# DETERMINING OF COMPLEMENTARY FOOD PRACTICE AND STUNTED THAI CHILDREN AGED 24 MONTHS

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**ABSTRACT:** This descriptive study was conducted to determine the prevalence of child stunting at 24 months by using the Thai and New WHO growth standard and to examine the association between time of introduction of complementary food and child stunting at 24 months. The data of 4,245 children aged 24 months were selected from a cohort study of Thai children. After excluding 60 twin infants and 18 with abnormalities, 4,167 children remained for data analysis. Chi-square tests and multiple logistic regression were undertaken to identify variables that influenced child stunting at 24 months. For the 2001 Thai reference, the study showed 13.95% stunting prevalence whereas 2006 WHO reference showed 16.48%. After adjusting for confounding factors, the study showed that prolonged breast feeding was significantly associated with child stunting from both the WHO (OR=2.70, 95% CI=1.77-4.10) and Thai references (OR=2.31, 95% CI=1.48-3.60). By using WHO reference, this study found that children who were introduced pork before four months (OR=4.72, 95% CI=1.11-20.19) had the highest risk to be stunting at 24 months. And, by using Thai reference, it was found that children who were introduced whole eggs before four months (OR=2.76, 95% CI=0.56-3.54) had the highest risk to be stunting at 24 months. In conclusion, this study found that early introduction of complementary foods is a risk of child stunting. Implementing various health education programs to mothers and caretakers focusing on the improvement of feeding practices and by timely introduction of complementary food, optimum growth in children can be achieved.

**Keywords:** childhood stunting, child growth, infant growth, complementary food

## INTRODUCTION

Globally about, one in four are stunted with the rate in Asia and Africa being the highest. In the period of two decades, globally, the proportion of stunted children has come to 27% in 2010 from 40% in 1990 [1]. The national variability for stunting is explained by national and geographic factors whereas in individual cases, the affecting factors can be micronutrient deficiencies, inadequate protein intake, and prenatal nutrition [2]. The transition period from dependency on breast milk to introduction of complementary food is the crucial time for linear growth [3]. The practice of introduction solid foods prior to three months is quite common in Thailand [4-6]. The detrimental effects of early introduction of solid foods include high risk of diarrhea and respiratory infections [7-12]. Several studies have shown the association of time of introduction of complementary food with child growth [12-18]. Appropriate complementary feeding practices help meet the extra needs of young children thus preventing child malnutrition [19, 20]. Optimal young child feeding–continued breastfeeding for at least two years, together with age-appropriate, nutritionally adequate complementary foods can have impact on child survival unlike any other preventive interventions [21, 22]. Despite of being a major component of child rearing, infant feeding practices have been one of the most neglected determinants of young child malnutrition [23]. This study aims to fulfill the existing research gap in Thailand on appropriate time of introduction of complementary food with stunting.

The main objectives of this study are; to determine the prevalence of child stunting at 24 months by using the Thai growth standard comparing with WHO new growth reference standard, and to examine the association between time of introduction of complementary food and child stunting at 24 months. This study will provide a better understanding of the affects of the time of

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introduction of complementary foods in children below 24months of age thereby helping to improve feeding practices in order to give these children the best start in life so that they can grow up to be healthy and well-adjusted physically, intellectually and socially with mother and family.

## METHODS

This descriptive study was conducted to determine the association between complementary food practices and stunting in Thai children aged 24 months by using information of the participants from the Prospective Cohort Study of Thai Children (PCTC). PCTC was an observational prospective cohort study which included children born in four selected community-based districts in different regions and the Bangkok metropolitan area between July 1, 2000, and June 30, 2002. The study areas comprised four community-based rural areas: 1) Nan district, Nan province, in the north; 2) Kranuan district, Khon Kaen province, in the northeast; 3) Panomtuan district, Kanchanaburi province, in the west; and 4) Thepa district, Songkhla province, in the south. The urban hospital-based area is from Ramathibodi Hospital, Mahidol University, Bangkok, the capital city of Thailand.

