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## ORIGINAL ARTICLE

# Development of a Validated and Reliable Questionnaire to evaluate the Nutritional status and Eating pattern of Obese Subjects in India

**Shelly Garg \*^, Luxita Sharma^, Sakshi Garg#, Hardik Dalal^**
*Department of Nutrition and Dietetics, Faculty of Allied Health Sciences, SGT University,
Haryana, India.
^ Department of Dietetics & Applied Nutrition, Amity Medical School, Amity University
Haryana, India.
#Hamdard Institute of Medical Sciences, Jamia Hamdard, Delhi, India.

### ABSTRACT
*Excessive body weight is considered Obesity. Twenty percent or more increase in the bodyweight for a specific gender, age, stature, and bone health is Obesity, and the person is said to be obese. A questionnaire is a research tool comprising questions to gather data/ information from a population through statistical study or survey. A questionnaire with 46 questions was identified on the Likert scale and was marked by seven panelists. Content validity and face validity of the questionnaire were calculated. Based on the content validity, seven items in the questionnaire needed to be validated and included. All the panelists found the questionnaire easy to answer, and 85% (6/7) indicated that the appearance and layout of the questionnaire were appropriate for the target population, thus assuring good face validity. Item discrimination was measured, and two items were discarded. Hence a questionnaire with 37 items was developed. The reliability coefficient was found to be 0.968, indicating a high correlation level between different questionnaire items.*
***Keywords:*** *Validity, Questionnaire, Obesity, Reliability, Development*

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## INTRODUCTION
Excessive body weight is considered obesity. Twenty percent or more increase in the body weight for a specific gender, age, stature, and bone health is obesity, and the person is said to be obese [1]. According to World Health Organization (2021), BMI over 30 kg/m² is considered Grade I Obesity, and a range between 25-30 kg/m² is overweight [2]. The WHO (2021) has currently listed obesity and being overweight as one of the most critical general medical conditions, which is spreading like wildfire across the globe [2].
An increase in body fat or excess body fat is the reason behind obesity. Increased fat deposition occurs over time because of poor metabolism and increased energy consumption with reduced energy output [3].
In 2015, 100 million children and 600 million adults were categorized as obese, affecting more women than men. High BMI accounted for 4.0 million deaths globally, nearly 40 % of which occurred in persons who were not obese. More than two-thirds of deaths related to high BMI were due to cardiovascular disease. The disease burden related to high BMI has increased since 1990 [4].
Globally, over 1.9 billion adults are overweight, and 650 million are obese. In contrast, 2.8 million deaths are reported because of being obese or overweight. India's contribution to obesity is 135 million adults [5]. The global prevalence rate of obesity and overweight has been doubling since 1980, with charts reaching a significant number of 1.9 billion overweight and 600 million obese adults in 2014. In an estimate by WHO (2000), two-thirds of the global disease burden will be accredited to chronic non-communicable diseases strongly associated with diet. The most dramatic rise in the incidences of obesity is seen in developing countries [6].

The ever-increasing prevalence of obesity has increased the demand for methods to combat obesity and its complications. So, a need was felt to develop a validated and reliable questionnaire for obesity.

A questionnaire is a research tool comprising questions to gather data/ information from a population through statistical study or survey. It generally includes both open-ended and close-ended questions [7]. Questionnaires have various advantages over other survey tools, as questionnaires are cheap, generally standardized, and require significantly less verbal or telephonic interaction [8]. The most common example of a questionnaire is a food frequency questionnaire (FFQ). FFQ is used as a research instrument and collects data on the type of diet consumed and assessment of vitamin/minerals/nutrient intake [9].

This article reports the development of a self-administered questionnaire whose items are customized to report the current status of obesity to evaluate the dietary consumption of subjects.

**MATERIAL AND METHODS**

A pilot study was done via circulating online questionnaires as google forms among the nutritionists of the Delhi-NCR region of India, to evaluate the nutritional status of individuals suffering from obesity. General information and medical history of obesity and related complications, dietary intake, physical activity, and pattern, and anthropometric measurements of the subjects were recorded with the help of a questionnaire. A reliable and validated questionnaire was developed through a number of steps [10].
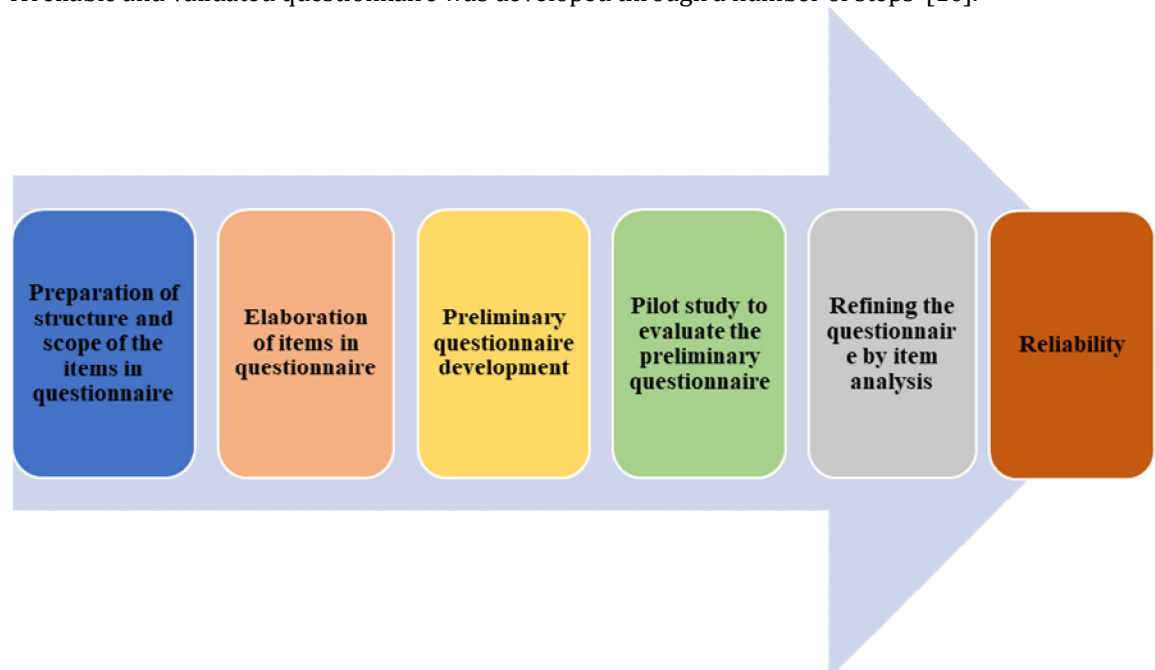


