



# DEVELOPMENT OF NUTRIENT RICH RECIPES USING TAKE HOME RATION FOR IMPROVING DIETARY DIVERSITY AMONGST PREGNANT WOMEN

Dr Vijayata Sengar<sup>1</sup> and Ms Gauri Rathi<sup>2</sup>

<sup>1,2</sup> Dept of Foods and Nutrition, Faculty of Family and Community Sciences, The Maharaja Sayajirao University of Baroda, Vadodara, Gujarat- India

**Abstract:** Poor dietary diversity is one of the main reasons of maternal undernutrition and affects development of foetus. Take home ration (THR) which is provided under Integrated Child Development Scheme (ICDS) to improve maternal nutrition is mostly not utilized by pregnant women. Therefore, the present study dealt with development of nutrient rich recipes using THR under snacks, desserts and appetizer categories. Thirty semi-trained panel members who qualified the threshold test performed organoleptic evaluation of the recipes in duplicates using nine-point hedonic scale. Data was also obtained on THR consumption amongst pregnant women. Nine recipes namely Mix veg muthiya, besan chilla, mix veg uttapam, thepla, handvo, namakpara, mixveg cutlets, upma, thalipeeth were developed under snacks. Desserts included five sweet recipes and appetizer included a tomato carrot soup. The salient feature of recipes was incorporation of locally available foods and THR to improve dietary diversity. Mix vegetable cutlets (8.54+0.51) and Shakkarpara (8.23+0.51) received the highest overall scores. Development of manual to educate pregnant women about the THR provided to them and how to use it for preparing the recipes was undertaken. A chart containing various combinations of these recipes to provide the recommended 145g of THR/day to pregnant women was a part of the manual. Cook and store recipes were also developed to ensure sustainability. Development of nutrient rich recipes using THR can help in improving the dietary intakes of pregnant women along with ensuring reduction in wastage of THR.

**Index Terms** - Dietary diversity, maternal nutrition, take home ration, nutrient rich recipes

## INTRODUCTION

Pregnancy is an anabolic process and women's normal nutritional requirement increases during pregnancy to meet the need of growing foetus and maternal tissues associated with pregnancy (Ventura *et al*, 2008). An undernourished mother inevitably gives birth to an undernourished baby, perpetuating an intergenerational cycle of undernutrition (UNICEF India, 2018). According to NFHS-4, almost half of pregnant Indian women aged between 15 and 49 years were anaemic which has increased by at least 10% in NFHS-5, and more than one-thirds of women have a low body mass index ( $<18.5\text{kg/m}^2$ ). Pregnant women in India receive THR for improving their nutrient intakes. However, many of these women are unaware about the ways of using it. Therefore, the present study helped in developing nutrient rich recipes using take home ration for pregnant women.

## METHODS AND MATERIALS

Institutional review board granted ethical approval to the study for design and protocol (IECHR/2019/16).

### Situational Analysis

North zone was randomly selected from four zones of Vadodara city and three urban health centres (UHC) from that zone were randomly selected. Three hundred and fifty pregnant women registered with UHCs enrolled for the study. A semi-structured questionnaire was used to assess the dietary diversity along with THR consumption amongst pregnant women. Data was obtained using Epicollect 5 software by conducting interviews with the pregnant women. Secondary data on height, weight and haemoglobin was obtained from mother cards.

### Developing nutrient rich recipes incorporating THR (Matrushakti flour)

Development and evaluation of nutrient rich recipes from locally available foods and take-home ration (THR) provided by ICDS known as “Matrushakti” for pregnant women was carried out. Matrushakti is a cereal pulse powdered mix which is fortified with essential nutrients. Development of 15 recipes under three main categories namely snacks, dessert and appetizer was undertaken. For snacks, nine different recipes were developed while five recipes were developed for desserts. Appetizer consisted of one soup recipe.

During recipes development, various preferences were kept in mind for example some women did not prefer cooking for themselves daily therefore recipes like namakpara, kansara or Shakkarpara were developed for them which could be easily stored and had a longer shelf life. Whereas, some recipes were developed keeping in mind women who preferred freshly cooked recipes.

### Sensory evaluation and development of a manual

This phase dealt with assessing the organoleptic attributes of the developed recipes followed by development of a recipe booklet for pregnant women. In this phase, selection of panel members was carried out based on the threshold test (Ranganna 1995). The participants were asked to identify and rank the samples in increasing order of concentration of taste from the test solutions offered.