Data for the time of introduction of complementary food was recorded by using a food calendar. A colourful pictoral food calendar was provided to each mother immediately after birth of child. The food calendar had stickers of individual food items. Mothers were instructed to stick the food sticker corresponding to the month as soon as the food item was introduced to the child in order to avoid recall bias.

The required dataset was obtained. 4,245 children were included in the present study. Sixty twin infants and 18 with abnormalities were excluded, thus 4,167 children remained for data analysis. The obtained dataset was further cleaned and analysed using SPSS and Minitab software. WHO new growth reference year 2006 –Anthro software and 2001 Nutristat software, constructed by the Institute of Nutrition, Mahidol University were used to process and standardized the child growth data (age in days and height) and generate z-scores for each child. The cutoff point of <-2 SD was used to determine stunted status of a child. The three category cut-off point, i.e. <4 months, 4-6 months and >6 months, was used to differentiate time of introduction of complementary food. Associations between the independent variables and dependent variable were calculated using Chi-square tests. For predicting factors associated with stunting of children at age 24 months, all the independent variables were included in the model at first. The best models accommodating most of the food items were selected after eliminating the insignificant variables. This study was approved by the National Ethical Committee for the Ministry of Public Health and the ethics committee of Mahidol University, Institutional Review Board (COA No.2012 / 140.1004).

## RESULTS

For demographic characteristic in this study, above three-fourth of mothers belonged to age group 20-35 years. Over half of mothers had informal or primary education. Only about 18% of mothers were housewives or students. Three in four mothers stood 150 centimeters (cm) or more. Mothers attending ANC (86.62%) and well baby clinics (67.75%) more than four times were comparatively higher. Over 90% of children had birth weight 2,500 grams (gm) or more. The male and female ratio was nearly equal. Only 11.23% children were reported to fall ill at 24 months. Regarding feeding practice, about 40% of the children received breast milk over 12 months. The results showed that nearly 60% of the children were introduced banana before four months. Also, fruit juice was introduced before four months to majority of the children (43.93%). The time of introducing rice, cereal, yolk and leafy vegetables for most of the children was 4-6 months. Other food items like chicken, liver, whole eggs, fish, pork, orange, papaya, oil, and other vegetables were introduced after 6 months for most of the children.

Figure 1, the prevalence of stunting at 24 months according to Thai reference was 13.95% (Boys= 32% and girls=68%) and that according to 2006 WHO standard was 16.48% (Boys=42% and girls=58%).

