Infant and Young Child Feeding Index and its association with nutritional status: A cross-sectional study of urban slums of Ahmedabad

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Abstract:

BACKGROUND: Infant and young child feeding (IYCF) practices are multidimensional and change rapidly in short intervals in the 1st year of life, asking for simultaneous assessment of various feeding dimensions in children of 6 months and older. Infant and Child Feeding Index (ICFI) is a composite index which measures complete feeding practices for infants and young children. The present study was conducted to assess IYCF practices for children aged 6–36 months in terms of ICFI and some sociodemographic factors and find out the association of ICFI with nutritional status.

MATERIALS AND METHODS: A cross-sectional study was conducted from July 2015 to October 2015 in Girdharnagar ward of Ahmedabad. Two hundred and ten mother–child pairs were selected by two-staged cluster sampling and were interviewed using a schedule adapted from Knowledge, Practices, and Coverage 2000+ model questionnaire. Appropriate anthropometric measurements were taken and nutritional indicators were calculated. Chi-square test, t-test, and regression analysis were applied wherever required. Epi info version 7.0 and MS Excel 2007 were used for statistical analysis.

RESULTS: Nearly 65.2% of the children were stunted, 43.3% were underweight, and 11.9% were wasted. Only 38.3% of the children were initiated on breastfeeding within 1 h of birth. Only 19.1% of the children were breastfed for 2 years and beyond. Meal frequency was adequate in 64.3% and dietary diversity of >4 food groups was given to only 15.7% of the children. Significant higher proportions of children with low ICFI scores had illiterate mothers, were older, and belonged to lower socioeconomic strata. There was statistically significant association of ICFI with all the three nutritional status indicators. Higher proportion of children with lower ICFI scores had lower weight-for-height Z-scores, weight-for-age Z-scores, and height-for-age Z-scores.

CONCLUSION: The present study revealed that ICFI can be used to measure IYCF practices in a single composite index, which in turn can reflect the nutritional status of the children.

Keywords:
Infant and Child Feeding Index, infant and young child feeding, malnutrition, nutrition, nutritional indicators

Introduction

Optimal nutrition and hearty feeding are imperative for healthy growth and development of infants and young children. Globally, more than one-third of childhood deaths are attributed to undernutrition, which is more prevalent in low- and lower-middle-income countries. In India, the third National and Family Health Survey indicated that 46% of children below the age of three were underweight, 38% were stunted, and 19% were wasted.

The time from birth to 2 years of age is regarded as “critical window period” owing to rapid growth and brain development that
occurs in children during this period. It is often marked by growth faltering, micronutrient deficiencies, and common childhood illnesses such as diarrhea and pneumonia. Out of all proven preventive health and nutritional interventions, the single greatest potential impact on child survival during this period is the infant and young child feeding (IYCF). This is a set of well-known and common recommendations for appropriate feeding of the newborn and young children defined by the World Health Organization (WHO 2003). It includes early initiation of breastfeeding, exclusive breastfeeding for the first 6 months; complementary feeding, i.e., complementing solid/semi-solid food with breastmilk after child attains the age of 6 months.

IYCF practices are multidimensional, change rapidly within short age intervals during the 1st year of life, and measuring them in children of 6 months and older requires simultaneous assessment of various feeding dimensions (WHO 2008). Infant and Child Feeding Index (ICFI), a composite index developed by Ruel and Menon, can measure IYCF practices in their entirety. This index is based on an age-specific scoring system that gives points for positive practices such as breastfeeding, adequate meal frequency, dietary diversity, and avoidance of bottle-feeding. Measurement and quantification of IYCF practices using ICFI and its association with nutritional status are shown in many studies. Against this background, the present study was undertaken in the slums of Girdharnagar ward of Ahmedabad, Gujarat, to assess IYCF practices for children aged 6–36 months in terms of ICFI and some sociodemographic factors and to find out their association with nutritional status.

Materials and Methods

The study was a community-based cross-sectional study conducted from July 2015 to October 2015, of children aged 6–36 months, in the urban slums of Girdharnagar ward of Ahmedabad.

Minimum sample size was calculated taking 33% expected proportion of underweight children based on a pilot study conducted earlier in the study area, 20% relative precision, and 95% confidence interval, which was 203.

