹¹ Resulting milk waves are ejected into sinuses adjacent to the areola and nipple, which, unlike in ruminants, have little storage capacity¹¹; between pulses, milk travels back up the ducts where it is unavailable.¹² The let-down reflex is susceptible to both conditioning and interference. Regular feeds condition the reflex. Constant oxytocin concentrations interfere with the reflex, resulting in ineffective uncoordinated waves.¹¹ Oxytocin is also necessary for normal prolactin function.^{11 15} Oxytocin has positive feedback,¹¹ and prolonged stimulation may inhibit the reflex, interfering with both milk production and delivery.

Milk constituents and flow vary throughout stimulation: protein and lactose concentrations remain constant,¹⁴ and fat content rises with time.^{14 15} Flow is initially high (the fore milk) but rapidly reduces (the hind milk).¹⁵ During feeding from the first breast, the same neural reflexes act on the second breast such that, when it is used, fore milk flow is slowed and contains more fat.¹⁵

Thus, each breast delivers most of its calories in the first few minutes: in the first as a higher volume of lower-fat milk, and in the second as a lower volume of higher-fat milk.¹⁵ Babies feeding from both breasts at each feed receive more milk than babies feeding from one breast,¹⁶ and those feeding for shorter average lengths experience increased weight gain and other positive outcomes.^{17 18} The little information available on the physiology of prolonged feeds suggests abnormally slowed flow patterns,^{3 19 20} lower milk volume production,²¹ and possible attenuation of the let-down reflex.¹²

The breast acts as an autocrine gland: factor inhibiting lactation produced during lactation downgrades prolactin receptors when the breast is not used²²; some or all feeds from one breast will reduce milk production by this mechanism. Traditional breastfeeding advice uses these physiological mechanisms to encourage breast feeding in two ways. Firstly, the use of both breasts ensures sufficient calories for the baby and prevents the autocrine gland effect, and secondly the development of a regular feeding pattern is convenient for the mother and ensures a plentiful milk supply by conditioning the let-down reflex.

However, one paper in 1988³ suggested that a baby changed from the first to the second breast within 10 min may receive a high-volume, low-fat feed containing large amounts of lactose. This “overfeeding” would cause lactose to pass undigested into the large bowel, with ensuing diarrhoea (so-called “infant colic”).³ The authors advocated that the baby should be allowed to remain on the first breast until it was spontaneously relinquished, in the belief that baby knows best,⁴ and that both breasts need not be used at each feed: this baby-led breastfeeding advice of an unlimited feed from the first breast would use the hind milk and prevent overfeeding.

The authors admitted that they had no objective evidence for this overfeeding hypothesis, and a literature review confirms that it has not been supported by clinical studies.⁵ Furthermore, the concept fails to consider the altered composition of fore milk from the second breast, and it has been repeatedly shown that weight gain in breastfed babies correlates strongly with the volume of milk taken,^{23–26} and “overfeeding” as a cause of poor weight gain is rarely recognised.²⁷ Furthermore, anecdotal and qualitative studies suggest that the baby will remain on the first breast for hours if allowed to do so.^{28 29} Babies denied the large amount of milk and fat in the second breast may feed endlessly from a dwindling supply of milk from the first breast, ultimately detaching from exhaustion or frustration.

Original article

What is already known on this topic

- ▶ Exclusively breastfed babies show rapid weight gain over the first 6–8 weeks of life.
- ▶ There has been no comparison between the effect of the traditional breastfeeding method and the newer baby-led method on infant weight gain and exclusive breastfeeding rates.

What this study adds

- ▶ Babies whose mothers are given traditional breastfeeding advice are more likely to be fed for 10 min or less from the first breast, gain more weight, and to be exclusively breast fed to at least 12 weeks than those given baby-led advice.
- ▶ Short feeds (10 min or less) from the first breast are associated with increased infant weight gain.

Despite this, in 1988 the Royal College of Midwives' book *Successful breastfeeding*⁴ described the baby-led method as the preferred way of breast feeding. It now forms the basis of professional and lay breastfeeding advice.^{30 31}

In our general practice (with a high breastfeeding rate), both mothers and health professionals noticed poor weight gain in breastfed babies at the very time rapid weight gain was expected. This seemed to be related to the new baby-led breastfeeding advice. In 1998, we therefore decided to revert to the traditional breastfeeding advice.

Our study compares the consequences of baby-led and traditional advice. Using a longitudinal design, we studied two similar groups of babies over a similar time period. We acknowledge that there are potential weaknesses in our study: using a part retrospective design is not ideal, and our groups were not randomised and studied concurrently. However, we believe this is difficult in a field setting involving nursing mothers and very young babies, a view already accepted by the Health Development Agency.³² In keeping with this, only routine clinical data were collected, and our intervention was limited to a change in breastfeeding advice with no extra supervision. Mothers were unaware of the reason for this change until they received the questionnaire, which was only sent to them after the period of study was completed. Indeed mothers in group 2 were given the baby-led breastfeeding advice until their babies were at least 10 days old. Despite this, significant changes still occurred in the second group. Furthermore, other researchers have used similar cohort design and observational studies to assess infant weight growth; we studied more babies and followed them up for longer than most other workers to demonstrate breastfeeding physiology.^{12 15–18 21 24–26} Also, this is the first study to assess the effect of prolonged feeds on infant weight gain and breastfeeding rates.

We have shown that the babies of mothers given traditional advice fed from the first breast for a shorter time, were more likely to feed from both breasts, and gained weight more quickly. They were more likely to be exclusively breast fed to at least 12 weeks, suggesting that their mothers were more comfortable with the results of the traditional breastfeeding method. Our data show that feeds for 10 min or less from the first breast were associated with greater weight gain, irrespective of the breastfeeding advice given.

This study shows that, in our subjects, the traditional method of breast feeding confers more benefit than that resulting from baby-led breastfeeding advice, both in terms of infant weight gain and continuation of exclusive breast feeding.

Acknowledgements: The authors contributed to the work as follows. CW contributed to the original idea, carried out the literature search, collected and collated the data, and wrote the original draft. JO contributed to the original idea, collected data, and contributed to writing the paper. AS performed the statistics and contributed to writing the paper. MW helped to devise the questionnaire, advised at all stages of the study, and performed the major role in writing the paper. CW is the guarantor.

Funding: None.

Competing interests: None.

Ethics approval: Local research ethics committee approval was obtained from Airedale NHS Trust before the start of the study. Patient consent was not sought: only anonymised routinely collected data were used.

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