Figure 1: Steps for development of a validated and reliable questionnaire

**Step 1- Preparation of structure and scope of the items in the questionnaire-** This was done with an extensive literature review and data collection from various studies conducted over time. The scope of the questionnaire was prepared and a basic structure of the questionnaire was prepared, which became the blue print of the questionnaire.

**Step 2- Elaboration of items in the questionnaire-** Initially, 100 questions were designed to collect data from the subjects, these questions became the first draft of the questionnaire. The questions were then scrutinized from the first draft of the questionnaire, based on the language, requirement of question, and appropriateness. Based on the information and content available, an item pool of 46 questions was generated from the first draft, and it became the secondary draft of the questionnaire. Only clear, non-repetitive, specific, non-redundant, and easy to answer questions were included in the secondary draft. All 46 questions were identified on a five-point Likert scale, ranging from a score of 5 corresponding to excellent, to a score of 1 corresponding to very poor. Words of simple and unambiguous nature were included in questionnaire [11].

Content validity and face validity of the questionnaire were calculated. Content validity is described as the systematic evaluation and examination of the content under test to ensure that it encompasses the sample of the behavior domain to be measured. It refers to how well a test measures the data it was supposed to measure. Face validity, conversely, is defined as the transparency or relevance of a test or questions as they appear to the participants. A test or questionnaire is said to have face validity if it looks like it will measure

what it is supposed to. To ensure the questionnaire's good face and content validity, the item pool was evaluated by five senior faculties of the Department of Dietetics and Applied Nutrition, Amity University Haryana. The experts selected 46 questions, and it became the third draft of the questionnaire. All 46 questions were then grouped under various categories like breakfast eating habits, physical activity habits, medical history, and were constructed on the Likert scale. Changes like editing the language, clubbing some questions, and removing and adding new questions were done.

**Step 3- Preliminary questionnaire development-** A self-administered questionnaire comprising of 46 questions. The first page of the questionnaire consists of a declaration and instructions for filling out the questionnaire. Demographic details, including the name of the respondents, age, gender, address, family composition, educational qualifications, income, smoking and drinking habits were recorded.

**Step 4- Pilot study to evaluate the preliminary questionnaire-** A pilot study was carried out in the Department of Dietetics & Applied Nutrition, Amity University Haryana, to examine the compatibility and appropriateness of the questionnaire. Seven panelists, who were nutritionists in hospitals of Haryana and Delhi-NCR were randomly selected for the pilot study. Internal consistency was measured using SPSS version 27.0.

**Step 5- Refining the questionnaire by item analysis-** The test of the appropriateness of each item to be included in the questionnaire is termed item analysis. It provides an item difficulty index assessment. Kline classified items answered correctly by either less than 20 % or more than 80 % of respondents as unusable items [12].

**Step 6- Reliability-** The questionnaire's reliability was evaluated. Reliability is described as the ability of the questionnaire to measure the consistency of a particular attribute and the level of correlation between items.

Internal consistency is the degree of homogeneity between all the items in a questionnaire. It was measured using Cronbach's alpha using SPSS version 27.0. Values of Cronbach's α land between 0 and 1. A score of 0.7 or more is considered acceptable. It was calculated for the whole questionnaire.

**RESULTS**

A total of 100 questions were designed, out of which 46 questions were pooled to frame a questionnaire. All 46 questions were identified on the Likert scale, and seven panelists marked all the questions.

**Content Validity of Questionnaire**

A CV index score of four or five indicates the validity and appropriateness of the content [13]. Content validity is calculated by dividing the number of relevant responses (scores 4 and 5) by the total number of responses. The level for CVI is set at 0.8 or 80 %. Any score below 0.8 is rejected, and the content is removed based on low face validity [14]. Five out of seven experts rated an item as relevant (scored 4 or 5), then CVI was 5/7= 0.71. The rated item is thus removed. Seven items in the questionnaire needed to be revised on the above criteria and were omitted from the questionnaire.

| | | N | % |
|---|---|---|---|
| Cases | Valid | 7 | 100.0 |
| | Excluded | 0 | .0 |
| | Total | 7 | 100.0 |

Table 1: Case Processing Summary

**Face Validity of Questionnaire**

The seven panelists rated all the questions on a Likert scale of 1-5. All the panelists found the questionnaire easy to answer, and 85 % (6/7) indicated that the appearance and layout of the questionnaire would be appropriate for the target population, thus assuring good face validity.

**Item Discrimination of Questionnaire**

It was measured by correlating the scores on each item with the overall test scores using SPSS version 27.0. The cut-off value for an item to total score correlation is set to 0.2; any value below 0.2 is discarded [15].

| | Scale Mean if Item Deleted | