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Review Article
Association of Infant and Young Child Feeding Practices with Linear Growth of Children under 24 Months in Asia and Africa

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Abstract

Background and Objective: Adequate nutrition during infancy and early childhood is very important for child growth, health and development. The present study was conducted to review previous literature involving infant and young child feeding (IYCF) practices and stunting in order to examine the relationship between eight core indicators of IYCF and child stunting/HAZ in Asia and Africa. **Materials and Methods:** Online database searching was conducted to obtain studies that examined the association between at least one IYCF indicator and stunting/HAZ in Asia and/or Africa. Significant associations between eight core IYCF indicators and stunting/HAZ in each country were determined. **Results:** Ten studies conducted in 11 countries (7 in Asia, 4 in Africa) were included for analysis. Exclusive breastfeeding was significantly associated with HAZ in Ethiopia. Continued breastfeeding at 1 year was a stunting risk factor in Rwanda and negatively associated with HAZ in Ethiopia and Zambia. Introduction of solid, semi-solid, or soft foods was positively associated with HAZ in Bangladesh and Zambia but increased stunting risk in Rwanda. Minimum dietary diversity was a protective factor against stunting in Indonesia and positively associated with HAZ in India, Bangladesh and Zambia. Minimum acceptable diet was positively associated with HAZ in India, Bangladesh, Ethiopia and Zambia. **Conclusion:** World Health Organization (WHO) IYCF indicators are useful for measuring the dietary quality of children under 2 years-old and closely related to nutritional status and health.

Key words: Breastfeeding, child growth, complementary feeding, height-for-age z-scores (HAZ), infant and young child feeding, stunting, WHO feeding indicators

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Competing Interest: The authors have declared that no competing interest exists.

Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

Impaired growth and development, called stunting, is a major public health problem in most developing countries. Stunting is largely caused by chronic malnutrition, recurrent infectious diseases and inadequate psychological stimulation. Children are defined as stunted if their height-for-age z-score (HAZ) is less than -2 standard deviations from the WHO child growth standards median[1]. In 2017, stunting was estimated to globally affect around 151 million (22.2%) children under 5 years old, of which 83.6 million (55%) lived in Asia and 58.7 million (39%) in Africa[2]. Stunting not only negatively affects human health but also human capital[3]. Furthermore, since stunting impairs linear growth and brain formation[4], long-term consequences that begin in early life are an increased risk of child mortality and economic burden as well as impaired cognitive ability, physiological development and social behavior[5,6].

Inadequate nutrition practices, especially in the first 2 years of life, lead to poor child growth, development and health. In response, the WHO published indicators of infant and young child feeding (IYCF) in 2008 to optimize feeding practices for children. IYCF indicators are practical measures of appropriate feeding practices, breastfeeding and complementary feeding, in children under 24 months[7]. Data presented in countries profiled previously revealed inadequate IYCF practices among large proportions of children in Africa and Asia[8], which may have caused the high prevalence of child stunting in these countries. Recently, some studies have suggested a potential causality between each IYCF indicator and stunting[9-17]. Therefore, the present study reviewed previous literature involving IYCF practices and stunting in order to examine the relationship between eight core indicators of IYCF and child stunting/HAZ in Asia and Africa.

MATERIALS AND METHODS

Literature review: The present study began as a literature review of articles published on several online databases, including PubMed, Wiley Online, Google Scholar, Taylor and Francis Online, ProQuest, Scopus and SpringerPlus. Database search terms were "IYCF," "infant and young child feeding," "stunting," and "child anthropometry." Articles were selected for inclusion if they were cross-sectional in design and analyzed the correlation between at least one IYCF indicator and stunting/HAZ in Asia and/or Africa. A total of 10 articles were included that examined a total of 11 countries: Bangladesh, India, Nepal, Bhutan, Myanmar, Cambodia, Indonesia, Rwanda, Ghana, Ethiopia and Zambia.

IYCF indicators: The eight core indicators of IYCF assessed by the present study in relation to stunting/HAZ were early initiation of breastfeeding (EIB); exclusive breastfeeding (EBF); continued breastfeeding at 1 year (CBF); introduction of solid, semi-solid, or soft foods (ISF); minimum dietary diversity (MDD); minimum meal frequency (MMF); minimum acceptable diet (MAD) and consumption of iron-rich or iron-fortified foods (IRF). EIB among children aged 0-23 months was based on recall by mothers who began breastfeeding their baby within the first hour after giving birth. EBF among 0-5 month-old, CBF among 12-15 month-old and ISF among 6-8 month-old children were based on recall of practice the previous day. MDD was defined in the present study as the proportion of children 6-23 months of age who consumed four or more of the following seven food groups during the previous day: grains, roots and tubers; beans; dairy products; meat, fish, poultry and organ meats; eggs; vitamin A-rich fruits and vegetables; other fruits and vegetables. MMF was defined in the present study as the proportion of children 6-23 months of age who received solid, semi-solid, or soft foods the minimum number of times or more during the previous day as follows: two or more times for breastfed infants aged 6-8 months, three or more times for breastfed children aged 9-23 months and four or more times for non-breastfed children 6-23 months.

