

## The timing of introduction of solid foods and food type during the first year of life in children in Qazvin, Iran

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### Summary

The timing of the transition and the quality of infants' diet can have important health implications. The purpose of the present study was to detect the factors that affect the times of introduction of solid foods and food type through the first year of life in healthy infants. This cross-sectional study was conducted in 2012 to determine complementary feeding pattern and associated factors in 707 children in Qazvin. Chi-square test, ANOVA and t-tests were employed to analyse the data. The results showed that 44.8% of mothers in this study introduced solid food when their child was 6 months old. The mean age of initiating complementary food was  $5.7 \pm 1.1$  months and "Fereni" (a kind of cereal food) was the first complementary food (73.7%). The mean age of initiating solid foods in unemployed mothers was  $5.8 \pm 1.1$  months and in employed mothers was  $5.5 \pm 1.1$  months ( $p < 0.05$ ). Complementary food was introduced earlier in the group of fathers with a higher educational level ( $p < 0.05$ ). According to our findings, the complementary feeding pattern in Qazvin appeared to be satisfactory based on the World Health Organization recommendations.

### Keywords

complementary feeding; solid food; Fereni; blended almond; soup

During the first two years of life, children are particularly vulnerable and, at this time, adequate nutrition is essential to optimize health as well as physical and mental development [1]. Inappropriate complementary feeding increases the risk of undernutrition, illness and mortality in infants and children [2]. From 6 months onwards, when breast milk alone is no longer sufficient to meet all nutritional requirements, infants need complementary feeding during which they make a gradual transition from breastfeeding to eating family foods [3]. Appropriate complementary feeding in children aged 6–8 months was associated with better child growth [4]. Introduction of complementary food at 4–5 months compared to 0–3 months was negatively associated with overweight or obesity [5]. Population-based studies showed that the greatest risk of nutritional deficiency and growth retardation occurred in children between 3 and 15 months of age because of poor breastfeeding and inappro-

priate complementary feeding practices [6].

Complementary foods are often of inadequate nutritional quality, or they are given too early or too late, or not frequently enough. Premature cessation or low frequency of breastfeeding also contributes to insufficient nutrient and energy intake in infants beyond 6 months of age [7]. Both breastfeeding and complementary feeding can have direct or later consequences on health. Possible short-term health effects concern growth velocity [8] and infections, while possible long-term effects may relate to obesity [5] and cardiovascular disease, autoimmunity (celiac disease and type 1 diabetes) and atopic disorders [2]. Poor nutrition can lead to significant mortality and morbidity [1]. It is established that 6% of under-5 deaths could be prevented through the achievement of appropriate complementary feeding alone [9].

Nutrition-related factors are responsible for about 35% of child deaths and 11% of the total

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global burden of disease [10]. Poor nutrition in infancy and early childhood can also have longer-term effects on adolescent and adult intellectual performance and general health, which may ultimately effect their life changes and ability to work [1]. During the first year of life, infants transit from a diet of breast milk or infant formula to one that includes solid foods and other beverages. During the past decade, there has been considerable improvement in breastfeeding practices in many countries; however, similar progress has not been made in the area of complementary feeding [11]. The timing of the transition and the type of diet can have important health implication [12]. There are, however, no published data regarding the timing and food type of introduction of complementary food in Iranian infants. Therefore, the purpose of the present study was to detect the factors that associated the times of introduction of solid foods and food type through the first year of life in healthy infants in Qazvin, Iran.

## MATERIAL AND METHODS

A total of 718 children under 30 months of age were initially included. Low birth weight and multiple birth children were excluded. We included children younger than 30 months since some of the children at the time of the study were too young to introduce the complementary food and they were excluded from the study. This cross-sectional study was conducted on 707 children (320 girls, 45.3% and 387 boys, 54.7%; birth weight: 2500–4000 g) admitted to health centres in Qazvin (Iran) in 2012. The mean age of the children was  $9.9 \pm 0.7$  months (range: 6 days to 30 months). Qazvin is located about 150 km

north-west of Tehran. Although the study protocol raised no ethical considerations, informed consent forms were obtained from the selected children's mothers after they had been briefed about the study objectives. Participants were carried out from all 10 health centres and 11 health stations in Qazvin. The mothers were interviewed only if they already had household records at the health centres and stations. A questionnaire containing child and parent characteristics, and complementary feeding practices e.g.: the reasons for early initiating complementary food, the first complementary food, the age of introduction of complementary feeding, parents age, occupation and educational level, family income was designed and completed through face to face interviews with mothers. The reliability of the questionnaire was confirmed with Cronbach's alpha (0.82) and validated by two expert nutritionist and an epidemiologist.

