Increased Maternal Education and Knowledge of Nutrition and Reductions in Poverty are Associated with Dietary Diversity and Meal Frequency in an Observational Study of Indonesian Children

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Abstract: *Background*: Optimal infant and young child feeding during the first two years of life is essential to optimum child development and health. While the link between feeding practices and child health outcomes is well documented, little is known about the determinants of these feeding practices in Indonesia. The purpose of this study was to better understand factors associated with appropriate child feeding among Indonesian children 6–23 months of age.

Methods: Interviewers conducted interviews with 1498 mothers of children 6–23 months of age to identify practices. Measures of feeding practices included dietary diversity, meal frequency, and minimum acceptable diet. Multivariate logistic regression was used to identify factors associated with dietary diversity and separately with meal frequency.

Results: After adjusting for covariates, increased maternal education was associated with improved dietary diversity. Age of child [OR=1.11], knowledge of stunting [OR=1.80], and having ever received nutrition information [OR=1.89] were also associated with greater dietary diversity. Wealth [OR=0.86] and age of child [OR=0.92] were inversely associated with meal frequency. Maternal education, age of child, being a male child, knowledge of stunting, and having received nutrition information increased the odds of the child consuming a minimum acceptable diet.

Conclusion: Increasing maternal education, knowledge of stunting, and knowledge of nutrition may improve dietary diversity while poverty alleviation has the potential to improve minimum meal frequency. These findings corroborate similar studies and confirm the importance of government efforts that help girls stay in school, improve families' understanding of nutrition, and reduce poverty.

Keywords: Dietary diversity, Meal frequency, Nutrition, Children, Indonesia.

BACKGROUND

Adequate maternal, infant, and young child feeding (IYCF) practices during pregnancy and the first two years of life are essential to optimal birth outcomes, child growth, development, and health [1]. Exclusive breastfeeding during the first six months of life, coupled with appropriate complementary feeding practices when children reach six months of age, provide the basis for a solid nutritional start for children [2]. Children who do not receive adequate nutrition during the first two years of life–including those who do not consume diverse diets frequently enough–are at increased risk of stunting, morbidity, mortality, and developmental delay [3-6]. Appropriate feeding practices, along with psychosocial stimulation and improved sanitation and hygiene practices, decrease these risk [4, 7].

Child undernutrition in Indonesia persists despite improvements in economic growth and health in recent years. Of the 24.5 million children under 5 years of age in Indonesia, approximately 9.2 million (37%) are stunted, a primary indicator of inadequate IYCF practices during the first two years of life [8]. Per DHS data from 2012, 58% of Indonesian children received the recommended number of food groups (minimum dietary diversity) while 66% of children were fed the recommended number of times (minimum food frequency) in the previous day [9].

While it is well documented that dietary diversity and food frequency (among other behaviors) are critical to improving children's nutritional status as well as other outcomes such as cognition and labor force productivity in adulthood, considerably less is known about the determinants poor infant feeding practices, particularly in Indonesia. In this study, we describe the prevalence of optimal complementary feeding practices and identify their determinants. We hypothesize that:

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1. Children whose mothers have more formal schooling are more likely than children whose mothers with little or no schooling to give diverse foods with sufficient frequency;

2. Receiving nutrition information is associated with feeding diverse foods frequently;

3. Children whose mothers know about stunting are more likely than children whose mothers do not to give diverse foods frequently;

4. Wealthier mothers' children are more likely than children of less well-off mothers to feed diverse foods frequently; and

5. Boys are more likely than girls to receive diverse foods frequently.

METHODS

Design

The current analysis draws from survey data collected in rural Indonesian provinces to assess nutrition-related attitudes and behaviors of mothers. These data were collected to guide a national media campaign addressing child undernutrition.

Sample

The data consisted of two sub-samples: 1) expectant mothers and 2) mothers of children under two years of age. This study analyzed only data from interviews with mothers of children under two living in Sumatera, Java, Kalimantan, Nusa Tenggara, and Sulawesi. These regions were selected because of the high prevalence of stunting, representativeness of the national population, and accessibility to media, especially TV and Internet. Cluster sampling was used to select villages within each district and respondents within each village. A village within a given district was considered a cluster, and 30 villages were selected from each district. Respondents within villages were then randomly selected to participate by using village hall as a starting point, choosing a random direction from that center, moving to the nearest house in the chosen direction and then moving out from the center from there. In the case of insufficient number of respondents in a particular cluster, a neighboring village (cluster) was added. The sample for the current study included 1498 respondents.