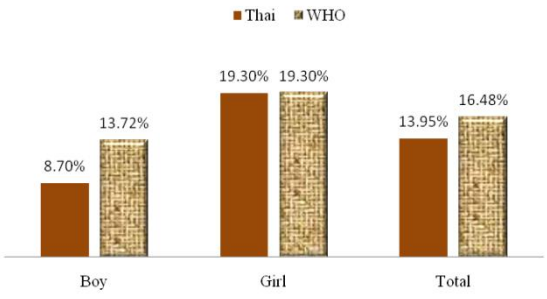



**Figure 1** Prevalence of child stunting by gender, comparing the Thai Growth reference with the WHO reference

**Table 1** Association between time of introduction of complementary food and child stunting at 24 months

| Variables | | WHO Reference | | | | Thai Growth Reference | | | |
|---|---|---|---|---|---|---|---|---|---|
| | n | Stunted (%) | Crude OR (95% CI) | Adjusted OR 95% CI | *p-value* | Stunted (%) | Crude OR (95% CI) | Adjusted OR 95% CI | *p-value* |
| **Family income** | | | | | | | | | |
| ≥25 percentile | 2668 | 325(54.90) | 1 | 1 | | 275(54.89) | 1 | 1 | |
| <25 percentile | 939 | 267(45.10) | 2.86*** (2.38-3.44) | 1.68 (1.10-2.57 ) | 0.017 | 226(45.11) | 2.76*** (2.27-3.35 ) | 1.57 (1-2.47 ) | 0.051 |
| **Study area** | | | | | | | | | |
| Non hill tribe | 3593 | 545(89.20) | 1 | 1 | | 461(89.17) | 1 | 1 | |
| Hill tribe | 114 | 66(10.80) | 7.69*** (5.24-1.28) | 3.57 (1.07-11.95 ) | 0.039 | 56(10.83) | 6.56*** (4.49-9.59 ) | 2.15 (0.62-7.52) | 0.23 |
| **Birth weight** | | | | | | | | | |
| ≥2500gm | 3305 | 485(82.20) | 1 | 1 | | 410(82.16) | 1 | 1 | |
| <2500gm | 280 | 105(17.80) | 3.49*** (2.69-4.53 ) | 4.57 (2.66-7.85 ) | <0.001 | 89(17.84) | 3.29*** (2.51-4.32 ) | 4 (2.29-6.98) | <0.001 |
| **Gender** | | | | | | | | | |
| Boy | 1873 | 257(42.1) | 1 | 1 | | 163(31.53) | 1 | 1 | |
| Girl | 1834 | 354(57.9) | 1.5*** (1.26-1.79 ) | 1.65 (1.12-2.44 ) | 0.011 | 354(68.47) | 2.51*** (2.06-3.06) | 3.32 ( 2.15-.14) | <0.001 |
| **Age of mother** | | | | | | | | | |
| 20-35 years | 2874 | 439(72.09) | 1 | | | 360(69.77) | 1 | 1 | |