Chi-square tests, analysis of variance (ANOVA) and t-tests were employed to analyse the data. Results are presented as mean  $\pm$  standard deviation.  $p$ -Value  $< 0.05$  was accepted as statistically significant for all tests. Data were analysed by the SPSS package Version 13 (SPSS, Chicago, Illinois, USA).

## RESULT AND DISCUSSION

Approximately one third of the studied children ( $n = 246$ ; 34.8%) had not received complementary feeding yet. The main reason was the inclusion of children who were too young to introduce the complementary food (babies under 4–6 months). According to the mothers, complementary feeding started at two, four and six months of age for 3 (0.4%), 34 (4.8%) and 317 (44.8%) children, respectively. The mean age at which the children received complementary food for the first time was  $5.70 \pm 1.08$  months (range: 0.5–12 months; Tab. 1).

Tab. 2 summarizes the first food given to the children. Fereni (a type of Iranian pudding made from rice flour, sugar and cows' milk) was the first complementary food in 73.7% children. Introduction of complementary food with iron supplementation simultaneously was recommended by the Iranian Ministry of Health. A variety of meat soups, blended almond (a mixture of ground almond, sugar and cows' milk), and formula milk were the first complementary foods for 6.8%, 6.4% and 5.3% of the children, respectively. More than a half (55.5%) of the mothers had never given vegetables puree to their children until the time of interview. Vegetables puree was not a popular dish

**Tab. 1.** The distribution of children by age of initiating of complementary feeding.

Age (month)	<i>n</i>	Percentage [%]
< 1	7	1
2	3	0.4
3	5	0.7
4	34	4.8
5	56	7.9
6	317	44.8
7	32	4.5
$\geq 8$	7	1
Too young to get complementary feeding	246	34.8
Total	707	100

with Iranian families. Vegetables puree with potatoes, carrots and zucchini were used by 15.0%, 2.3% and 0.3% of the mothers, respectively. The first biscuits given to the child had been plain biscuits in 98.1% of the cases and wafers only in 0.1%. None of the mothers had used creamed or chocolate biscuits at the beginning. Mothers had introduced juices to their children by giving them apple juice (58.2%), citrus fruit juices (22.6%) and carrot juice (6.1%).

The mean age of introduction of complementary food in mothers' infants with less than 12 years of education (without a high school diploma), high school diploma and associate degree (12–14 years of education), and university degree were  $5.8 \pm 1.3$  months,  $5.7 \pm 1.1$  months and  $5.6 \pm 1.1$  months, respectively. Although the time of starting complementary feeding had no significant association with mothers' education, it was significantly related with fathers' education, i.e. fathers' higher educational level corresponded to earlier initiation of complementary feeding (Tab. 3). On the other hand, the association between parents' education and type of the first complementary foods were not statistically significant. While employed mothers began complementary feeding significantly earlier than housewives or unemployed mothers ( $5.5 \pm 1.1$  months vs  $5.8 \pm 1.1$  months, respectively,  $p < 0.05$ ), no significant association was found between the type of complementary food and mothers' occupation. Moreover, there were significant association between the time of introduction of complementary food and mothers' age ( $p < 0.05$ ) and mothers working status ( $p < 0.05$ ). There was no significant association between the timing of complementary food and birth weight, family size and birth order of the child (Tab. 4). The Chi-Square test showed that the variables "type of the first complementary food" and mother's age ( $p < 0.05$ ), and mothers information source, are not independent ( $p < 0.05$ ). Also, the data showed that there was no significant association between the type of first complemen-