To check the acceptability for 15 recipes, sensory organoleptic evaluation (Hedonic scale rating-David Peryam, 1957) was conducted by 35-panel members' selected using Threshold test. The most widely used scale for measuring food acceptability is the 9-point hedonic scale, which has approximately equal successive scale points. This equal interval property helps to justify the practice of analysing the responses by assigning successive integer values (1,2,3,4.....up to 9) to the scale points which has 4 positive points, 4 negative points and one is none of them. Attributes tested were appearance, flavour, odour, texture, colour, mouthfeel and overall score were taken. A manual on healthy diet during pregnancy was developed using information from previous phases.

## RESULTS AND DISCUSSION

Mean age of the pregnant women was  $25.8 \pm 4.62$  years while mean age of marriage was  $21.54 \pm 3.53$  years and mean age when the first child of pregnant women was born was  $23.10 \pm 4.97$  years. Majority (80%) of the women were in second/ third trimester. Two third of the women had anaemia. Nearly 47% of subjects received THR i.e. Matrushakti Packets.

Around 42.6% of women received more than 3 packets of THR (usually 4), 2.6% of women received three packets and 1.7% received two packets only. Only one fourth of the women who received THR used it for themselves. However, remaining women shared it with their families. Nearly one fourth of the women who received THR used it for combination recipes (sweet or salty) whereas 16% of the women used it for sweet recipes.

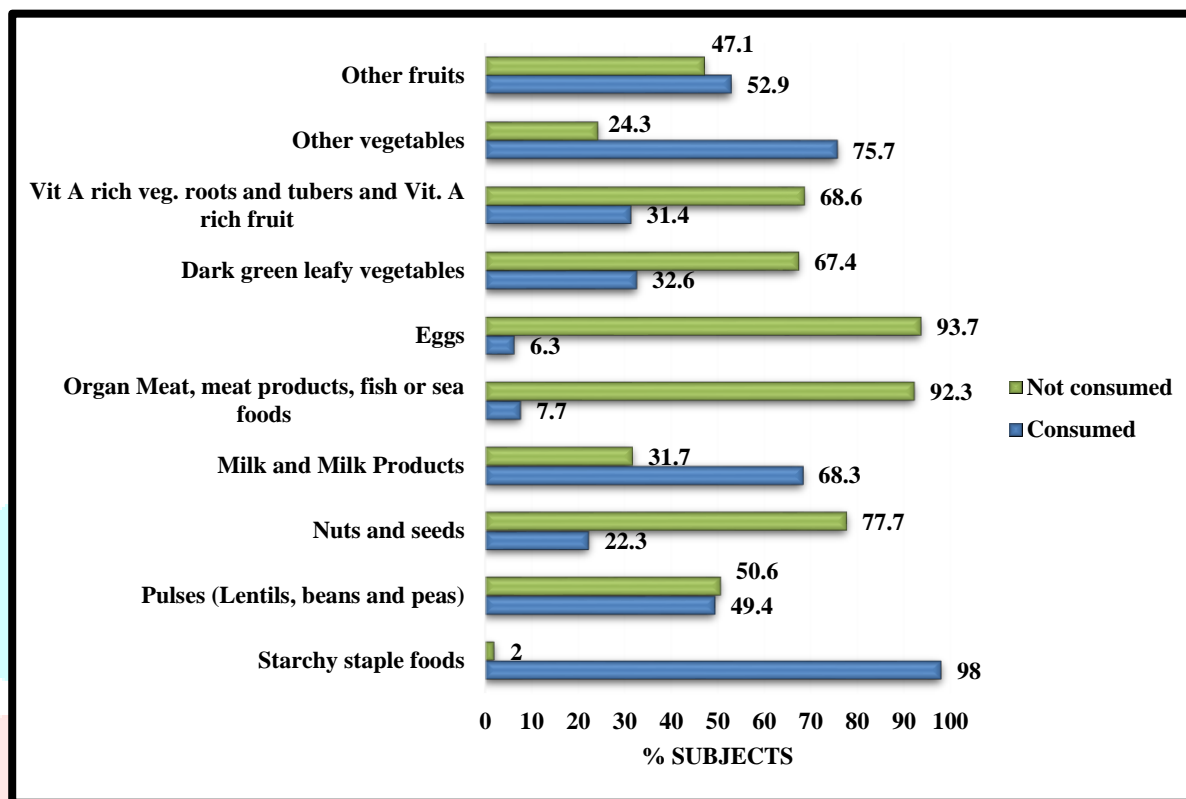
Except 17% women, rest of the women either did not like the taste or smell of THR. For dietary diversity calculations out of 18 food groups 10 main food groups were considered. **Figure 1** shows that majority of the subjects reported consuming foods made from grains, white roots and tubers and plantains followed by 75.7% subjects who reported consuming other vegetables. However, green leafy vegetables were reportedly consumed by 32.6% and other fruits were consumed by 52.9% subjects.

