



## STUDY ON COOKING PRACTICES INFLUENCING DIETARY IRON BIOAVAILABILITY IN CAUSING IRON DEFICIENCY ANEMIA IN PREGNANT WOMEN

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### ABSTRACT

**Background:** Common south Indian cooking practices including precooking processes and cooking method has a variable effect on dietary Iron bioavailability (1) by altering the level of promoters and inhibitors of dietary Iron absorption. Limited studies are there to describe the association between common cooking practices influencing dietary Iron bioavailability and Iron deficiency anemia (IDA). **Objective:** To study the association between cooking practices influencing dietary Iron bioavailability and IDA in antenatal women. **Design:** Cross sectional study was conducted on 150 Primi pregnant women who were recruited consecutively based on the haemoglobin status. Interviewer administered pretested questionnaire was used to collect data about their pre-cooking and cooking practices. Comparison was made between the anemic (Hb < 10 gm/dl), latent anemic (Hb 10-10.9 gm/dl) and non-anemic (> 11 gm/dl) pregnant women and their cooking practices. **Results:** Using Fischer exact and Chi-square test method, association between cooking practices and anemia was made out. Precooking method was found to be significant with the p value of 0.000. **Conclusions:** Dietary modification by adapting appropriate Cooking practices is essential to improve the dietary Iron bioavailability. Enhancing dietary iron bioavailability through optimum cooking practices would be an alternative approach to prevent IDA (2).

**KEYWORDS :** IDA, dietary Iron bioavailability, Cooking practices, precooking processes, cooking method, Pregnant women

### INTRODUCTION

Iron deficiency Anemia (IDA) is the most common cause of anemia in pregnant women worldwide, imposing the greater risk of Low birth weight babies, Preterm delivery, Maternal mortality. 40% of pregnant women are anemic worldwide (3). In NFHS 5, 66.4% of Indian women are found to be anemic (4). Even with adequate total iron intake, Iron supplementation and food fortification, IDA is still being prevalent (5) because of poor dietary Iron bioavailability. Most of the South Indians consume cereal based non heme iron containing diet with high level of inhibitors of iron absorption like phytate, oxalate, calcium and low level of promoters of iron absorption like vitamin C. Iron bioavailability from mixed diets is about 14-18% and 5-12% from vegetarian diets (6). Poor Dietary Iron bioavailability is being the major modifiable factor in preventing IDA. Cooking Practices that influences dietary iron bioavailability include the Precooking processes and cooking method. The precooking processes like Soaking is a simple, conventional and cost effective method that reduces the phytate and tannin level by the loss of water soluble phytates and activation of phytase enzyme (7). Germination, fermentation are the other precooking processes that tend to activate the phytase action, increase the vitamin C and Organic acid level in the food and reduces the tannin content by 66.1% and 72.2% respectively and reduces phytate content by 45.3% and 87.2% respectively. (8).

Idli and dosa being the common south Indian breakfast with good dietary Iron bioavailability. Soaking for 48 hrs would lead to maximum reduction in inhibitors but at least 12 hrs of soaking is essential and effective in reducing the inhibitors. Washing vegetables and fruits after cutting into pieces adds to the loss of vitamin C. Proper precooking processes followed by appropriate cooking practices would lead to reduction of tannin by 72.2% and phytic acid by 81.2%. Heat degradation, leaching out effects, change in chemical reactivity and formation of insoluble complexes might be the factors that results in the significant reduction of these anti nutrients in cooking (7). Pressure cooking and Boiling in adequate water are the best cooking practices that increase the dietary iron bioavailability by decreasing the inhibitors in the diet (9). Over cooking of vegetables in excess water would lead to destruction of vitamin C in the diet and decreases the iron bioavailability (9). Frying and intake of smoked food destroys

the promoter vitamin C and raise the inhibitor phosphorus (10)

Practicing appropriate precooking and cooking practices could combat the inhibitors and enhances the promoters of iron absorption thereby increases the dietary Iron bioavailability. This study aims to study the association between common cooking practices influencing dietary iron bioavailability and IDA among antenatal women based on their haemoglobin status.

