

## Perception of Rural and Urban Mothers about Consumption of Targeted Fortified Products in Jaipur, Rajasthan - India: A Cross-Sectional Study

Anup Nagaraj<sup>1</sup>, \*Asif Yousuf<sup>1</sup>, Shravani Ganta<sup>1</sup>

<sup>1</sup>Department of Public Health Dentistry, Jaipur Dental College, Jaipur, Rajasthan- 303101, India

ARTICLE INFO	ABSTRACT
<p><b>Article type:</b> Original Article</p>	<p><b>Background:</b> Food fortification is the addition of one or more essential nutrients to a food whether or not it is normally contained in the food, for the purpose of preventing or correcting a demonstrated deficiency of one or more nutrients in the population or specific population groups. The present cross-sectional study was conducted to obtain comprehensive information towards consumption of Targeted Fortified Products (TFP) among rural and urban mothers of children &lt; 3 years in Jaipur, India.</p> <p><b>Methods:</b> In this cross-sectional study conducted in 2012, three hundred rural and urban mothers were selected from Primary Health Centre, Achrol Village and Uniara Hospital in Jaipur, Rajasthan. The data were collected using a self-administered questionnaire. The current nutritional status of children was determined by anthropometric measurements.</p> <p><b>Results:</b> A total of 53.33% rural and 65.33% urban mothers had knowledge (<math>P=0.046</math>), amongst which 52.67% rural and 66.00% urban mothers (<math>P= 0.026</math>) consumed TFP directed towards mothers. In addition, 56% rural and 94.67% urban mothers had knowledge (<math>P=0.000</math>) about TFP directed towards children, amongst which 19.33% rural and 50.67% urban mothers (<math>P=0.000</math>) fed their children with TFP.</p> <p><b>Conclusion:</b> There was significantly less awareness regarding consumption of TFP directed towards both pregnant women and children among rural when compared to urban population. Attitudes seemed to be governed by the traditional beliefs and family influences of region rather than the knowledge obtained. There is a need of intensive coordinated efforts to create awareness among mothers to enhance the maternal and child diets through TFP.</p>
<p><b>Article history:</b>            Received: Dec 10 2012            Accepted: March 20 2013            e-published: Jun 30 2013</p>	
<p><b>Keywords:</b>            Supplements,            Food,            Fortified,            Child malnutrition,            Anthropometry</p>	
<p><b>*Corresponding Author:</b>            Asif Yousuf            Tel: +91 967 2751988;            e-mail:  <a href="mailto:as_if_you_suffer@yahoo.co.in">as_if_you_suffer@yahoo.co.in</a></p>	

**Citation:** Nagaraj A, Yousuf A, Ganta S. Perception of Rural and Urban Mothers about Consumption of Targeted Fortified Products in Jaipur, Rajasthan - India: A Cross-Sectional Study. Health Promot Perspect 2013; 3(1): 65-73

### Introduction

Food Fortification is a process where-in nutrients are added in small quantities to the foods, to maintain or to improve the nutritional quality of food and to reduce nutritional deficiencies. It is an important public

health measure that has widely been practiced by developed countries as a strategy to combat malnutrition and to address micronutrient gaps in the diet. The most common examples are the fortification of salt with iodine, milk

with vitamins A and D, wheat flour with iron, vitamins B<sub>1</sub>, B<sub>2</sub> and niacin<sup>1-4</sup>.

Food fortification can deliver essential nutrients such as vitamins and minerals to large segments of the population including specific population subgroups such as lactating mothers, infants and young children without requiring changes in their eating practices.

Poor nutritional quality during pregnancy<sup>5</sup>, infancy and early childhood<sup>6</sup> results in stunted growth, intrauterine growth restriction (IUGR)<sup>7</sup>, limited psychosocial development, increased risk of mortality and reduced learning capacity and productivity later in life so greater focus has to be laid on maternal, infant and young child nutrition (M.I.Y.C.N)<sup>8</sup>.