A two-stage cluster sampling methodology was adopted. In the first stage, population-wise listing of 43 Anganwadi centers of Girdharnagar ward was done, and thirty clusters were selected. In the second stage, a house-to-house survey was done and seven children aged 6–36 months were taken from each cluster.

The mother and child pair was included in the study based on the following criteria: mother’s willingness to participate in the study and a child with no congenital disease or anomaly or any kind of food allergy. They were informed of the purpose of study and informed consent was obtained from the mothers.

Information regarding sociodemographic variables such as caregiver’s education, total number of family members, income, and the child’s characteristics such as gender, age, and ordinal position were collected by interviewing mothers/responsible caregivers of the children at home. An interview schedule adapted from Knowledge, Practices and Coverage 2000+ model questionnaire was used to collect information on IYCF practices, dietary diversity, and frequency of meals.

Anthropometric measurements of children were taken thrice and their average was calculated. Weight was measured using Salter scale calibrated to the nearest 100 g with a maximum capacity of 25 kg. Length was measured using an infantometer to the nearest 0.1 cm.

The ICFI as described by Ruel and Menon and Arimond with modifications based on the current feeding recommendations in the Indian context was used. The variables used in the indices were as follows: (a) breastfeeding (whether the mother is currently breastfeeding the child or not); (b) use of baby bottles in the previous 24 h (yes/no); (c) dietary diversity (whether or not the child had the selected food groups in the previous 24 h); and (d) meal frequency (how many times the child was given solid or semi-solid, or soft foods other than liquids in the previous 24 h). The scoring patterns with variables are shown in detail in Table 1.

Data were analyzed using Microsoft Excel 2007 and EPI info 7.2 computer package (Epi Info is statistical

| Variable | Age groups | 6-9 months | 10-12 months | 13-36 months |
|----------|------------|------------|--------------|--------------|
| Breastfeeding | No=0 | No=0 | No=0 |
| | Yes=2 | Yes=2 | Yes=1 |
| Bottle-feeding | Yes=0 | Yes=0 | Yes=0 |
| | No=1 | No=1 | No=1 |
| Diet diversity | 0=0 | 0=0 | 0=0 |
| Sum of (grains, | 1-3=1 | 1-3=1 | 1-3=1 |
| tubers + meat | 4 and | 4 and above=2 | 4 and above=3 |
| fish+pulses + dairy | above=2 | | |
| + eggs + other fruits | | | |
| and vegetables) | | | |
| Meal frequency | 0 m/d=0 | 0 m/d=0 | 0-1 m/d=0 |
| (meal/day) | 1 m/d=1 | 1-2 m/d=1 | 2-3 m/d=1 |
| (m/d) | ≥ 2 m/d | 3 and more | ≥ 4 m/d=2 |
| meals/day=2 | | |
| Total score | 7 points | 7 points | 7 points |
software for epidemiology developed by Centers for Disease Control and Prevention (CDC) in Atlanta, Georgia (US) and licensed as public domain. Standard deviation (SD)/Z-scores were calculated using the WHO Anthro software (2009) (WHO Anthro: Software is developed by Department of Nutrition, World Health Organization, 20 Avenue Appia, 1211 Geneva 27, Switzerland) for weight-for-age Z-scores (WAZ), height-for-age Z-scores (HAZ), and weight-for-length Z-scores. Children were classified into various grades of nutritional status based on the WHO Growth Standards 2006. Descriptive statistics and bivariate and multiple regression analysis were conducted. The Chi-square test was used to test differences in proportions. t-test and ANOVA were used to compare means between groups wherever required. \( P < 0.05 \) was considered statistically significant.

Ethical approval was obtained from the Ethical Committee and informed written consent was taken from all participants.

Results

Of the 210 mothers, 40% were illiterate and most were homemakers (77%); a few were skilled workers (12.9%) and the rest were laborers (10%). The mean age of the mothers at first birth was 21.96 ± 1.04 years.

Of the children, 52.4% were males and 47.6% were females and the majority were full term at birth (92.8%). The largest proportion of children in birth order was second (42.4%) followed by first (31%), third (24.3%), and fourth (2.4%).