### METHODOLOGY

**Design:** Cross sectional study

**Centre:** Dept. of Biochemistry, Dept. of Obstetrics and Gynaecology RSRM lying in Hospital, Govt. Stanley medical College and Hospital.

**Study Population:** Primi pregnant women age group (18-30 yrs) attending antenatal clinic of RSRM Hospital.

**Exclusion Criteria:** Pregnant women with H/O Passing clots during menstruation, Menstrual Irregularities, Multiple Pregnancies, Bleeding Diathesis, Haemolytic jaundice, family h/o jaundice, hepatosplenomegaly, H/o passing worms in stools, previous H/o abortion, Chronic Kidney Disease, Malnutrition, Malabsorption, Chronic diseases Tuberculosis, Chronic Heart Failure, Diabetes Mellitus Asthma, Alcoholics were excluded from the study using a predesigned questionnaire.

**Sample Size:** 150 Primi pregnant (first trimester) women in the age group of (18-30 yrs) attending the antenatal op who satisfies the selection criteria were recruited and grouped consecutively under three groups 50 each based on their Hemoglobin status (ICMR) as,

**Latent Anemic:** clinically not anemic but Hb between 10-10.9 gm/dl

**Anemic:** Clinically anemic with Hb < 10 gm/dl

**Non Anemic:** Hb value > 11 gm/dl

Hemoglobin estimation was done using 5part cell counter (N 1000 sysmex).

**Technique And Procedure Used:**

After obtaining informed consent from the patient, using the pretested interviewer administered questionnaire, data regarding the common cooking practices were recorded. The cooking practices is divided into precooking processes and cooking method. Pre-cooking processes includes soaking, germination, fermentation. Cooking method involves Steaming, Pressure cooking, Boiling, Overcooking, Frying, Roasting, Smoked foods. Table 1 grades pre-cooking processes and cooking method based on their influence on dietary Iron bioavailability

**Table 1: Grading Of Cooking Practices Based On Their Influence On Dietary Iron Bioavailability**

Grading Of Cooking Practices	Precooking Processes	Cooking Method
Good Bioavailability	Soaking(12hrs) cereals and pulses Germination, Fermentation,	Steaming, Pressure cooking ,Boiling in adequate water
Moderate Bioavailability	Soaking(8-12 hrs), Both Good and poor practices	Both good and poor practices
Poor Bioavailability	Unsoaked cereals and pulses, washing fruits and vegetables after cutting into pieces	Overcooking, Frying, Roasting, Smoked foods

**RESULTS**

The sociodemographic details of the study population and the data regarding their precooking processes and cooking method were shown in table 2:

**Table2: Comparison Of Sociodemographic Details And Data Regarding The Precooking Processes And Cooking Method**

		Total Study Population		PREGNANT WOMEN PRACTISING PRECOOKING PRACTICES (Graded -table1)			PREGNANT WOMEN PRACTISING COOKING METHODS (Graded -table1)		
				GOOD	MODERATE	POOR	GOOD	MODERATE	POOR
EDUCATION:	Illiterate	5	3%		5			5	
	Primary school	4	2.6%		3	1		4	
	Middle school	8	5.3%	1	6	1		8	
	High school	42	28%		39	3	5	37	
	Intermediate-Diploma	41	27%		40	1	4	37	
	Graduate	48	32%	1	41	6	11	36	1
	Professional	2	1.3%		2			2	
	NA								
SOCIO ECONOMIC STATUS:	Upper	3	2%		3			3	
	Upper middle	36	24%		32	4	4	32	
	Lower middle	63	42%	1	57	5	6	56	1
	Upper lower	45	30%	1	41	3	10	35	
	Lower	1	0.6%		1			1	
	NA	2	0.1%		2			2	
PRECOOKING PROCESSES	Good	2	1.3%						1
	Moderate	136	90.6%						49
	Poor	12	8%						
	NA								
COOKING METHOD	Good	20	13%						8
	Moderate	129	86%						42
	Poor	1	0.6%						

HEM OGL	Latent anemic	50		1	48	1	6	44	1
OBIN	Anemic	50			39	11	6	43	
STAT	Non anemic	50		1	49		8	42	

Precooking processes and Cooking method practiced by the study population and their sociodemographic details were compared with their anemic status and is shown in table 3.