| <20 years | 445 | 85(13.96) | 1.31* (1.01-1.69 ) | **** | **** | 79(15.31) | 1.51*** (1.15-1.97 ) | 1.06 (0.60-1.88) | 0.849 |
| >35 years | 363 | 85(13.96) | 1.7*** (1.30-2.21) | **** | **** | 77(14.92) | 1.88*** (1.43-2.47) | 1.35 (0.71-2.56) | 0.361 |
| **Education of mother** | | | | | | | | | |
| Secondary/ higher | 1666 | 164(26.93) | 1 | 1 | | 141(27.33) | 1 | 1 | |
| Informal/primary | 2004 | 445(73.07) | 2.61*** (2.16-3.17) | 1.25 (0.82-1.91) | 0.302 | 375(72.67) | 2.49*** (2.03-3.06 ) | 1.19 (0.75-1.87) | 0.46 |
| **Occupation of mother** | | | | | | | | | |
| Housewife/student | 650 | 99(16.26) | 1 | | | 88(17.05) | 1 | | |
| Agriculture/fishermen/ construction labor | 1988 | 428(70.28) | 1.53*** (1.20-1.94 ) | **** | **** | 357(69.19) | 1.40** (1.09-1.80 ) | **** | **** |
| Shopkeeper/professional /clerk | 1049 | 82(13.46) | 0.47*** (0.35-0.64 ) | **** | **** | 71(13.76) | 0.46*** (0.33-0.64) | **** | **** |
| **Height of mother** | | | | | | | | | |
| ≥150 cm | 3137 | 406(67.55) | 1 | 1 | | 338(66.27) | 1 | 1 | |
| <150 cm | 518 | 195(32.45) | 4.06*** (3.30-4.99 ) | 3.52 (2.21-5.61) | <0.001 | 172(33.73) | 4.12*** (3.32-5.10 ) | 2.79 (1.72-4.55) | <0.001 |
| **ANC** | | | | | | | | | |
| ≥ 4 times | 3211 | 508(83.14) | 1 | 1 | | 426(82.40) | 1 | 1 | |
| <4 times | 496 | 103(16.86) | 1.39** (1.10-1.77 ) | 0.57 (0.29-1.14 ) | 0.112 | 91(17.60) | 1.47** (1.14-1.88) | 0.46 (0.21-0.98) | 0.046 |
| **Well baby clinic** | | | | | | | | | |
| ≥ 4 times | 2470 | 440(72.85) | 1 | 1 | | 374(73.19) | 1 | 1 | |
| <4 times | 1176 | 164(27.15) | 0.75** (0.62-0.91) | 1.2 (0.81-1.79) | 0.366 | 137(26.81) | 0.74** (0.60-0.91 ) | 1 (0.65-1.53) | 0.986 |