**Tab. 2.** The distribution of children by the type of the first complementary food.

First complementary food	<i>n</i>	Percentage [%]
Formula	24	5.3
Pasteurized cows' milk	1	0.2
Fereni (rice flour, cows' milk and sugar)	334	73.7
Yogurt	2	0.4
Vegetable puree	4	0.9
Soup	31	6.8
Shirbereng (rice and cows' milk)	4	0.9
Blended almond	29	6.4
Water with sugar	5	1.1
Fruit juice	3	0.7
Commercial baby food	12	2.6
Biscuits and breads	2	0.4
Family food	2	0.4
Egg	0	0
Cooked pulses	0	0
Total	453	100

tary food and mothers working status, family size, birth order of the child and birth weight (Tab. 5).

Furthermore, there was a significant association between mothers' information source and timing of complementary food introduction. In fact, mothers who obtained their information from medical staff started complementary feeding closer to six months ( $5.9 \pm 1.1$  months vs  $5.6 \pm 1.1$  months;  $p < 0.05$ ) than those who used their own or others' experiences or information from the mass media as their information source. In addition, the first mentioned group of mothers, for whom the medical staff was the source of information, tended to begin complementary feeding with Fereni (mixture of rice flour, cows' milk and sugar), Shirbereng (rice and cows' milk), blended almond, fruits and vegetables instead of

**Tab. 3.** The timing of introduction of complementary feeding in relation to parents' educational level.

Level of education	Mothers ( $p = 0.5$ )		Fathers ( $p = 0.03$ )	
	<i>n</i>	Mean $\pm$ SD	<i>n</i>	Mean $\pm$ SD
< 12 years	83	$5.76 \pm 1.31$	101	$5.44 \pm 1.32$
12–14 years	256	$5.75 \pm 1.07$	235	$5.71 \pm 0.47$
Bachelor's degree or more	122	$5.62 \pm 1.08$	124	$5.56 \pm 1.04$

SD – standard deviation.

**Tab. 4.** The timing of introduction of complementary feeding with different characteristics of the subjects.

Variables		<i>n</i>	Percentage [%]	Timing [month]	<i>p</i> -Value
Mother's working status	Employed	89	19.4	5.5 ± 1.05	0.04 <sup>a</sup>
	Unemployed	371	80.6	5.8 ± 1.09	
Family size	3 members	276	60	5.7 ± 1.06	0.89 <sup>b</sup>
	4 members	147	31.4	5.7 ± 1.11	
	≥ 5 members	37	8.1	5.8 ± 0.83	
Birth order of the child	First	278	61.5	5.7 ± 1.06	0.67 <sup>b</sup>
	Second	140	31	5.7 ± 1.11	
	Third and further	34	7.5	5.8 ± 1.24	
Birth weight	< 3 kg	124	72.4	5.6 ± 1.26	0.43 <sup>a</sup>
	≥ 3 kg	334	27.1	5.7 ± 1.01	
Mother's age	< 20 years	18	3.4	5.1 ± 1.57	0.034 <sup>b</sup>
	20–35 years	410	88.9	5.7 ± 1.07	
	> 35 years	33	7.2	5.6 ± 0.4	
Mother's information source	Medical staff	163	35.4	5.9 ± 1.08	0.01 <sup>a</sup>
	Non-medical staff	244	64.6	5.6 ± 1.08	

Timing of introduction of complementary food is presented as mean ± standard deviation.

a – T-test, b – ANOVA.

pulses. The relationship between mothers' information source and type of the first complementary food was significant ( $p < 0.05$ ; Tab. 5). There was a negative association (non-significant) between timing of complementary food introduction and household income, i.e. families with higher monthly income started complementary feeding earlier than those with lower income ( $5.4 \pm 1.1$  months vs  $5.8 \pm 1.1$  months).