**Table 3: Comparison Of Anemic Status Of The Study Population With Their Cooking Practices And Their Sociodemographic Details**

		TOTAL STUDY POPULATION		LATENT ANEMIC Hb(10-10.9gm/dl)	ANEMIC C Hb (<10 gm/dl)	NON ANEMIC C Hb (>11gm/dl)
EDUCATION:	Illiterate	5	3%	3	2	
	Primary school	4	2.6%	4		
	Middle school	8	5.3%	3	2	3
	High school	42	28%	11	14	17
	Intermediate-Diploma	41	27%	12	17	12
	Graduate	48	32%	17	14	17
	Professional	2	1.3%		1	1
	NA					
SOCIO ECONOMIC STATUS:	Upper	3	2%	1		2
	Upper middle	36	24%	13	8	15
	Lower middle	63	42%	20	20	23
	Upper lower	45	30%	15	20	10
	Lower	1	0.6%		1	
	NA	2	0.1%	1	1	
PRECOOKING PROCESSES	Good	2	1.3%	1		1
	Moderate	136	90.6%	48	39	49
	Poor	12	8%	1	11	
	NA					
COOKING METHOD	Good	20	13%	6	6	8
	Moderate	129	86%	43	44	42
	Poor	1	0.6%	1		

After data collection, all the data obtained were presented as mean  $\pm$  standard deviation(SD). p value <0.05 was considered significant. Between groups, Comparison was made using chi square test. All the statistical analysis was done using SPSS software version 16.0.

Using Fischer exact and chi-square test, Association between precooking processes and anemia was made out. Pre-cooking processes was found to be significant with the p value of 0.000. Association between Cooking method and anemia was made out. P value was found to be 0.869. The cooking method and anemia was not found to have significant association.

**DISCUSSION**

In our study population (n=150),2%(n=3) belongs to upper class, one was found to be latent anemic and 2 was non anemic. 66%(n=99) belongs to middle class, of them 33 were latently anemic, 28 were anemic and 38 were non anemic. About 30% (n=46) belongs to lower class of them 15 were

latent anemic, 21 were anemic, 10 were non anemic. These details were depicted in table 3.

32% (n=48) of our study population are graduated, 17 of them were latent anemic and 14 were anemic and 17 were non-anemic. 1.3% (n=2) were professional, one was latent anemic and one was non anemic. 55% (n=83) were educated upto high school and intermediate diploma courses, 23 were latent anemic, 31 were anemic, 29 were non anemic. 5.3% have completed middle school, of them 3 were latent anemic, 2 were anemic and 3 were non anemic. 2.6% (n=4) have completed upto primary schooling and were found to be latent anemic. 3% (n=5) were illiterate and 3 of them were latent anemic and 2 were found to be anemic. These details were depicted in table 3.

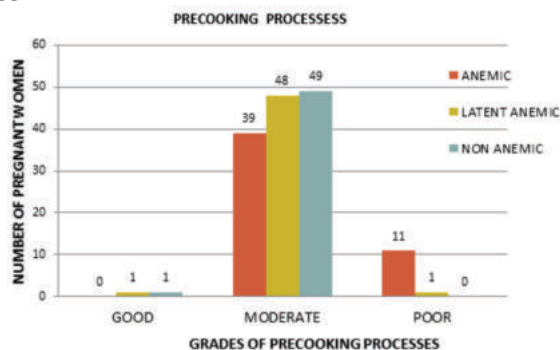
#### Pre-cooking processes (Table 2 & 3):

8% (n=12) of the pregnant women were practising the precooking processes that decrease the dietary iron bioavailability. Of those 11 were found to be anemic and 1 was latent anemic. Among them, 6 were graduates, 1 is diplomate, 5 have completed only schooling. 4 of them belongs to upper middle class, 5 belongs to lower middle class and 3 belongs to upper lower class.