| Variables | n | WHO Reference | | | | Thai Growth Reference | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Stunted (%) | Crude OR (95% CI) | Adjusted OR 95% CI | *p-value* | Stunted (%) | Crude OR (95% CI) | Adjusted OR 95% CI | *p-value* |
| **Illness at 24 months** | | | | | | | | | |
| No | 3233 | 530(87.31) | 1 | **** | **** | 450(87.55) | 1 | **** | **** |
| Yes | 409 | 77(12.69) | 1.18 (0.91-1.54 ) | **** | **** | 64(12.45) | 1.15 (0.86-1.53 ) | **** | **** |
| **Prolonged breastfeeding** | | | | | | | | | |
| ≤12 months | 1631 | 121(32.79) | 1 | 1 | | 102(32.69) | 1 | 1 | |
| >12 months | 1140 | 248(67.21) | 3.47*** (2.75-4.38 ) | 2.7 (1.77-4.10) | <0.001 | 210(67.31) | 3.38*** (2.64-4.35 ) | 2.31 (1.48-3.60) | <0.001 |
| **Rice** | | | | | | | | | |
| 4-6m | 1889 | 307(54.63) | 1 | 1 | | 260(54.74) | 1 | 1 | |
| <4m | 1342 | 213(37.90) | 0.97 (0.80-1.18 ) | 0.93 (0.58-1.49) | 0.777 | 179(37.68) | 0.96 ( 0.79-1.18) | 1.06 (0.65-1.71) | 0.821 |
| >6m | 194 | 42(7.47) | 1.42 (0.99-2.05 ) | 0.98 (0.42-2.27 ) | 0.959 | 36(7.58) | 1.43 (0.97-2.10 ) | 1.03 (0.44-2.40) | 0.951 |
| **Cereal** | | | | | | | | | |
| 4-6m | 1276 | 174(31.64) | 1 | 1 | | 148(31.76) | 1 | 1 | |
| <4m | 1013 | 207(37.64) | 1.63*** (1.30-2.03) | 1.41 (0.88-2.24 ) | 0.149 | 176(37.77) | 1.6*** (1.27-2.03 ) | 1.45 (0.89-2.37) | 0.138 |
| >6m | 967 | 169(30.73) | 1.34* (1.07-1.69 ) | 0.97 (0.59-1.60) | 0.902 | 142(30.47) | 1.31* (1.02-1.68 ) | 1.03 (0.61-1.74) | 0.909 |
| **Chicken** | | | | | | | | | |
| 4-6m | 685 | 123(23.16) | 1 | 1 | | 102(22.82) | 1 | | |
| <4m | 43 | 13(2.45) | 1.98* (1-3.91 ) | 0.5 (0.04-5.92 ) | 0.581 | 11(2.46) | 1.96 (0.96-4.02 ) | **** | **** |
| >6m | 2468 | 395(74.39) | 0.87 (0.70-1.09 ) | 0.66 (0.37-1.16 ) | 0.149 | 334(74.72) | 0.89 (0.70-1.14 ) | **** | **** |
| **Liver** | | | | | | | | | |
| 4-6m | 1423 | 194(36.26) | 1 | 1 | | 163(36.14) | 1 | 1 | |
| <4m | 127 | 11(2.06) | 0.6 (0.32-1.14) | 0.45 (0.09-2.39) | 0.349 | 10(2.22) | 0.66 (0.34-1.29 ) | 0.77 ( 0.17-.36) | 0.724 |
| >6m | 1667 | 330(61.68) | 1.56*** (1.29-1.90) | 1.21 (0.75-1.94 ) | 0.439 | 278(61.64) | 1.55*** (1.26-1.90) | 1.1 (0.68-1.77) | 0.703 |
| **Yolk** | | | | | | | | | |
| 4-6m | 2278 | 344(65.15) | 1 | 1 | | 291(64.81) | 1 | 1 | |
| <4m | 499 | 63(11.93) | 0.81 (0.61-1.08 ) | 0.62 (0.30-1.28) | 0.196 | 54(12.03) | 0.83 (0.61-1.13) | 0.61 (0.29-1.28) | 0.189 |
| >6m | 528 | 121(22.92) | 1.67*** (1.32-2.11) | 1.89 (1.07-3.33) | 0.028 | 104(23.16) | 1.67*** (1.31-2.14 ) | 1.34 (0.74-2.4 ) | 0.331 |
| **Whole eggs** | | | | | | | | | |
| 4-6m | 706 | 131(25.24) | 1 | 1 | | 112(25.45) | 1 | 1 | |
| <4m | 56 | 10(1.93) | 0.95 (0.47-1.94 ) | 1.94 (0.30-12.74) | 0.49 | 8(1.82) | 0.88 (0.41-1.92 ) | 2.76 (0.56-3.54) | 0.211 |
| >6m | 2389 | 378(72.83) | 0.83 (0.66-1.03) | 0.67 (0.41-1.09 ) | 0.105 | 320(72.73) | 0.82 (0.65-1.04) | 0.52 (0.32-0.84) | 0.007 |
| **Fish** | | | | | | | | | |
| 4-6m | 1401 | 184(34.52) | 1 | 1 | | 150(33.33) | 1 | | |
| <4m | 53 | 6(1.13) | 0.84 (0.36-2 ) | 0 (0-*) | 0.999 | 5(1.11) | 0.87 (0.34-2.22) | **** | **** |
| >6m | 1742 | 343(64.35) | 1.62*** (1.33-1.97) | 0.69 ( 0.43-1.11) | 0.13 | 295(65.56) | 1.70*** (1.38-2.10 ) | **** | **** |