According to modified Prasad’s classification of socioeconomic class (SEC),10 the majority of the mother–child pair interviewed belonged to middle and lower SEC, namely, fourth (42.4%), third (27.1%), fifth (22.9%), and very few belonged to the higher SEC, namely, second (6.7%) and first (1%) [Table 2].

Almost all of the children in the study population were breastfed at some point in life (98.1%). Of these, breastfeeding had been initiated within 1 h for only 38.3%, 28.6% within 24 h, and 33% after 24 h. Colostrum and prelacteal feeds were given to 54.8% and 60.5% of the children, respectively.

Only 19.1% of the children were breastfed for 2 years and beyond, 35.6% were breastfed for 6–12 months, 30.4% for 12–23 months, 14.3% only up to 6 months or less, and 26.2% of the children were found to have been bottle-fed.

Meal frequency was adequate in 64.3% of the children. Dietary diversity of >4 food groups was given to 15.7% of the children.

Nutritional status assessment of the children revealed that 65.2% of the children were stunted (height for age, i.e., HAZ score < −2SD), 43.3% children were underweight (i.e., WAZ score < −2SD), and 11.9% children were wasted (weight for height, i.e., weight-for-height Z-scores [WHZ] < −2SD). The mean HAZ, WAZ, and WHZ scores of the study population were −1.63 ± 0.48, 1.42 ± 0.49, and −1.11 ± 0.32, respectively. The mean HAZ, WAZ, and WHZ scores for the children aged 6–9 months were 1.18 ± 1.3, −0.4 ± 1.3, and −2.14 ± 0.8, respectively; for children aged 10–12 months were −0.21 ± 1.7, −1.4 ± 2.0, and −2.32 ± 1.8, respectively, and for those aged 13–36 months were −0.48 ± 1.4, −1.8 ± 1.1, and −2.70 ± 1.3, respectively.

Assessment of nutritional status revealed that a statistically significant higher proportion of wasted children had illiterate mothers as compared to mothers who were literate. Higher proportions of underweight children were male. Stunting was prevalent in all socioeconomic groups. However, the significant trend was that underweight and wasting were more prevalent in the lower socioeconomic groups. No significant association of age and birth order was found with nutritional status [Table 2].

On determining the association between IYCF practices and nutritional status, it was found that the mean WHZ, WAZ, and HAZ scores were higher for those who were currently being breastfed, who were fed colostrum, and whose age-wise minimum meal frequency was adequate. Besides this, early initiation of breastfeeding was associated with higher WHZ and WAZ scores; duration of breastfeeding was associated only with HAZ score; not giving bottle-feeds was associated with higher WAZ and HAZ scores, while dietary diversity of > 4 food groups had no statistically significant association with any of the three nutritional status parameters [Table 3].

The ICFI was calculated for each child according to the scoring of IYCF practices as explained earlier. The median ICFI score of the sample was 4. Mean ICFI score for children aged 6–9 months was 4.64 ± 1.0; for those aged 10–12 months was 5.0 ± 1.1 and for those aged 13–36 months, it was 4.2 ± 1.1. Significant higher proportions of children with low ICFI scores had illiterate mothers, older mothers, and mothers belonging to lower socioeconomic strata. There was no significant association of ICFI with sex and birth order.

On determining the association between ICFI and nutritional status, it was found that ICFI showed statistically significant association with all the three nutritional status indicators. Higher proportion of children with lower ICFI scores had lower WHZ, WAZ, and HAZ scores [Table 3].
Table 2: Association between sociodemographic variables and nutritional status