Food fortification<sup>9</sup> is defined as “the deliberate addition of synthetic vitamins to food.” The additional amount of nutrient is added to a food, usually in an amount higher than that present before processing. The *Codex General Principles for the Addition of Essential Nutrients to Foods* defines “fortification”, as “the addition of one or more essential nutrients to a food, whether or not it is normally contained in the food, for the purpose of preventing or correcting a demonstrated deficiency of one or more nutrients in the population or specific population groups”<sup>10</sup>. Poor maternal nutritional status has been related to adverse birth outcomes and is influenced by many biologic, socioeconomic, and demographic factors, which vary widely in different populations<sup>11</sup>. Micronutrient malnutrition (MNM) can affect all age groups, but young children and women in reproductive age are high-risk groups for developing micronutrient deficiencies<sup>12</sup>. Multiple Micronutrients (MMN) supplementations during pregnancy reduced the relative risk of low birth weight, small-for-gestational age and anaemia<sup>13</sup>. Providing pregnant females with balanced protein energy supplementation leads to reduction in risk of premature delivery, especially among undernourished pregnant women<sup>5</sup>.

The provision of multiple micronutrient (MMN) - fortified food supplements

(FFS) to pregnant women resulted in higher birth length of their child than did MMN supplementation alone<sup>14</sup>. Iron deficiency anaemia (IDA) is widely prevalent in low and middle-income countries. It is estimated that 3.5 billion persons have IDA (UNICEF/WHO 1999)<sup>15</sup>. Providing pregnant females with balanced protein energy supplementation resulted in a significant reduction of 31% in the risk of giving birth to small for gestational age infants and maternal undernourishment may lead to adverse perinatal outcomes including intrauterine growth restriction (IUGR)<sup>5</sup>. According to an estimate, approximately 30 million newborns per year are affected with intrauterine growth restriction (IUGR) in developing countries. The highest burden of prevalence of term low birth weight/ IUGR lies in Asia (75%), mainly South East Asia, followed by Africa (20%) and Latin America (5%)<sup>16</sup>. Most common macronutrient interventions directed towards pregnant women include dietary advice, balanced protein energy supplementation, high protein and isocaloric protein supplementation<sup>17-19</sup>. The use of micro nutrient fortified beverages and supplementary foods during pregnancy had positive effects on reducing maternal anemia, neural tube defects, intrauterine growth restriction and pre-eclampsia<sup>1</sup>.

The main objective of this study was to evaluate the awareness of mothers about special formulated fortified foods and their relationship with anthropometric measurements of children and to promote consumption of Targeted Fortified Products (TFP).

## **Materials and Methods**

### ***Participants and Procedure***

The sampling frame comprised of 300 mothers attending Primary Health Centre at Achrol Village and a Pediatric Hospital in Jaipur, Rajasthan - India (26.9200° N, 75.8200° E). They were sampled using arbitrary sampling method. Jaipur was geographically di-

vided into four zones. One zone was randomly chosen by using Lottery method. Primary Health Centre at village Achrol and Uniar Hospital were selected from that particular zone. Mothers of children attending the hospitals for regular check-ups or vaccination at randomly chosen times of the day were invited to participate in the study from June to July 2012.

Mothers aged 18-35 yr having children between 1 month to 3 years and the respondents who were co-operative and granted their consent were included in the study. Mothers having children with any systemic illness and uncooperative mothers were also excluded. A comprehensive close-ended, pre-tested, self-administered, 20-itemed questionnaire both in local and English language, were employed to collect socio-demographic details and data on maternal knowledge, attitude and practices towards consumption of TFP by mothers and their children. For the respondents who were not willing to reveal their identity, the name and address column in the questionnaire were kept optional so that their confidentiality could not be breached. A pilot study was carried out among 30 eligible mothers and their children who reported to various departments of Jaipur Dental College to ascertain the appropriateness and applicability of the questionnaire and clinical examination. Minor modifications were made based on comments and suggestions received from respondents.