Vitamin A rich vegetables, roots and tubers and Vitamin A rich fruits were reportedly consumed by only 31.4% subjects. Milk and milk products were consumed by more than half of the women 68.3%. As protein foods, pulses (lentils, beans and peas) were consumed by 49.4% whereas Nuts and oilseeds were consumed by 22.3% subjects. Non-vegetarian food groups like organ meat, meat products, fish or seafood were

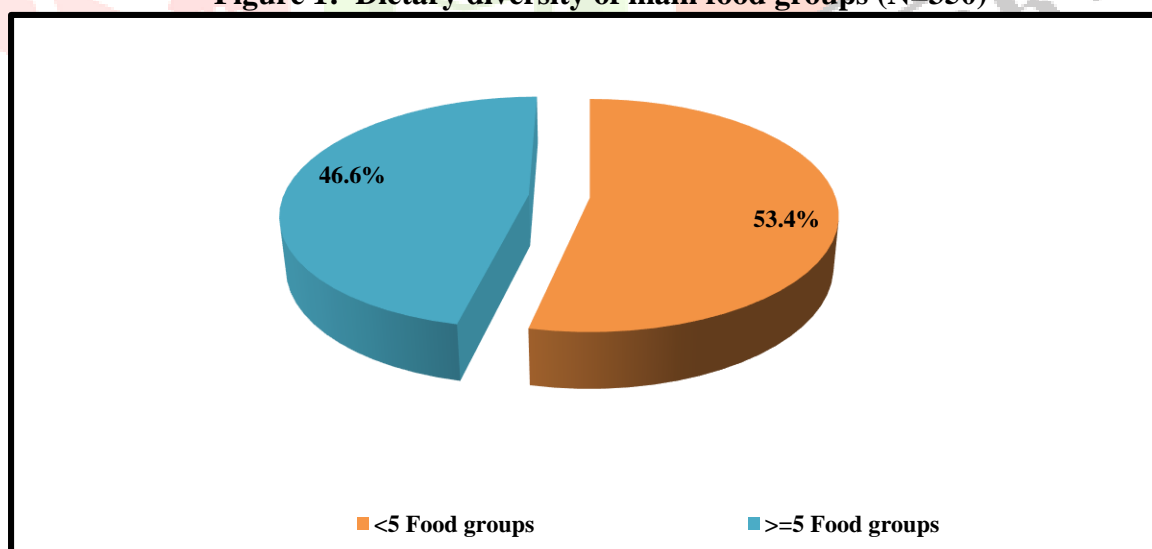
consumed only by (7.7%) while eggs were consumed by (6.3%) women as these foods were considered to cause miscarriage.

“Minimum dietary diversity for women or MDD-W is a dichotomous indicator of whether or not women of 15-49 years of age have consumed at least 5 out of 10 defined food groups the previous day or night (FAO, 2016).

**Figure 2** shows that 46.6% of the subjects consumed foods from five or more food groups out of the 10 specified food groups the previous day. There was a strong need to educate these women about the importance of incorporating various food groups in their diets as well as to teach them the correct ways of using THR in their meals. The next phase dealt with the same.



**Figure 1: Dietary diversity of main food groups (N=350)**



**Figure 2: Minimum Dietary Diversity for Women (MDD-W) (N=350)**

### Developing nutrient rich recipes incorporating THR (Matrushakti flour)

This phase dealt with the development of nutrient rich recipes made from the locally available foods and also incorporating THR provided by ICDS to the pregnant women. Various recipes were developed and standardized under three main categories namely snacks, desserts and appetizer as shown in Figure3.

**Category 1: Snacks**

Mix vegetable muthiya	Besan chilla
Mixed vegetable uthappam	Thepla
GLV namakpara	Handvo
Mixed vegetable cutlets	Upma
Thalipeeth	

**Category 2: Desserts**

Suji ka halwa	Kansara
Banana smoothie	Shakkarpara
Ragi coconut laddoo	

**Category 3: Appetizer**

Tomato carrot soup

**Sensory evaluation and development of a manual**

To check the acceptability for the 15 developed recipes sensory organoleptic evaluation was conducted by 35 panel members selected on the basis of Threshold test.

**Organoleptic evaluation of snacks**

Table 1 shows the mean values for various Organoleptic attributes studied to check the overall acceptability of the recipes. On comparing all the recipes it was observed that the mean maximum total score was highest for mix vegetable cutlets being  $50.57 \pm 2.42$ .