| Variables | n | WHO Reference Stunted (%) | WHO Reference Crude OR (95% CI) | WHO Reference Adjusted OR 95% CI | WHO Reference *p-value* | Thai Growth Reference Stunted (%) | Thai Growth Reference Crude OR (95% CI) | Thai Growth Reference Adjusted OR 95% CI | Thai Growth Reference *p-value* |
|---|---|---|---|---|---|---|---|---|---|
| **Pork** | | | | | | | | | |
| 4-6m | 1082 | 132(24.81) | 1 | 1 | | 105(23.39) | 1 | | |
| <4m | 73 | 7(1.32) | 0.76 (0.34-1.70 ) | 4.72 (1.11-20.19 ) | 0.036 | 5(1.11) | 0.68 (0.27-1.73) | **** | **** |
| >6m | 2110 | 393(73.87) | 1.65*** (1.33-2.04 ) | 1.54 (0.93-2.53 ) | 0.092 | 339(75.50) | 1.78*** (1.41-2.25 ) | **** | **** |
| **Leafy vegetables** | | | | | | | | | |
| 4-6m | 1627 | 205(38.25) | 1 | 1 | | 174(38.33) | 1 | 1 | |
| <4m | 163 | 16(2.99) | 0.76 (0.44-1.29 ) | 1.39 (0.43-4.48 ) | 0.58 | 15(3.30) | 0.85 (0.49-1.47 ) | 1.2 ( 0.35-.13) | 0.772 |
| >6m | 1451 | 315(58.77) | 1.92*** ( 1.59-2.33) | 0.81 (0.51-1.28 ) | 0.366 | 265(58.37) | 1.87*** (1.52-2.29 ) | 0.77 (0.47-1.26) | 0.302 |
| **Other vegetables** | | | | | | | | | |
| 4-6m | 1424 | 167(30.53) | 1 | | | 136(29.44) | 1 | 1 | |
| <4m | 165 | 14(2.56) | 0.7 (0.39-1.24 ) | **** | **** | 11(2.38) | 0.68 (0.36-1.28 ) | 0.89 (0.25-3.15) | 0.858 |
| >6m | 1663 | 366(66.91) | 1.29*** (1.20-1.37 ) | **** | **** | 315(68.18) | 2.21*** (1.78-2.74) | 1.27 (0.79-2.05) | 0.33 |
| **Banana** | | | | | | | | | |
| 4-6m | 1327 | 236(41.04) | 1 | 1 | | 192(39.83) | 1 | 1 | |
| <4m | 2023 | 281(48.87) | 0.75** (0.62-0.90 ) | 1.28 (0.79-2.07 ) | 0.325 | 242(50.21) | 0.8* (0.66-0.98) | 1.31 (0.79-2.17) | 0.292 |
| >6m | 173 | 58(10.09) | 1.33*** ( 1.18-1.49) | 1.09 (0.81-1.46 ) | 0.577 | 48(9.96) | 2.27*** (1.57-3.27 ) | 2.16 (0.91-5.13) | 0.081 |
| **Fruit juice** | | | | | | | | | |
| 4-6m | 1297 | 187(34.31) | 1 | 1 | | 166(36.01) | 1 | | |
| <4m | 1479 | 202(37.06) | 0.94 (0.76-1.16 ) | 1.12 (0.71-1.76 ) | 0.624 | 166(36.01) | 0.86 (0.68-1.08 ) | **** | **** |
| >6m | 591 | 156(28.62) | 2.13*** (1.67-2.71 ) | 0.88 (0.50-1.55 ) | 0.662 | 129(27.98) | 1.90*** (1.48-2.45) | **** | **** |
| **Orange** | | | | | | | | | |
| 4-6m | 788 | 108(21.56) | 1 | | | 93(22.20) | 1 | 1 | |
| <4m | 374 | 44(8.78) | 0.84 (0.58-1.22 ) | **** | **** | 38(9.07) | 0.85 (0.57-1.26 ) | 0.64 (0.31-1.33) | 0.231 |
| >6m | 1921 | 349(69.66) | 1.4** (1.11-1.77) | **** | **** | 288(68.74) | 1.32* (1.03-1.69 ) | 1.12 (0.70-1.77) | 0.638 |
| **Papaya** | | | | | | | | | |
| 4-6m | 936 | 129(24.39) | 1 | 1 | | 112(25.11) | 1 | 1 | |
| <4m | 130 | 19(3.59) | 1.07 (0.64-1.80) | 0.74 (0.27-1.98 ) | 0.547 | 16(3.59) | 1.03 (0.59-1.81) | 1.7 (0.68-4.24) | 0.253 |
| >6m | 2081 | 381(72.02) | 1.40** (1.13-1.74) | 0.97 (0.63-1.50) | 0.895 | 318(71.30) | 1.33* (1.05-1.67 ) | 1.07 (0.67-1.73) | 0.766 |
| **Oil** | | | | | | | | | |
| 4-6m | 597 | 113(21.08) | 1 | 1 | | 90(19.87) | 1 | | |
| <4m | 30 | 3(0.56) | 0.48 (0.14-1.60 ) | 0.5 (0.03-9.44 ) | 0.644 | 2(0.44) | 0.4 ( 0.09-1.72) | **** | **** |
| >6m | 2612 | 420(78.36) | 0.82 (0.65-1.03) | 0.85 ( 0.49-1.47) | 0.558 | 361(79.69) | 0.9 (0.70-1.16 ) | **** | **** |