Approval of the study was obtained from the Hospital and the Primary Health Centre authorities. The research protocol of the study was reviewed and ethical clearance was obtained from Jaipur Dental College Institutional Board. The participants who signed a written consent form before being interviewed were included in the study.

### **Measures**

Data was collected through a questionnaire comprised of a set of 20 pre-tested questions divided into socio-demographic factors and 2 separate sections. First section

was designed to collect information related to TFP directed towards mothers and the other section was directed towards children. The questionnaires were distributed to the mothers of children during their visit to the hospitals and were asked to respond to the questions. Answers to questions related to awareness, attitudes and practices were based on Guttman scale and respondents were asked to agree or disagree using binary answers yes or no. All responses used tick boxes. *e.g.: Do you have any knowledge about Targeted Fortified Products such as Vitamin, Iron or Folic acid supplementation available in the market for pregnant women? Yes/ No. If Yes, the source of knowledge: T.V, radio/ Print media/ Friends and peers/ Relatives/ Doctor, Health Care Worker.*

The current nutritional status of children was determined by calculating the B.M.I by direct methods of assessment using anthropometric measurements i.e. mid-arm circumference, height and weight of the child. Shakir's arm tape, which is a color-coded band, was employed for anthropometric measurement of the mid-arm circumference of the child. Mid arm circumference of less than 12.5 cm (red-band) was considered as severe malnutrition, between 12.5-13.5 cm (yellow-band) indicated mild/moderate malnutrition and above 13.5 cm (green band) indicated well nourished child. Weight and height of the child were measured using a standardized physician scale.

### **Statistical Analysis**

Data were entered and were analyzed using SPSS 17. Frequencies were calculated for all variables.

For each of the parameters in the questionnaire, the percentage means and standard deviations for both groups were calculated. Chi square ( $\chi^2$ ) test was employed for inter group comparison of variables such as between rural and urban mothers. Unpaired *t* test was applied to unpaired data of independent observations between two separate groups. For all tests a *P* value of 0.05 or less was used for statistical significance.

**Results**

The results in Table 1 show that the mean maternal age among rural group was

23.58 ± 3.07 SD as compared to 24.83 ± 3.61 SD among urban mothers.

**Table1:** Socio-demographic characteristics of the respondents (n=150)

	Sector	Mean(SD)	P-value*
Maternal age (yrs)	Rural	23.58(3.07)	<b>0.001</b>
	Urban	24.83(3.61)	
Income (US \$)	Rural	98.76(29.98)	<b>0.000</b>
	Urban	273.35(123.70)	
Number of family members	Rural	7.45(2.07)	0.824
	Urban	7.39(2.56)	
Number of children	Rural	1.81(0.75)	0.202
	Urban	1.69(0.87)	
Per capita income (US \$)	Rural	14.10(5.29)	<b>0.000</b>
	Urban	41.44(22.32)	
Mean age of children (months)	Rural	10.84(7.09)	0.066
	Urban	12.59(9.24)	

\*Unpaired group t-test

Table 2 shows that the mean weight of children (in kg) among rural group was 7.91 ± 2.19 SD as compared to 8.47 ± 2.48 SD among urban group. The mean height of children (in cm) among rural group was 68.21 ± 8.31 SD as compared to 70.83 ± 9.63 SD among urban children.

**Targeted Fortified Products directed towards pregnant women**

The response rate among rural mothers for knowledge about TFP's directed towards pregnant women was 53.33% (n=80) compared to 65.33% (n=98) of the urban population (P = 0.046).