The texture of mix vegetable muthiya had higher mean score compared to other organoleptic properties. Colour and appearance ( $8.17 \pm 0.79$ ) of besan chilla was the most accepted attribute followed by its overall score ( $8.09 \pm 0.78$ ). As can be observed from table 2, mix vegetable uthappam had highest mean scores for mouth feel ( $8.00 \pm 0.84$ ). For thepla the colour and appearance had highest acceptability as it was made using various vegetables and more likely due to beetroot present in it which gave it a red appearance. The texture of handvo received maximum scores ( $7.86 \pm 0.94$ ) as the ingredients provided crunchiness. For green leafy vegetable namakpara the flavour received highest score by the panellist ( $8.11 \pm 0.99$ ) followed by its mouth feel. For thalipeeth flavour received highest score ( $8.51 \pm 0.61$ ).

**Organoleptic evaluation of desserts**

Kansara was the most accepted dessert by the panellist; the mean total score for kansara was  $49.51 \pm 3.72$ . Kansara received the highest scoring for its flavour ( $8.40 \pm 0.65$ ). Overall score ( $8.49 \pm 0.51$ ) was the highest ranked attribute of Shakkarpara (Table 2).

**Organoleptic evaluation of appetizer**

In Appetizer, tomato carrot soup was prepared using THR as a thickening agent. Colour and appearance ( $8.09 \pm 0.56$ ) were highest scored attributes for tomato carrot soup followed by texture and overall score (Table 3).

**Development of manual**

Baseline data from revealed a general lack of awareness amongst women regarding dietary diversity which was clearly shown by their low dietary diversity scores.

Thus, development of a manual on Healthy eating during Pregnancy was carried out in order to promote optimum consumption of nutritious foods along with THR.

The contents of the manual on 'Healthy diet during Pregnancy' were as follows:

- Introduction to the dietary diversity and food groups.
- Information regarding the Antenatal Care (ANC) practices during the ANC visit.
- Supplementation (THR) provided for different groups (Pregnant and lactating women, Adolescent girls and children) by Government of Gujarat.
- Information regarding fifteen nutrient rich recipes developed along with ingredients, method of preparation, total servings, and nutritive value of each recipe.

As per Government of Gujarat guidelines, a pregnant woman should consume 145g of THR daily. Therefore, a chart containing various combinations of the developed recipes providing 145 g of THR was incorporated in the manual in order to teach them how to consume the required amounts of THR per day.



Figure 3: Developed Recipes

Table 1: Organoleptic qualities of snacks (Mean $\pm$ sd)

Sr. No	Name of Recipe	Colour & Appearance	Texture	Odour	Flavour	Mouthfeel	Overall Score	Total score
1	Mix Vegetable Muthiya	7.49 $\pm$ 0.95	7.86 $\pm$ 0.81	7.29 $\pm$ 1.27	7.60 $\pm$ 1.09	7.43 $\pm$ 1.04	7.54 $\pm$ 0.82	45.20 $\pm$ 4.65
2	Besan Chilla	8.17 $\pm$ 0.79	7.89 $\pm$ 0.80	7.63 $\pm$ 1.17	8.09 $\pm$ 1.20	7.77 $\pm$ 1.29	8.09 $\pm$ 0.78	47.63 $\pm$ 4.62
3	Suji Ka Mix Vegetable Uthappam	7.83 $\pm$ 0.92	7.57 $\pm$ 1.04	7.97 $\pm$ 0.71	7.94 $\pm$ 0.73	8.00 $\pm$ 0.84	8.09 $\pm$ 0.61	47.40 $\pm$ 3.49
4	Thepla	7.14 $\pm$ 1.17	6.49 $\pm$ 1.27	6.83 $\pm$ 1.18	7.03 $\pm$ 0.95	6.83 $\pm$ 1.36	6.91 $\pm$ 0.98	41.23 $\pm$ 5.49
5	Handvo	7.86 $\pm$ 0.91	7.86 $\pm$ 0.94	7.57 $\pm$ 0.81	7.66 $\pm$ 0.84	7.77 $\pm$ 0.94	7.89 $\pm$ 0.63	46.60 $\pm$ 3.84
6	GLV Namakpara	7.54 $\pm$ 1.20	7.83 $\pm$ 1.15	7.94 $\pm$ 1.08	8.11 $\pm$ 0.99	8.20 $\pm$ 0.99	8.00 $\pm$ 0.84	47.63 $\pm$ 4.92
7	Mix Vegetable Cutlet	8.43 $\pm$ 0.61	8.06 $\pm$ 0.73	8.40 $\pm$ 0.65	8.54 $\pm$ 0.66	8.60 $\pm$ 0.50	8.54 $\pm$ 0.51	50.57 $\pm$ 2.42
8	Upma	8.09 $\pm$ 0.70	7.94 $\pm$ 0.76	8.03 $\pm$ 0.71	8.00 $\pm$ 0.69	7.91 $\pm$ 0.89	8.17 $\pm$ 0.62	48.14 $\pm$ 3.04
9	Thalipeeth	8.31 $\pm$ 0.68	8.20 $\pm$ 0.72	8.20 $\pm$ 0.83	8.54 $\pm$ 0.70	8.51 $\pm$ 0.61	8.37 $\pm$ 0.60	50.14 $\pm$ 3.07