MAD is a composite indicator of MDD and MMF. It was calculated from the proportion of breastfed children 6-23 months of age who met MDD and MMF during the previous day and the proportion of non-breastfed children 6-23 months of age who received two or more times milk feedings and met MDD and MMF during the previous day. Finally, IRF was defined in the present study as the proportion of children 6-23 months of age who received iron-rich or iron-fortified foods during the previous day. Stunting was defined as HAZ less than -2 standard deviations from the WHO child growth standards median.

Statistical analysis: The present study conducted cross-country comparisons of the relationship between eight core indicators of IYCF and child stunting/HAZ. $p<0.05$ were considered statistically significant for associations between the IYCF indicators and child stunting/HAZ.

RESULTS

The prevalence of child stunting in each country is shown in Table 1. Overall, Bhutan had the lowest prevalence of

Table 1: Prevalence of child stunting by country

Negara	Stunting (%)
Bhutan	15.00
India	38.77
Bangladesh	33.69
Nepal	23.70
Myanmar	20.20
Indonesia	30.69
Kamboja	36.70
Rwanda	35.07
Ghana	20.50
Ethiopia	46.60
Zambia	45.40

stunting (<20%), while Myanmar, Ghana and Nepal showed a moderate prevalence (20-29%). While the prevalence of stunting was high in Indonesia, Bangladesh, Rwanda, Cambodia and India (30-39%), it was highest in Zambia and Ethiopia (>40%).

The proportions of children meeting criteria for each of the eight core IYCF indicators are shown in Table 2. EIB was highest in Bhutan (78.00%) and lowest in India (23.00%), while EBF was highest in Nepal (70.00%) and lowest in Bangladesh (36.05%); CBF was highest in Bangladesh (96.00%) and lowest in India (78.00%). ISF was highest in Bhutan (93.00%) and lowest in Ethiopia (60.70%). The proportion of children achieving MDD was highest in Indonesia (62.43%) and lowest in Ethiopia (7.10%). The highest proportion of children who met MMF criteria was in Bangladesh (84.50%), while the lowest was in India (45.00%). The proportion of children who achieved a MAD was lowest in Ethiopia (5.20%) and highest in Bangladesh (42.70%). Finally, IRF was highest in Zambia (59.50%) and lowest in Ethiopia (8.90%).

Associations between IYCF indicators and stunting/HAZ in each country are summarized in Table 3. EIB, IRF and MMF were not significantly associated with stunting/HAZ. EBF was significantly negatively associated with HAZ in Ethiopia ($p<0.01$). CBF was significantly associated with stunting in Rwanda ($p<0.001$, OR = 3.72), negatively associated with HAZ in Ethiopia ($p<0.01$) and Zambia ($p<0.05$). ISF was significantly positively associated with HAZ in Bangladesh ($p<0.001$) and Zambia ($p<0.01$). ISF had a significant association with stunting in Rwanda ($p = 0.01$, OR = 1.49). MDD was significantly positively associated with HAZ in India ($p<0.001$), Bangladesh ($p<0.05$) and Zambia ($p<0.05$). Lower MDD had a significant association with stunting in Indonesia ($p = 0.00$, OR = 16.76). MAD was significantly positively associated with HAZ in India Bangladesh ($p<0.05$), Ethiopia ($p<0.05$) and Zambia ($p<0.05$).

Table 2: Percentage of children 0-23 months meeting the eight core WHO IYCF indicators by country

Countries	Early initiation of breastfeeding (%)	Exclusive breastfeeding under 6 months (%)	Continued breastfeeding at 1 year (%)	Introduction of solid, semi-solid or soft foods (%)	Minimum dietary diversity (%)	Minimum meal frequency (%)	Minimum acceptable diet (%)	Consumption of iron-rich or iron-fortified foods (%)
Bhutan	78.00	52.00	-	93.00	18.00	75.00	-	-
India	23.00	42.00	78.00	64.00	16.00	45.00	9.00	22.00
Bangladesh	42.28	36.05	96.00	79.70	45.16	84.50	42.70	51.46
Nepal	48.00	70.00	93.00	66.00	33.00	83.00	29.00	27.00
Myanmar	-	-	-	-	25.00	58.00	16.00	59.00
Indonesia	-	50.26	-	-	62.43	-	-	-
Kamboja	-	-	89.60	82.40	-	-	-	-
Rwanda	-	-	-	-	-	-	-	-
Ghana	-	-	-	-	34.80	58.20	27.80	-
Ethiopia	66.90	43.00	94.80	60.70	7.10	54.7	5.20	8.90
Zambia	56.20	51.40	93.10	90.00	37.40	56.3	25.10	59.50

Table 3: The association of each of the eight core WHO IYCF indicators with stunting by country