90.6% of the pregnant women are practicing both the good and poor the precooking processes that has variable effect on iron absorption resulting in moderate iron bioavailability. Of them 48 were latent anemic, 39 were anemic and 49 were non anemic. Majority of the study population comes under this grade of moderate dietary iron bioavailability. This population even on practicing the good precooking processes they fail to do it appropriately like inadequate soaking, frying or roasting the adequately soaked food items resulting in the destruction of promoters.

Out of 90.6% of the study population practising both good and poor precooking processes 2 were professionals, 41 were graduate, 40 were diplomate, 39 have completed high school, 9 have completed primary and middle school and 5 were illiterate. 3 of them belongs to upper class, 32 belongs to upper middle class, 57 belongs to lower middle class, 41 belongs to upper lower class, 1 belongs to lower class.

Only 1.3% (2 pregnant women) were following the appropriate precooking processes thereby consuming the diet with good bioavailability, 1 of them was latent anemic and one was non anemic. One was a graduate and one have completed middle school. One belongs to lower middle class and one belongs to upper lower class.



**Figure.1** Bar chart depicting the association between precooking processes and the anemic status of the study population

This study implies the lack of awareness about the appropriate cooking practices despite literacy and socioeconomic status. Inadequate knowledge, scarcity of water, changes in food habits, avoidance of fermented and

germinated foods contributes to this improper precooking processes and poor dietary iron bioavailability.

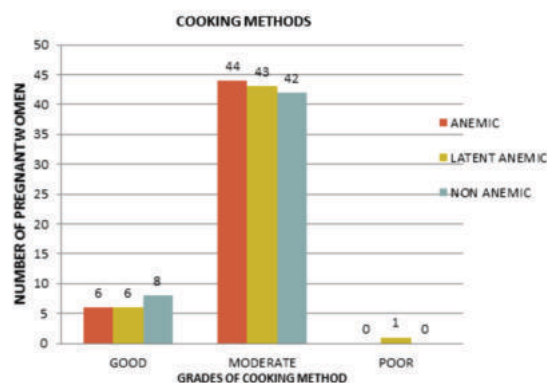
On statistical analysis, using Fischer exact and chi-square test, Association between precooking processes and anemia was made out and was found to be significant with the p value of 0.000.

#### Cooking Method (Table 2&3):

0.6% (n=1) of the study population practising only poor cooking method was found to be latent anemic, belongs to lower middle class and was a graduate.

13% (n=20) of the study population were practising appropriate cooking method like boiling, steaming and avoids roasting, frying, smoked food. 8 of them were non anemic, 6 were latent anemic, 6 were anemic. Of those 10 belongs to upper lower class, 6 belongs to lower middle class, 4 belongs to upper middle class. 11 were graduate, 4 have completed diploma and 5 have completed high school.

86% (n=129) of the pregnant women despite practising good cooking method also practices cooking method that would decrease the dietary iron bioavailability thereby consuming the diet with moderate bioavailability. 43 of them were latent anemic, 44 were anemic and 42 were non-anemic. 3 of them belongs to upper class, 32 belongs to upper middle class, 56 belongs to lower middle class, 35 belongs to upper lower class, 1 belongs to lower class, of them 5 were illiterate, 49 have completed schooling, 37 completed diploma, 36 were graduates and 2 were professionals.



**Figure.2** Bar Chart Depicting The Association Between Cooking Method And The Anemic Status Of The Study Population

On statistical analysis, Using Fischer exact and chi-square test, Association between Cooking method and anemia was made out. P value was found to be 0.869. The cooking method and anemia was not found to have significant association.

#### CONCLUSION:

IDA being a most common preventable nutritional deficiency are multifactorial. Dietary iron bioavailability is the most important modifiable factor of all. Various diet and host related factors contributes to the dietary iron bioavailability. This study signifies the association between the cooking practices and anemia in pregnant women. The precooking processes were found to be significantly associated with anemia.

Literacy and Socioeconomic status does not found to be have any impact on adapting appropriate cooking practices. This indicates the lack of awareness about the importance of dietary iron bioavailability and appropriate cooking practices irrespective of the educational status. Community based education is essential to implement dietary modification as an approach to prevent IDA.

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**Conflict Of Interest:** None declared

**Ethical Approval:** The study was approved by the Institutional Ethics Committee.

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