Procedure

Participants randomly selected were invited to participate in one-hour face-to-face interviews. Researchers drafted the questionnaire based on the 2012 DHS then pre-tested it among 20 respondents per study location. Interviewers then administered the final questionnaire. Paper based surveys were subsequently entered into an electronic database using SPSS. Subsequently, data were cleaned and analyzed using SAS 9.2 (Cary, North Carolina, US).

Measures

Mothers provided information about demographics (household size, education, wealth, etc.), their awareness of stunting, whether they gave birth with a trained professional in attendance, and child feeding practices. Respondents reported highest level of education completed. These responses were recoded to create four categories: no schooling or some primary school education, primary graduate through junior secondary graduate, some senior secondary or secondary graduate, and some university or university graduate. Household assets included ownership of a radio, hand phone, refrigerator, television, bicycle/boat, motorcycle/motorbike, and computer/laptop. These assets were totaled to create a simple wealth index ranging from 0-7 which had a Cronbach's alpha of .60.

Two items were used to measure stunting awareness. Mothers were asked if they had ever received information about nutrition (yes/no) and if they had ever heard of stunting/shortness (yes/no). There is no direct translation for the term, 'stunting' in Bahasa Indonesian. Instead, less formal terms such as, "shortness" are used. Mothers were also asked whether they had given birth with a trained professional (yes/no).

Minimum Dietary Diversity

Mothers were asked to identify all foods given to the child in the previous 24 hours. Any amount of food given from each of seven food groups was counted as consumption for the given food category. Food groups considered for dietary diversity included: 1) grains, roots and tubers; 2) legumes and nuts; 3) dairy products [e.g., milk, yogurt]; 4) Flesh foods [e.g., meat, fish, poultry and liver/organ meats]; 5) eggs; 6) vitamin A-rich fruits and vegetables; and 7) other fruits and vegetables. Children 6–23 months of age who received foods from four or more of the groups were coded as

'yes' for minimum dietary diversity [3]. All others were coded as 'no.'

Minimum Meal Frequency

A meal is defined as receiving solid, semisolid, or soft foods (including milk for non-breastfed children) for children 6–23 months of age. The minimum frequency per day was defined as: two meals for breastfed infants 6–8 months, three meals for breastfed children 9–23 months, and four meals for non-breastfed children 6–23 months [3]. Children were coded as 'yes' if they met the minimum frequency. All others were coded as 'no.' Almost all (95.9%) children were breastfed at some point while 85.2% of mothers reported currently breastfeeding.

Minimum Acceptable Diet

Children who met the criteria for minimum dietary diversity and minimum meal frequency were considered to have a minimum acceptable diet. Children who met only one or neither of those two standards were considered to not have a minimum acceptable diet [3].

Demographic variables were summarized with frequency statistics. Logistic regression analysis was used to explore factors associated with minimum dietary diversity, minimum meal frequency, and minimum acceptable diet.

RESULTS

This study sample included 1498 mothers with at least one child under two years of age (Table **1**). The average age of mothers was 28.2 years and the average age of their children was 13.9 months. The highest level of education attained for the majority of mothers was graduating from primary or junior secondary school (55.1%) followed by graduating from senior secondary school (25.9%).

According to WHO measures, 22.0% of children consumed diverse diets in the 24 hours prior to survey, 54.9% were fed the minimum number of times, and 13.0% received a minimum acceptable diet (Table **2**). The percent of children who met the minimum dietary diversity standard increased with age, while minimum meal frequency was highest for 6–8 month olds.