| Parameters                  | Nutritional status | WHZ | WAZ | HAZ |
|-----------------------------|--------------------|-----|-----|-----|
|                             | Normal             | Wasted | Normal | Underweight | Normal | Stunted |
| Maternal literacy           |                    |       |      |     |       |       |
| Illiterate                  | 106 (84.1)         | 20 (15.9) | 78 (61.9) | 48 (38.1) | 50 (39.7) | 76 (60.3) |
| Literate                    | 79 (94)            | 5 (6) | 41 (48.8) | 43 (51.2) | 23 (27.4) | 61 (72.6) |
| p-Value                     | <0.05              | Nonsignificant | Nonsignificant | Nonsignificant | Nonsignificant | Nonsignificant |
| Sex                         |                    |       |      |     |       |       |
| Female                      | 86 (86)            | 14 (14) | 66 (66) | 34 (34) | 41 (41) | 59 (59) |
| Male                        | 99 (90)            | 11 (10) | 53 (48.2) | 57 (51.8) | 32 (29.1) | 78 (70.9) |
| p-Value                     | Nonsignificant     | <0.05 | Nonsignificant | Nonsignificant | Nonsignificant | Nonsignificant |
| SEC                         |                    |       |      |     |       |       |
| Upper SEC                   | 15 (93.7)          | 1 (6.3) | 11 (68.7) | 5 (31.3) | 07 (43.7) | 09 (56.3) |
| Middle SEC                  | 55 (96.5)          | 2 (3.5) | 43 (75.4) | 14 (24.6) | 18 (31.6) | 39 (68.4) |
| Lower SEC                   | 115 (83.9)         | 22 (16.1) | 65 (47.4) | 72 (52.6) | 48 (35) | 89 (65) |
| p-Value                     | <0.05              | Nonsignificant | Nonsignificant | Nonsignificant | Nonsignificant | Nonsignificant |
| Birth order                 |                    |       |      |     |       |       |
| 1                           | 56 (86.2)          | 9 (13.8) | 36 (55.4) | 29 (44.6) | 25 (38.5) | 40 (61.5) |
| 2                           | 81 (91)            | 8 (9) | 54 (60.7) | 35 (39.3) | 25 (28.1) | 64 (71.9) |
| 3 or higher                 | 48 (85.7)          | 8 (14.3) | 29 (51.8) | 27 (48.2) | 23 (41.1) | 33 (58.9) |
| p-Value                     | Nonsignificant     | Nonsignificant | Nonsignificant | Nonsignificant | Nonsignificant | Nonsignificant |
| Age groups (months)         |                    |       |      |     |       |       |
| 6-9                         | 18 (78.3)          | 5 (21.7) | 15 (65.2) | 8 (34.8) | 10 (43.5) | 13 (56.5) |
| 10-12                       | 23 (85.2)          | 4 (14.8) | 16 (59.3) | 11 (40.7) | 13 (48.1) | 14 (51.9) |
| 13-36                       | 144 (90)           | 16 (10) | 88 (55) | 72 (45) | 50 (31.2) | 110 (68.8) |
| p-Value                     | Nonsignificant     | Nonsignificant | Nonsignificant | Nonsignificant | Nonsignificant | Nonsignificant |

WAZ=Weight-for-age Z-scores, HAZ=Height-for-age Z-scores, WHZ=Weight-for-height Z-scores, SEC=Socioeconomic class

Multiple regression analysis was performed to determine if there was any significant relationship between the ICFI and nutritional status (WHZ, WAZ, and HAZ scores) after controlling other variables (age, sex, SEC, maternal literacy, and birth order). The validity of the multiple regression model was tested with homoscedasticity and collinearity statistics and was found to be a good fit. According to Table 6, ICFI was found to be significantly associated with all the three nutritional status parameters. Other significant factors which emerged significant were sex and age.

Discussion

IYCF is critical for the prevention of stunting in infancy and early childhood and the disruption of the intergenerational cycle of undernutrition. It is an effective public health tool with multiple prongs for the prevention of morbidity and mortality in children. Although it is multidimensional and therefore simple and effective, successful IYCF outcomes, especially with regard to complementary feeding practices, are dismal throughout the world, even more so in developing countries. India has the largest number of under-five children who are moderately or severely stunted, accounting for 38% of the global burden. India also has the highest number of children with moderate and severe wasting. The link between poor nutritional status and faulty IYCF practices is well established. According to National Family Health Survey-3 data, about 20 million children in our country are not exclusively breastfed for the first 6 months and about 13 million do not get good, timely, and appropriate complementary feeding together with continued breastfeeding.

In the present study, initiation of breastfeeding within 1 h of birth occurred only in one-third of the children. Furthermore, only one-fifth of the children were breastfed for 2 years and beyond. Not feeding colostrum, giving prelacteal feeds, and bottle feeding were also high in our study. The finding is similar to the NFHS-3 data for an urban area which indicates that no improvement has been achieved in this area. For only two-thirds of the children was the frequency of meals adequate while only 15% had appropriate dietary diversity of food groups. This finding was similar to that of the study in the urban areas of Meerut, but lower than the study findings from rural areas of Ahmedabad.