Doctors/ Health care workers were the source of the knowledge about TFP's among 71.25% of rural mothers (n=80) as compared to 65.33% of the urban population (n=98) P= 0.000. Eighty percent of rural mothers and 89.33% of urban mothers were of the opinion that TFP's should be used for pregnant women. 52.67% of rural mothers and 66% of the urban mothers had consumed TFP's during pregnancy. Table 3 shows, among all rural mothers who did not consume TFP's for preg-

nant women (n=71), 73.24% the reason behind was non availability and for 22.54% were economic reasons as compared to urban mothers who did not consume TFP's for pregnant women (n=51), 50.98% the reason behind was refusal from family and for 33.33% the reason was non availability.

**Table 2:** Anthropometric measurements of children (n=150)

	Sector	Mean (SD)	P value*
Weight	Rural	7.91 (2.19)	<b>0.038</b>
	Urban	8.47 (2.48)	
Height	Rural	68.21 (8.31)	<b>0.011</b>
	Urban	70.85 (9.63)	
BMI	Rural	16.69 (2.37)	0.445
	Urban	16.50 (1.85)	

\* Unpaired group t-test

A total of 49.33% (n=74) of rural mothers were registered with Govt. agencies as compared to only 12% (n=18) of the urban population. 68.42% of rural mothers (n=76)

considered non-awareness as the reason for non registration with Govt. agencies and 27.63% considered distance to be the reason as compared to the urban mothers (n=132) among which 50% considered non-awareness

to be the reason and 44.70% considered distance to be the reason. 87.33% of the rural children were exclusively breast fed compared to 58% children of the urban population.

**Table 3:** Reasons/ Barriers for not using Targeted Fortified Products for pregnant women and children

Reason for not using TFP	Pregnant women			Children		
	Rural (71) n(%)	Urban (51) n(%)	Total (122) n(%)	Rural (121) n(%)	Urban (74) n(%)	Total (195) n(%)
Refusal from family	3(4.24)	26(50.98)	29(23.77)	64(52.89)	63(85.14)	127(65.13)
Economic reasons	16(22.54)	3(5.88)	19(15.57)	9(7.44)	1(1.35)	10(5.13)
Non-availability	52(73.24)	17(33.33)	69(56.56)	34(28.10)	2(2.70)	36(18.46)
Non-palatability	0	5(9.80)	5(4.10)	14(11.57)	8(10.81)	22(11.28)

**Targeted Fortified Products directed towards children**

It was observed that 56% (n=84) of rural mothers and 94.67% (n=142) of the urban mothers were aware of TFP'S directed towards children (p-value= 0.000). 76.67% of rural mothers and 63.33% of the urban mothers were of the opinion that TFP's should not be used for children. 19.33% of rural mothers fed their children targeted fortified products as compared to 50.67% of the urban population (P = 0.000). Among all rural mothers who fed their children with TFP's (n=29) 55.17% received encouragement from Doctors/ Health care providers, 40.79% from relatives as compared to urban mothers who fed their children with TFP's (n=76) 40.79% received encouragement from relatives and 32.89% from Doctors/ Health care providers. Table 3 shows that among all rural mothers who did not feed their children with TFP's (n=121), the reason behind for 52.89% was refusal from family and for 28.10% were non availability as compared to urban mothers who did not feed their children with TFP's (n=74), the reason behind for 85.14% was refusal from family and for 10.81% the reason was non palatability.

A total of 59.33% of rural mothers were registered with Govt agencies as compared to only 11.33% of the urban population. 77.05% of rural mothers (n=61) considered non-awareness as the reason for non registration with Govt. agencies and 19.67% considered distance to be the reason as compared to the urban mothers (n=194) among which 50% considered non-awareness to be the reason and 44.70% considered distance to be the reason. Table 4 shows that amongst all rural children, 24.67% were severely malnourished, 31.33% were well nourished and 44% were mild/ moderately nourished as compared to urban population where 16.67% were severely malnourished, 48% were well nourished and 35.33% were mild/ moderately nourished.