Countries	Stunting/HAZ							
	Early initiation of breastfeeding (%)	Exclusive breastfeeding under 6 months (%)	Continued breastfeeding at 1 year (%)	Introduction of solid, semi-solid or soft foods (%)	Minimum dietary diversity (%)	Minimum meal frequency (%)	Minimum acceptable diet (%)	Consumption of iron-rich or iron-fortified foods (%)
	p-value	p-value	p-value	p-value	p-value	p-value	p-value	p-value
Bhutan	NS	NS	NS	NS	NS	NS	NS	-
India	NS	NS	NS	NS	<0.001	NS	<0.05	NS
Bangladesh	NS	NS	NS	<0.01	<0.05	NS	<0.05	NS
Nepal	NS	NS	NS	NS	NS	NS	NS	NS
Myanmar	-	-	-	-	NS	NS	-	NS
Indonesia	-	NS	-	-	0.00	-	-	-
Cambodia	NS	NS	-	-	NS	NS	NS	NS
Rwanda	NS	NS	<0.01	0.01	-	-	-	-
Ghana	-	-	-	-	NS	NS	NS	-
Ethiopia	NS	<0.01	<0.01	NS	NS	NS	<0.05	NS
Zambia	NS	NS	<0.05	<0.01	<0.05	NS	<0.05	NS

DISCUSSION

The current analysis of the association between core IYCF indicators and stunting/HAZ showed the prevalence of stunting varied in Asian and African countries. Whereas Bhutan was found to have the lowest prevalence of stunting, Zambia and Ethiopia had the highest. Overall, IYCF practices were poor in most countries.

With respect to IYCF indicators, the significantly negative association between EBF and HAZ in Ethiopia does not mean that EBF is unimportant to or even negatively impacts on child growth, development and /or health. Rather, this suggests the 24 h recall method does not accurately/completely describe the history of EBF for a specific infant in the first 6 months of life[9]. In fact, infants aged 0-5 months who are not exclusively breastfed have been shown to have 10.52-times greater risk of diarrhea-related mortality than those who were exclusively breastfed[18]. Moreover, the risk of infectious diseases, in general, has been shown to increase when infants under 6 months-old are given any food other than breast milk because their immune and digestive systems are not completely formed[19].

While continued BF in children aged 12-15 months significantly increases the risk of stunting in Rwanda (OR = 3.78), it was associated with significantly lower HAZ in Ethiopia and Zambia. Previous studies have shown the practice of CBF delays ISF[9,19]. Additional foods and fluids other than breast milk are necessary for children over 6 months-old because breast milk is no longer able to fulfill their growing energy, protein and various nutrient needs[20,21].

The present results showed an inconsistent association between ISF and stunting/HAZ, in which ISF was significantly associated with higher HAZ in Bangladesh but significantly associated with lower HAZ in Zambia and higher risk of stunting in Rwanda (OR = 1.49). Like EBF, ISF is measured based on 24 h recall. This indicator had a lack of specificity and not accurately reflect the timing of the initial introduction of solid, semi-solid, or soft foods. Children who are introduced to solid, semi-solid, or soft foods for the first time prior to 6 months of age are not excluded from the calculation. Moreover, children who introduced solid, semi-solid, or soft foods in 6-8 month window may not have eaten these foods the day before the survey. Both of these factors can cause misclassification[22].

According to the current results, MDD was a protective factor against stunting in Indonesia (OR = 0.083) and had a significant positive association with HAZ in Bangladesh and Zambia. Consuming a variety of foods typically raises the quality of the diet[5,23] because it helps meeting daily energy,

protein and micronutrient needs more efficiently[10,20,23]. While consuming enough food is foundational to meeting energy and nutritional needs, this indicator also describes the density and, to some extent, the quality of the energy available in the food[24]. Furthermore, MAD was found to be significantly associated with HAZ in India, Bangladesh, Ethiopia and Zambia. As a composite of MDD and MMF indicators, MAD represents the cumulative balance of dietary quality and quantity that is beneficial to growth and development. MDD and MAD had a positive association with child growth in some countries and not others. The small proportion of children meeting MDD and MAD in some countries allowed for the lack of power to detect differences in child anthropometry.

There are some limitations to the present study. First, the current analysis was based on the review of a small number of previous cross-sectional studies. Second, those studies included for review only assessed IYCF indicators and stunting/HAZ using one-time measurements. Therefore, additional studies using other research designs (e.g., cohort studies) and measurement methods are necessary to better elucidate causality.

CONCLUSION

IYCF indicators are useful tools for measuring the dietary quality of children under 24 months-old. Adequate IYCF practices in children 0-23 months of age are critical to improve nutrition, health and development of children. Herein, the association between eight core IYCF indicators and stunting/HAZ in Asia and Africa was found to vary by country. IYCF practices in most countries were poor, especially food diversity and iron-rich or iron-fortified food consumption.

SIGNIFICANCE STATEMENT

The present study discovered correlations between core IYCF indicators and child stunting/HAZ. These results will help researchers understand critical areas of impaired linear growth in developing countries and contribute to development of new methods for improving the health of children worldwide.

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