As in other studies, proportions of underweight, stunting, and wasting in children who were being currently breastfed were lower. Adequate minimum meal frequency was also associated with better nutritional status outcomes as was found in other studies, which indicates that there is the need for optimum complementary feeding.
Another issue with the multidimensional nature of IYCF is its accuracy. Indicators that measure optimal breastfeeding have been available for some time,[23] but only few attempts have been made to formulate and validate a single index to assess IYCF in totality. ICFI as developed by Ruel and Menon[6] compositely measures IYCF in a single index. ICFI has been validated and its association with nutritional status has been assessed by many studies.[7‑15]

The present study attempted to measure IYCF practices in a single index by using ICFI and determine its association with the nutritional status. The study depicts a significant association of ICFI with WHZ, WAZ, and HAZ scores. The median ICFI score of the study sample was 4, indicating a high prevalence of inappropriate child feeding practices. Besides this, higher proportions of lower ICFI scores were found in illiterate mothers, mothers belonging to lower socioeconomic groups, and mothers of older children. The findings were similar to a study conducted in urban slums of Mumbai by Lohia and Udipi.[7] Maternal illiteracy and lower socioeconomic status were also associated with lower nutritional status Z‑scores. Moreover, stunting was strikingly prevalent in all socioeconomic groups evincing the cumulative role of various factors as responsible for making HAZ a better indicator of overall nutritional status compared to the other two, i.e., WAZ and WHZ.[13,23]

On multivariate analysis also, ICFI emerged as the major factor that influenced all the three nutritional status parameters [Table 6]. Gender was another factor associated with nutritional status; males were more likely to be underweight and stunted than females. A few

### Table 3: Infant and young child feeding practices and their association with nutritional status

| IYCF practices | WHZ (wasting) | WAZ (underweight) | HAZ (stunting) |
|----------------|--------------|-------------------|---------------|
| Currently breastfeeding (n=210) |             |                   |               |
| Yes (n=170) | −0.082±1.56* | −1.230±1.36* | −2.205±1.23* |
| No (n=40) | −0.522±1.60 | −1.921±1.35 | −2.874±1.31 |
| Initiation of breastfeeding (n=206) |             |                   |               |
| Within 1 h (n=79) | −0.075±1.58* | −1.266±1.42* | −2.352±1.26 NS |
| 1–23 h (n=59) | −0.009±1.52 | −1.447±1.38 | −2.641±1.27 |
| After 24 h (n=68) | −0.898±1.60 | −2.163±1.27 | −2.766±1.42 |
| Duration of breastfeeding (n=206) |             |                   |               |
| 6 months or less (n=29) | 0.040±1.62 NS | −1.860±0.48 NS | −3.529±1.24* |
| 6-23 months (n=138) | −0.584±1.69 | −1.852±1.49 | −2.702±1.28 |
| 24 months or more (n=39) | −0.357±1.10 | −2.311±0.84 | −3.333±1.32 |
| Colostrum given (n=206) |             |                   |               |
| Yes (n=115) | −0.030±1.39* | −1.234±1.32* | −2.267±1.34* |
| No (n=95) | −0.696±1.75 | −2.092±1.35 | −2.969±1.19 |
| Bottle-feed given (n=210) |             |                   |               |
| Yes (n=55) | −0.572±1.79 NS | −2.069±1.25* | −3.021±1.06* |
| No (n=155) | −0.246±1.52 | −1.463±1.42 | −2.430±1.37 |
| Dietary diversity (n=210) |             |                   |               |
| <4 food items (n=177) | −0.391±1.60 NS | −1.661±1.42 NS | −2.565±1.32 NS |
| 4 or more food items (n=33) | −0.013±1.54 | −1.416±1.23 | −2.687±1.31 |
| Minimum meal frequency (n=210) |             |                   |               |
| Adequate (n=135) | −0.009±1.39* | −1.175±1.22* | −2.197±1.27* |
| Inadequate (n=75) | −0.912±1.77 | −2.428±1.35 | −3.283±1.09 |