**Table 4:** Nutritional Status of children

Arm circumference	Rural n(%)	Urban n(%)	Total n(%)
Well nourished	47(31.33)	72(48.00)	119(39.67)
Mild/ Moderate malnutrition	66(44.00)	53(35.33)	119(39.67)
Severe malnutrition	37(24.67)	25(16.67)	62(20.67)

$\chi^2= 8.9$ , d.f = 2; P-value = 0.011

## **Discussion**

The current study presents a comprehensive overview of the perception of mothers about consumption of TFP in view of maternal and child nutrition among rural and urban population of Jaipur, Rajasthan to explore the issues associated with malnutrition. A good understanding of maternal knowledge, attitudes, beliefs and awareness regarding TFP's is essential aimed at improving the health of mothers and young children. The more positive the mother's attitude is towards nutrition, the better will be the health status of the children. This study provides important new data towards the evidence base related to knowledge of mothers towards TFP's and its influence on the mothers and their infants.

The infant mortality rate is high in India. According to Annual Health Survey, ORGI, 2012 in India, Rajasthan had topped the list of states with children being born underweight (39%) of which the urban rate of underweight newborns was 31%, which shoots up to a shocking 42% in rural areas. This was one of the reasons for importance of interventions to promote TFP consumption among Indian pregnant women.

### ***Targeted Fortified Products directed towards pregnant women***

Our study revealed that the response rate for knowledge about TFP's directed towards mothers among urban mothers were slightly more (65.33%) as compared to rural mothers (53.33%). The low rates can be linked to the subject's literacy level, which was more among urban mothers as compared to rural mothers. Doctors/ Health care workers were the source of knowledge for 71.25% of rural mothers as compared to 52.04% of urban mothers. The reason might be attributed to the utilization of health services more among rural than urban population. The attitudes among rural population are governed by traditional beliefs and family influences. Thus, because of these constraints and cultural restrictions they could

not translate their knowledge into practice. The attitude towards TFP's were encouraging as the response rate for both rural and urban mothers was high in considering that TFP's should be used for the pregnant women. Consumption of Supplementary Foods/ TFP's was more among urban mothers than rural mothers were. The results from this study broadly demonstrated lack of availability and access towards these products in rural setup as compared to urban population. Non-availability was the major reason for not using TFP's among 73.24% of rural population. The findings were similar to a study where it was found that economic factors, health beliefs, other nurturing related values and access to food played important roles in the selection of complementary foods<sup>20</sup>. Nearly half of the rural mothers were registered under Government Programmes for pregnant women while only 12% of urban mothers were registered. The reason attributed to this might be that urban population preferred to visit private hospitals more as compared to Government hospitals and Health Care Center's.

### ***Targeted Fortified Products directed towards children***

When the results were compared between mothers in rural and urban area, it was found that a greater impact (94.67%) of knowledge about TFP's directed towards children was noticed among urban mothers as compared to rural mothers (56%). This high percentage of response among urban mothers might be attributed to their literacy level and better sources of knowledge like mass media like TV, radio, newspapers etc. available for urban population. The findings illuminate that the consumption of Supplementary Foods/ TFP's was very less among rural mothers as compared to urban mothers and nearly 90% of rural population exclusively breast fed their children as compared to more than half of the urban population. Refusal from family was the main reason among both rural and urban population. The reason behind this might be attributed to more traditional beliefs and fam-

ily influences on infant feeding among rural population despite having the knowledge. The knowledge was not translated to practice adequately.

Additionally, findings revealed that more than half of the rural children were either moderately or severely malnourished and there was a significant difference between the nutritional statuses of rural as compared to urban children. These results can be attributed to the poor dietary practices of mothers during pregnancy and to the low literacy rates, health beliefs, low awareness and limited access to foods among rural population as compared to urban setup.

Birth length was seen to be 0.4–0.5 cm greater in the treatment group than in the control group<sup>21</sup>. Several studies have shown that multiple micronutrient MMN supplementation increased mean birth weight by 22 gm, compared with the control, reduced the prevalence of low birth weight (LBW) and small-for-gestational age by 11% and 10% respectively<sup>22</sup>. Fortified supplementary foods have impacts on increasing birth length and birth weight of the child by around 60–73 gm and reducing pre-term delivery<sup>23</sup>.