In 2001, World Health Organization issued a global recommendation that mothers should exclusively breastfeed for the first 6 months of life, with the introduction of solid foods commencing at 6 months [10]. This was supported by a systematic review conducted by KRAMER and KAKUMA, which concluded that breastfeeding for 6 months had many benefits to both mother and infant [13], particularly reducing infant morbidity and mortality by decreased incidence of gastrointestinal infections [14, 15]. Despite this recommendation, the age at which solid foods are introduced to infants' diets varies worldwide [16]. The results of the present study showed that approximately half of the mothers (49.3%) had begun complementary feeding at recommended age between 6 to 8 months. Similar results were reported by SINHABABU and PATEL who stated that the prevalence of introduction of complementary food among infants aged 6–8 months was 47.1% in west Bengal and 55% in India [17, 18]. However, the rate of initiating of solid foods at 6–8 months

in Pakistan (39%) was lower than our results and in Nepal (70%), Bangladesh (71%) and Sri Lanka (84%) were higher than ours [19]. On the other hand, in Bangladesh, SAHA et al. found that 2.2% of infants had received complementary food below 1 month. The rates increased to 49.6% at 6 months and to 66.4% at 9 months [20]. In the present study, only 1% of mothers introduced complementary food to infants below 1 month. Meanwhile, most infants had received their first complementary food earlier than at 6 months (59.6%) and earlier than at 9 months (64.1%). A study by KIMANI-MURAGE et al. showed that only 2.0% of African children are exclusively breastfed until 6 months of age and the mean age at which the complementary was food introduced was 3.5 months [21].

In the present study, the mean age of initiating complementary food was  $5.7 \pm 1.1$  months, which is close to WHO recommendation. In the current study, the main reason for early initiating complementary feeding was mothers' perception that breastfeeding was not sufficient. In previous reports such a perception has also been identified as the main reason for early cessation of exclusive breast feeding [22–25]. Therefore, more than a half of the mothers in our study (59.6%) did not continue exclusive breastfeeding for six months due to its insufficiency. Delaying the introduction of complementary food beyond the age of 26 weeks is known to be associated with the risk of

nutritional insufficiency, particularly in low-income populations, and such delays may be associated with an increased risk for disorders connected with the immune system [26, 27]. However, introduction before the age of 17 weeks may be associated with adverse health consequences in later life and is not associated with any apparent health benefit [28–31].

GRUMMER-STRAWN et al. [32] reported that 41.0% of children (vs 6.9% in the present study) had received complementary foods at four months of age. However, according to the American Academy of Pediatrics [30], as children do not require solid foods before four months, introduction of such foods at an early age will increase the child's exposure to pathogens while not being immunologically supported by breastfeeding [31, 32]. GRUMMER-STRAWN et al. found infant cereals as the first food complementary to breastfeeding or formula feeding, and the most important supplement below eight months [32]. Fruits and vegetables were introduced at a mean age of five to six months, and meats were started at the mean age of eight months. Likewise, infant cereal was most commonly used as the first solid food in Italy [33]. In the present study, Fereni was the first complementary food (73.7%). Moreover, soups with meat, vegetable puree, and fruit juices were introduced at 7.1, 7.3, and 8.0 months, respectively.

Based on the findings of the present study and previous research [32], cereals are the first introduced complementary foods. Considering the reduction in an infant's iron and zinc supplies at about six months [11], the first complementary food needs to provide high amounts of bioavailable zinc and iron, but infant cereals have low contents of bioavailable iron [34]. High amounts of bioavailable zinc and iron can be provided by timely introduction of meats [27, 30].

KIMANI-MURAGE et al. identified mothers' education as a predictor of early initiation of complementary feeding [21]. Such a negative effect of mothers' low level of education on early complementary feeding has also been confirmed by other studies [35–37]. Our results showed no significant association between timing of complementary food introduction and mothers' education. This difference between our study and the above-mentioned researches can be justified by improvements in the mothers'

**Tab. 5.** The distribution of the subjects according to the type of the first complementary food and different characteristics.