*Significant at P<0.05. NS=Nonsignificant, WAZ=Weight-for-age Z‑scores, HAZ=Height‑for‑age Z‑scores, WHZ: Weight‑for‑height Z‑scores, ICFI=Infant and Child Feeding Index

### Table 4: Sociodemographic variables and their association with Infant and Child Feeding Index

| Parameters | High (6-7) | Moderate (4-5) | Low (1-3) |
|------------|------------|---------------|-----------|
| Literacy* |            |               |           |
| Literate | 23 (18.3) | 83 (65.9) | 20 (15.9) |
| Illiterate | 09 (10.7) | 46 (54.8) | 29 (34.5) |
| Sex |            |               |           |
| Female | 15 (15) | 62 (62) | 23 (23) |
| Male | 17 (15.5) | 67 (60.9) | 26 (23.6) |
| Age group (months)* |            |               |           |
| 6-9 | 07 (30.4) | 12 (52.5) | 04 (17.4) |
| 10-12 | 10 (37) | 12 (44.4) | 05 (18.5) |
| 13-36 | 15 (9.4) | 105 (65.6) | 40 (25) |
| Socioeconomic group* |            |               |           |
| Upper | 01 (6.3) | 14 (87.5) | 01 (6.3) |
| Middle | 11 (19.3) | 40 (70.2) | 06 (10.5) |
| Lower | 20 (14.6) | 75 (54.7) | 42 (30.7) |
| Birth-order |            |               |           |
| 1 | 05 (7.7) | 43 (6.2) | 17 (26.2) |
| 2 | 20 (22.5) | 47 (52.8) | 22 (24.7) |
| 3 or higher | 07 (12.5) | 39 (69.6) | 10 (17.9) |

*P<0.05. ICFI=Infant and Child Feeding Index
The findings of the present study confirm that the ICFI can be used to measure IYCF practices in a single composite index, which in turn can reflect the nutritional status of the children. The index can measure not only the quantity but also the quality of various feeding practices. ICFI can be immensely useful in guiding the collection of key information in nutritional surveys and thus can be used for research, monitoring, evaluation, and advocacy of IYCF. The results of the present study provide the incentive for future research to validate and create a more refined index for measuring IYCF according to international cutoff values. This study advocates the need for future research that focuses on rural and urban areas on a larger scale to further demonstrate the usefulness of ICFI in all children. Besides this, a time-trend relationship also needs to be established.

### Limitations of this study

Certain maternal and child characteristics such as nutritional status of mother, influence of extended family, standard of living, and birth weight were not studied.

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Nil.

### Conflicts of interest

There are no conflicts of interest.

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### Table 5: Infant and Child Feeding Index and their association with nutritional status indicators

| ICFI score categories | WHZ* | WAZ* | HAZ* |
|-----------------------|------|------|------|
| Low (1-3)             | Normal: 36 (19.5), Wasted: 13 (52) |
| Moderate (4-5)        | Normal: 111 (64.3), Wasted: 10 (40) |
| High (6-7)            | Normal: 30 (16.2), Wasted: 02 (08) |

Table 6: Multiple regression analysis for the determinants of height-for-age Z-scores, weight-for-age Z-scores, and weight-for-height Z-scores

| Parameters | WHZ* | WAZ* | HAZ* |
|------------|------|------|------|
| ICFI       | 0.370* | 0.541* | 0.450* |
| Sex (reference category – females) | −0.026 | −0.140* | −0.219* |
| Age        | −0.104 | −0.119* | −0.052 |
| Birth-order | −0.009 | −0.006 | −0.310 |
| SEC (reference category – high SEC) | −0.069 | −0.034 | 0.031 |
| Maternal literacy (reference category – literate) | 8.432* | 22.111* | 13.129* |

F (adjusted F) 0.20 (0.18) 0.39 (0.38) 0.28 (0.26)

ICFI=Infant and Child Feeding Index, WAZ=Weight-for-age Z-scores, HAZ=Height-for-age Z-scores, WHZ=Weight-for-height Z-scores

Studies report similar findings of the male child being more prone to undernutrition than the female child. Apart from these, the age of the child was significantly associated with the nutritional status, namely, older children were more likely to be wasted and underweight. A possible explanation of this is that more care and support is given to younger children; also older children are at a greater risk of infection leading to compromised growth parameters.
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