The results of our study revealed that multi-disciplinary approaches between Pediatricians, Pediatric Dentists, Public Health Specialists, Non Government Organizations (NGO's) and grass root level workers such as Anganwadi workers, Accredited Social Health Activists (ASHA's) etc. are needed to improve knowledge about TFP's and preventive strategies should be emphasized in programs organized for expecting mothers as well as for infants and young children. In addition, importance of breast-feeding and diet counseling need to be stressed upon.

Early identification of the high-risk groups such as Iron deficiency mothers and Low birth weight babies is indispensable so that appropriate preventive approaches can be implemented, and anticipatory guidance can be used<sup>24</sup>.

Accurate assessment of mother's knowledge and perceptions about TFP's can aid in the planning and implementation of educational and cognitive-behavioral interventions for health promotion at the community level.

There was significantly less awareness regarding consumption of TFP directed towards both pregnant women and children among rural when compared to urban population.

The accurate assessment of mother's knowledge and perceptions about TFP's can aid in:

- Planning of educational and cognitive-behavioral interventions for health promotion at the community level,
- Implementation of preventive strategies based on nutritional awareness programs for high risk population groups,
- Advocating greater focus on the consequences of malnutrition,
- Creating awareness among mothers to enhance the maternal diet during pregnancy and child diets through TFP's and breast feeding, and
- Improving the health of mothers and young children and counteracting maternal and child malnutrition.

## **Conclusion**

Implementation of nutritional awareness programs for high-risk population groups are needed to counteract maternal and child malnutrition and advocate greater focus on the consequences of malnutrition. Further quantitative and qualitative research studies on a larger sample and for a longer period are essential for the better understanding of the knowledge, attitudes and practices of mothers about TFP and the various factors that influence them. For rural population the goal can be achieved by providing subsidized TFP's and hence making it more affordable.

## Acknowledgements

We are grateful to Dr. Sanjay P. Kulshrestha, M.D, Pediatrics, Uniara Hospital, Jaipur and Dr. Mohsin Sidiq, MDS, Pedodontics, Srinagar, J&K for extending their support and suggestions throughout our study. The authors declare that there is no conflict of interest.