After adjusting for other covariates, the odds that maternal education (primary graduate/junior secondary vs. less than primary graduate [Odds Ratio (OR) = 2.24]; senior secondary vs. less than primary graduate [OR = 3.05]; post-secondary vs. less than primary graduate [OR =2.31]), age of child [OR = 1.11], knowledge of stunting [OR = 1.80], and having

Table 1: Mother, Child, and Household Characteristics

	N=1498
Child-level	
Age, average in months (SD)	13.9 (4.8)
Male, %	49.1
Maternal-level	
Mother's schooling, %	
Less than primary graduate	11.9
Primary or junior secondary	55.1
Secondary	25.9
Some university or university graduate	7.1
Mother's age, average in years (SD)	28.2 (6.5)
Gave birth with a trained provider, % yes	60.5
Have heard of stunting/shorty, % yes	34.6
Have received information about child nutrition, % yes	53.0
Household-level	
Asset index, 0-7 average (SD)	2.8 (1.5)
Number of children, average (SD)	2.0 (1.1)

Table 2: Food Groups Consumed

	6-8 mo	9-11 mo	12-14 mo	15-17 mo	18-20 mo	21-23 mo	Total
	N=242 (%)	N=312 (%)	N=284 (%)	N=261 (%)	N=233 (%)	N=166 (%)	N=1498 (%)
Grains, roots, and tubers	66.1	88.1	93.0	96.2	92.7	95.8	88.5
Legumes and nuts	4.6	11.5	19.0	18.4	18.0	21.1	15.1
Dairy products	0.0	0.3	1.4	2.7	3.4	1.8	1.5
Flesh food	16.5	32.1	42.6	52.5	58.8	63.9	42.8
Eggs	9.9	16.0	26.4	24.9	27.0	28.3	21.6
Vitamin A rich fruits and vegetables	28.9	48.1	63.0	63.2	67.0	60.2	54.7
Other fruits and vegetables	15.7	18.6	25.4	26.4	32.2	22.3	23.3
Minimum Dietary Diversity	7.0	13.8	26.4	28.0	32.6	27.7	22.0
Minimum Meal Frequency	80.6	56.1	55.1	44.4	46.2	45.6	54.9
Minimum Acceptable Diet	5.4	9.5	17.8	12.8	19.1	13.8	13.0
Average number of snacks (SD)	1.44 (0.91)	1.64 (0.93)	1.82 (1.02)	1.91 (1.08)	2.11 (1.19)	2.08 (1.21)	1.84 (1.08)

received nutrition information [OR = 1.89] were significantly associated with dietary diversity (Table **3**).

Wealth [OR = 0.86] and age of child [OR = 0.92] were associated with meal frequency (Table **4**). Maternal education (primary graduate/junior secondary vs. less than primary graduate [OR = 2.21]; senior secondary vs. less than primary graduate [OR = 3.02]), age of child [OR = 1.06], being a male child (OR = 1.40), knowledgeable about stunting [OR = 1.84], and having received nutrition information [OR = 1.73] were associated with minimum acceptable diet (Table **5**).

DISCUSSION

The proportion of children who received a diverse diet among this sample of households in Indonesia is relatively low at just 22.0%. Approximately half of children reached meal sufficiency and only 13% met the criteria for minimum acceptable diet in the previous

Table 3: Factors Associated with Minimum Dietary Diversity Practice

	Odds Ratio	*95% CI*[a]
Child's age, mo	1.11	1.08-1.14
Male	1.15	0.89-1.50
Mother's schooling		
Less than primary graduate	--	--
Primary or junior secondary	2.24	1.28-3.93
Secondary	3.05	1.70-5.47
Some university or university graduate	2.31	1.12-4.75
Mother's age, y	1.02	0.99-1.05
Asset index, 0-7	1.08	0.99-1.18
Number of children	0.88	0.74-1.05
Gave birth with a trained provider	1.01	0.76-1.34
Have heard of stunting/shorty	1.80	1.36-2.37
Have received information about child nutrition	1.89	1.42-2.51

[a]95% Confidence Interval for Odds Ratio.

Table 4: Factors Associated with Minimum Meal Frequency Practice

	Odds Ratio	*95% CI*[a]
Child's age, mo	0.92	0.89-0.94
Male	0.86	0.69-1.06
Mother's schooling		
Less than primary graduate	--	--
Primary or jr secondary	1.08	0.76-1.53
Secondary	1.20	0.81-1.77
Some university or university graduate	0.73	0.43-1.24
Mother's age, y	1.00	0.98-1.02
Asset index, 0-7	0.86	0.80-0.93
Number of children	0.93	0.81-1.06
Gave birth with a trained provider	0.82	0.65-1.03
Have heard of stunting/shorty	1.14	0.90-1.45
Have received information about child nutrition	1.18	0.94-1.49

[a]95% Confidence Interval for Odds Ratio.