Table 2: Organoleptic qualities of desserts (mean $\pm$ sd)

Sr. No	Name of Recipe	Colour & Appearance	Texture	Odour	Flavour	Mouthfeel	Overall Score	Total score
1	Suji Ka Halwa	7.29 $\pm$ 1.36	7.40 $\pm$ 1.33	7.49 $\pm$ 1.22	7.40 $\pm$ 1.33	7.29 $\pm$ 1.34	7.43 $\pm$ 1.09	44.29 $\pm$ 6.46
2	Banana Smoothie	7.26 $\pm$ 1.09	6.94 $\pm$ 0.80	6.97 $\pm$ 1.20	7.09 $\pm$ 0.95	7.37 $\pm$ 0.88	6.94 $\pm$ 0.73	42.57 $\pm$ 4.22
3	Ragi Coconut Ladoo	7.89 $\pm$ 0.90	7.80 $\pm$ 1.05	7.49 $\pm$ 1.17	7.83 $\pm$ 0.92	7.63 $\pm$ 0.77	8.03 $\pm$ 0.71	46.66 $\pm$ 3.90
4	Kansara	8.20 $\pm$ 0.76	8.14 $\pm$ 0.77	8.17 $\pm$ 0.82	8.40 $\pm$ 0.65	8.37 $\pm$ 0.81	8.23 $\pm$ 0.65	49.51 $\pm$ 3.72
5	Shakkara	7.43 $\pm$ 0.81	8.46 $\pm$ 0.70	8.26 $\pm$ 0.78	8.57 $\pm$ 0.50	8.57 $\pm$ 0.61	8.49 $\pm$ 0.51	49.77 $\pm$ 2.38

Table 3: Organoleptic qualities of appetizer (mean $\pm$ sd)

Sr. No	Name of Recipe	Colour & Appearance	Texture	Odour	Flavour	Mouthfeel	Overall Score	Total score
1	Tomato Carrot Soup	8.09 $\pm$ 0.56	7.54 $\pm$ 0.85	6.91 $\pm$ 0.92	6.11 $\pm$ 1.08	6.40 $\pm$ 1.09	6.91 $\pm$ 0.74	41.97 $\pm$ 3.49

## DISCUSSION AND RECOMMENDATIONS

More than half of the women (53.4%) has poor dietary diversity, which is quite similar to other studies conducted previously (Lander RL et al, 2019). Despite of Government's efforts the problem of maternal malnutrition remains the same over years. One reason as observed in the present study was very low consumption of nutritious Take home ration provided to them. Previous studies have reported that most of the pregnant women (98.17%) share the supplements with their families (Paul, S. et. al, 2022). Present study revealed that majority of the women who received THR did not know how to prepare different recipes using THR to improve dietary diversity.

There is a strong need to sensitize and train pregnant women about the facilities provided for them as well as ways of utilizing the same.

Creating an enabling environment for frontline functionaries by development and use of manuals and videos on effective ways of using THR and local foods will help in educating pregnant women on use of THR and local foods for improving dietary diversity.

Incorporation of effective Social and Behaviour Change approaches is required in the program to increase consumption of THR.

## CONCLUSION

Several studies have shown poor dietary diversity amongst pregnant women. Promoting healthy recipes made using locally available foods and THR can go a long way in improving dietary diversity amongst pregnant women. A healthy mother is the strongest pillar of support for a nation.

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**CORRESPONDING AUTHOR**

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**Dr Vijayata Sengar**

Department of Foods and Nutrition  
Faculty of Family and Community Sciences  
The Maharaja Sayajirao University of Baroda  
Vadodara, Gujarat, India-390002

**Email:** vijayata.sengar-fn@msubaroda.ac.in; gaurinrathi@gmail.com

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**CONFLICT OF INTEREST**

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None