## References

1. Yang Z., Huffman S. Review of fortified food and beverage products for pregnant and lactating women and their impact on nutritional status. *Matern Child Nutr* 2011; 7 (3S): 19–43.
2. Richard F. Hurrell, Sean Lynch, Thomas Bothwell, Héctor Cori, Ray Glahn, Eva Hertrampf et al. Enhancing the absorption of fortification iron. *Int J Vitam Nutr Res* 2004; 74 (6): 387–401.
3. Nancy T. Crane, Dennis B. Wilson, D. Annetta Cook, Christine J. Lewis, Elizabeth A. Yetley, Jeanne I. Rader. Evaluating food fortification options: General principles revisited with folic acid. *AJ Pub Health* 1995; 85: 660-5.
4. Alicia A. Romano, Carole A. Palmer. When is a food not a food? *Can J Dent Hygiene* 2011; 45(2): 117–27.
5. Aamer Imdad, Zulfiqar A Bhutta. Effect of balanced protein energy supplementation during pregnancy on birth outcomes. *BMC Public Health* 2011; 11(3S); S17: 1-9.
6. Linda S Adair, Ernesto Pollitt. Outcome of maternal nutritional supplementation: a comprehensive review of the Bacon Chow Study. *Am J Clin Nutr* 1985; 41: 948-78.
7. Kathryn G. Dewey, Khadija Begum. Long-term consequences of stunting in early life. *Maternal and Child Nutr* 2011; 7 (3):B5–18.
8. Sandra L. Huffman, Dominic Schofield. Consequences of malnutrition in early life and strategies to improve maternal and child diets through targeted fortified products. *Maternal and Child Nutr* 2011; 7 (3); 1–4.
9. Allen L, de Benoist B, Dary O, Hurrell R (2006). Guidelines on food fortification with micronutrients. WHO Press, World Health Organization, Geneva, Switzerland.
10. Codex Alimentarius Commission (1987). General principles for the addition of essential nutrients to foods CAC/GL 09-1987 (amended 1989, 1991). Rome, Joint FAO/WHO food standards programme, Codex Alimentarius Commission.
11. Villar J, Merialdi M, Gułmezoglu AM, Abalos E, Carroli G, Kulier R et al. Nutritional interventions during pregnancy for the prevention or treatment of maternal morbidity and preterm delivery: an overview of randomized controlled trials. *J Nutr* 2003; 133: 1606S–1625S.
12. Kathleen M. Rasmussen, Jean-Pierre Habicht. Maternal supplementation differentially affects the mother and newborn. *J Nutr* 2010; 140: 402–6.
13. Lindsay H. Allen, Janet M. Peerson, Deanna K. Olney. Provision of multiple rather than two or fewer micronutrients more effectively improves growth and other outcomes in micronutrient-deficient children and adults. *J Nutr* 2009; 139: 1022-30.
14. Lieven Huybregts, Dominique Roberfroid, Hermann Lanou, Joris Menten, Nicolas Meda, John Van Camp, Patrick Kolsteren. Prenatal food supplementation fortified with multiple micronutrients increases birth length: a randomized controlled trial in rural Burkina Faso. *Am J Clin Nutr* 2009; 90:1593–600.
15. Alok Bhargava, Howarth E. Bouis, Nevin S. Scrimshaw. Dietary intakes and socioeconomic factors are associated with the hemoglobin concentration of Bangladeshi women. *J Nutr* 2001; 131: 758–64.
16. De Onis M, Blossner M, Villar J. Levels and patterns of intrauterine growth retardation in developing countries. *Eur J Clin Nutr.* 1998; 52 (1S): S5-15.
17. De Onis M, Villar J, Gulmezoglu M. Nutritional interventions to prevent intrauterine growth retardation: evidence from randomized controlled trials. *Eur J Clin Nutr* 1998; 52 (Suppl 1):S83-93.
18. Kulier R, de Onis M, Gulmezoglu AM, Villar J. Nutritional interventions for the prevention of maternal morbidity. *Int J Gynaecol Obstet* 1998; 63(3):231-46.
19. Villar J, Gulmezoglu AM, de Onis M. Nutritional and antimicrobial interventions to prevent preterm birth: an overview of randomized



- controlled trials. *Obstet Gynecol Surv* 1998, 53(9):575-85.
20. Gretel H. Pelto, Margaret Armar-Klemesu. Balancing nurturance cost and time: complementary feeding in Accra, Ghana. *Maternal and Child Nutr* 2011; 7 (Suppl. 3): 66–81.
21. Huybregts L., Roberfroid D., Lanou H., Menten J., Meda N., Van Camp J. et al. Prenatal food supplementation fortified with multiple micronutrients increases birth length: a randomized controlled trial in rural Burkina Faso. *Am J Clinical Nutr* 2009; 90:1593–600
22. Fall C., Fisher D., Osmond C., Margetts B. Multiple micronutrient supplementation during pregnancy in low-income countries: a meta-analysis of effects on birth size and gestation length. *Food Nutr Bull* 2009; 30 (4S): S533–S546.
23. Yang Z., Huffman S. Review of fortified food and beverage products for pregnant and lactating women and their impact on nutritional status. *Maternal Child Nutr* 2011; 7 (3S): 19–43.
24. Kayode O. Osungbade<sup>1</sup>, Adeolu O. Oladunjoye. Preventive treatments of iron deficiency anaemia in pregnancy: A review of their effectiveness and implications for health system strengthening. *J Pregnancy* 2012: 1-7.