Characteristics	Dairy products		Fruits and vegetables		Meat and eggs		Pulses		Fereni		Water and sugar		Total		p-Value	
	n	[%]	n	[%]	n	[%]	n	[%]	n	[%]	n	[%]	n	[%]		
Mother's working status	Employed	2	2.6	1	1.3	4	5.2	2	2.6	68	88.3	0	0	77	18.3	0.616
	Unemployed	20	5.8	5	1.4	26	7.5	10	2.9	276	80.6	6	1.7	345	81.7	
Family size	3 members	17	6.3	6	2.2	18	6.7	11	4.1	215	74.6	3	0.1	270	60	0.249
	4 members	4	2.8	1	0.7	12	8.4	3	2.1	119	83.2	4	2.8	143	31.8	
	≥ 5 members	4	0.8	0	0	1	2.7	0	0	32	86.5	0	0	37	8.2	
Birth order of the child	First	14	5.6	5	2	19	7.6	9	3.6	199	79.9	3	1.2	249	40	0.486
	Second	4	3	1	0.8	10	7.6	3	2.3	111	84.1	3	2.3	132	31.8	
	Third and further	4	11.8	0	0	1	2.4	0	0	29	85.3	0	0	34	8.2	
Birth weight	< 3 kg	5	4.4	1	0	8	7	4	3.5	94	82.5	3	2.6	114	27.1	0.511
	≥ 3 kg	17	5.6	6	2	21	6.4	8	2.6	251	82	3	1	306	72.9	
Mother's age	< 20 years	5	27.8	0	0	2	11.1	0	0	11	61.1	0	0	18	4	0.009
	20–35 years	20	5	6	1.5	26	6.5	14	3.5	327	81.8	7	1.8	400	82.7	
	> 35 years	0	0	1	3	3	9.1	0	0	29	87.9	0	0	33	7.3	
Mother's information source	Medical staff	7	4.4	5	3.1	12	7.5	0	0	132	83	3	1.9	159	35.3	0.027
	Non-medical staff	18	6.2	2	0.7	19	6.5	14	4.8	238	80.4	4	1.4	291	64.7	

knowledge following the provision of related trainings in health centres by the healthcare staff in Qazvin. In other words, benefiting from trainings can eliminate the effects of mothers' education on timing of complementary feeding. Meanwhile, the significant association between fathers' education level and timing of complementary feeding observed in the present study could have in turn been caused by lower participation of fathers in training sessions (the sessions are generally held in the mornings when fathers are at work). Moreover, no significant association between family size and the time of introduction of complementary food was found in the current study similar to data reported previously [38, 39].

SCOTT et al. reported that timing of complementary food introduction depended on social characteristics and lifestyle of the family [40]. Other studies also suggested that younger mothers [41–43] and smoking mothers [42–45, 32] begin complementary feeding earlier. The results of current study confirmed previous findings of the significant relationship between mothers' age and timing of complementary food introduction.

A study by GRZYWACZ et al. showed that mothers in full-time employment most probably use commercial baby foods to feed their children. Moreover, formula, commercial fruit juice, vegetables and infant cereals were used by 86.4%, 92.0%, 93.4% and 92.4% of employed mothers, respectively [46]. However, a considerably lower percentage (29.9%) of mothers in the current study had fed their children with commercial baby foods. The reason might have been their general belief about the superiority of home-made foods over industrial foods.

We also detected a significant association between time of complementary food introduction and mothers' employment status, i.e. employed mothers started complementary feeding significantly earlier than unemployed mothers ( $5.5 \pm 1.1$  months vs  $5.8 \pm 1.1$  months) and thus continued exclusive breastfeeding for a shorter duration [47]. This finding is not surprising since working mothers are busy with their job and spend more time out of home than unemployed mothers or housewives during the day. Finally, the present study highlighted the effect of mothers' information sources on the pattern of complementary feeding. More precisely, mothers who received information from medical staff initiated complementary feeding at an age significantly closer to six months ( $5.9 \pm 1.1$  months vs  $5.6 \pm 1.1$  months).

A limitation of this study was its retrospective relying on mothers to recall the exact time of complementary feeding introduction and the different

complementary food they had used. Consequently, their answers were approximate and the accuracy of the results might be reduced. Since the majority of mothers reported insufficiency of breast milk as the reason for initiating complementary feeding below six months, extensive trainings are required to increase mothers' knowledge about the adequacy of exclusive breastfeeding for six months. On the other hand, considering the undeniable role of fathers, the presence of fathers in educational sessions can help modify the complementary feeding pattern. The results of the present study can help policy makers and researchers to design interventions to improve infant and young child feeding practices. According to our findings, the complementary feeding pattern in Qazvin appears to be satisfactory based on the WHO recommendations.

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