Table 5: Factors Associated with Minimum Acceptable Diet

	Odds Ratio	*95% CI*[a]
Child's age, mo	1.06	1.03-1.10
Male	1.40	1.01-1.92
Mother's schooling		
Less than primary graduate	--	--
Primary or jr secondary	2.21	1.08-4.54
Secondary	3.02	1.43-6.35
Some university or university graduate	1.38	0.53-3.62
Mother's age, y	1.02	0.99-1.06
Asset index, 0-7	0.97	0.87-1.08
Number of children	0.85	0.68-1.05
Gave birth with a trained provider	1.07	0.76-1.52
Have heard of stunting/shorty	1.84	1.32-2.59
Have received information about child nutrition	1.73	1.21-2.46

[a]95% Confidence Interval for Odds Ratio.

24 hours. These percentages are considerably lower than national level data from 2012 that indicate 58% of children ate a diverse diet and 66% consumed the minimum number of meals [9].

Consistent with our hypothesis related to maternal schooling and dietary diversity, older children and children with mothers with higher education were more likely to meet minimum dietary diversity guidelines. Similar findings have been reported in Ethiopia, Bangladesh, India, Nepal, and Ghana [2, 10, 11, 12, 13, 14]. As expected dietary diversity improved with age, a result likely driven, at least in part, by the fact that many foods are not given to younger children [15].

As we hypothesized based on previous studies, knowledge about stunting and receiving information about child nutrition were also associated with minimum dietary diversity. Other studies have shown that media exposure, which may increase knowledge

regarding nutrition, is associated with adequate dietary diversity among children [11, 14].

As the age of the child increased, the prevalence of achieving minimum food frequency decreased. While this finding might also be due to increased parental investment in children as probability of survival increases, further research is needed to better understand why this phenomenon might be occurring.

Inconsistent with our hypothesis and unlike previous research, this study found no association between maternal education and meal frequency [2, 12, 13]. Furthermore, while this study found an inverse relationship between wealth and meal frequency, others studies have not [2, 12, 13]. Further research is needed to understand if wealthier households prioritize assets over providing children more meals, or whether wealthier individuals were more likely to work outside the household, leave children in the care of less knowledgeable care-givers, and so on.

Older children, male children, and children with mothers with higher levels of education were all more likely to receive a minimally acceptable diet. Similar results have been reported in Nepal where child's age and maternal education were both associated with minimum acceptable diet [12]. In our study, receiving information about nutrition as well as knowledge of stunting were associated with adequate diet, a finding reported by other colleagues [16].

LIMITATIONS

This study has several limitations. First, the data are only representative of villages in the five provinces studied and because the study sample was pro-poor, the sample itself is more rural than the overall population of Indonesia. Due to the cross-sectional design of the study, children varied in age from 6–23 months at the time of the study. Hence, an assessment of the timing of the introduction of various complementary foods was not possible. Strengths of the study include a large sample of Indonesian children from across several geographic locations and the ability to examine dietary diversity and minimum meal frequency at different ages.

CONCLUSION

Addressing IYCF practices is critical to reducing child stunting and improving overall child health [6]. Increasing maternal education, knowledge of stunting, and knowledge of nutrition may improve dietary diversity while poverty alleviation has the potential to improve minimum meal frequency. These findings corroborate similar studies and confirm the importance of government efforts that help girls stay in school, improve families' understanding of nutrition, and reduce poverty.

ABBREVIATIONS

IYCF = infant and young child feeding

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AVAILABILITY OF DATA AND MATERIAL

Contact IMA World Health (https://imaworldhealth.org) for data queries.

AUTHORS' CONTRIBUTIONS

All authors contributed significantly to interpretation of the data and development of the manuscript. BTC conceived the study; IH, ST, ML, and AS were involved in the design of the study protocol; BTC carried out the analysis of data. BTC drafted the manuscript; BTC, JHW, PCH, ML, and KAD critically revised the manuscript for intellectual content. All authors read and approved the final manuscript. BTC is the guarantor of the paper.

COMPETING INTERESTS

The authors declare that they have no competing interests.

CONSENT FOR PUBLICATION

Not applicable.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

All participants provided informed consent. Data collection was approved by the Faculty of Public Health Universitas Indonesia IRB, Ethics Clearance Number: 104/H2.F10/PPM.00.02/2014.

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