*, P <0.05; **, P <0.01; ***, P <0.001; ****, not included in the final model of multiple logistic regression

Applying chi-square test, family income, study area, birth weight, gender, age of mother, education of mother, occupation of mother, height of mother, ANC and WBC were the factors which remained independently associated with stunting at 24 months according to both the references. After adjusting for other variables in the final model, the significant risk factors for stunting were family income, study area, birth weight, gender, height of mother, prolonged breastfeeding, yolk and pork according to WHO reference. Whereas according to Thai reference, the significant risk factors for stunting were family income, birth weight, gender, height of mother, ANC, prolonged breastfeeding and whole eggs (Table 1).

## DISCUSSION

The present study is the first exploring of the association between time of introduction of complementary food with child stunting. The use of both international and the Thai standard child growth reference to ensure comparability of the findings is also the strength of this study. Birth weight, age of mother, occupation of mother and ANC were accounted for confounders for child stunting in this present study, however, the confounding effect of family income, study area, gender, mother education and mother height on child stunting at age 24 months is referenced elsewhere [24].

The time of introducing complementary food for the first time to children has potential life-long impacts on health, thus is an important aspect of pediatric health supervision [25, 26]. This study is one of very few to provide information on the time of introduction of individual complementary food items to children. The results showed that most of the children were fed several kinds of foods before they were actually weaned from the breast milk. Even though this study found that most of the infants were introduced complementary food during 4-6 months, a high number of children seemed to been introduced rice and banana before four months, similar to the earlier studies conducted in Thailand; introducing mashed rice or banana seemed an old traditional practice as well [27]. Some previous studies have even reported the evidences of introducing rice or banana as early as a few days after birth in Thailand [27, 28]. This may be possible that they were some infants whose mother or care taker still lack of information regarding infants feed by WHO's recommendation [25].

After adjusting the confounding factors in the final model, prolonged breastfeeding was the most significant factor for stunting. Since most of the children were found being introduced complementary foods early, this result could be due to reverse causality as some previous studies have found [29, 30]. However, studies have shown the risk of malnutrition among the children getting prolonged breastfeeding [31, 32].

The final model for both WHO and Thai reference were significant ensuring capabilities of the included variables to explain the stunting effect at 24 months. According to WHO reference, introducing pork before four months was 4.72 times risk for stunting. Pork being animal source food, has high chance of bacterial contamination and zoonotic infection which ultimately has negative impact on nutritional status of children [33]. Studies in South and Central America [34], Peru [35], Kenya [36], New Guinea [37] have shown the positive association between animal source foods like meat, fish with linear growth of children only after six months of age.

According to Thai reference, introducing whole eggs before four months had the highest odds ratio of stunting at 24 months while introducing whole eggs after six months was protective to stunting. Feeding whole egg to young infants may result allergy [38] which may cause illness in them. But when introduced at appropriate age, it is seen beneficial as in this study. A study in China on complementary feeding showed negative correlation of food items like animal products, vegetables and fruits with prevalence of stunting among 9-24 months children [39].

Early introduction of complementary food is not beneficial to children [40]. Early introduction of complementary food displaces breast milk in one hand, whereas on the other hand, increases the risk of diseases [33]. Many studies have shown that due to the increased risk of various infections like diarrhea [7-9], respiratory infections [10-12] caused by poor quality of food supplied, early introduction of food does not benefit growth and can cause growth faltering [16, 18]. Earlier studies have reported the effect of early feeding of complementary foods, especially before four months of age, on growth and prevalence of obesity [17, 41].

## RECOMMENDATION

The present study, following the WHO standards for complementary food introduction after 6 months [25], addresses the research gaps on association of time of introduction of individual food items with child stunting. The age of introducing complementary food to infants is of public health importance as there is risk of infections from contaminated foods at one hand and at other, replacement of nutritious breast milk by inappropriate food items which ultimately

affects child growth. The close association of inappropriate diet with growth faltering stresses the need of ensuring compliance to infant feeding guidelines. However, integrating massive educational and awareness programmes based on hazard-analysis-critical-control-point approach into national infant feedings should be implemented and efforts to lessen an inappropriate type and time of complementary food for infants feeding should be practiced. Some studies have shown the risk of malnutrition among the children getting prolonged breastfeeding, therefore, promoting infants height, an appropriate time and type of complementary food parallel with an appropriate breastfeeding is also recommended.

The present study only accounts the time of introduction of complementary food, not the duration of continued feeding of the introduced food or whether it was discontinued. In future, qualitative research regarding to the reason behind also should be explored. Additional, taking into account the socio-cultural factors, and longitudinal studies should be carried incorporating aspects like dietary diversity and meal frequency, in feeding practices. Along with that, adequate sample size should be maintained to have clear view of the association between feeding practices and child stunting, therefore, next research need to be confirmed.

The prevalence of stunting was lower using Thai reference compare to WHO reference. WHO reference seemed more sensitive in detecting the stunted cases. Also, from the results, it is known that different references show different risk factors, so appropriate reference should be considered.

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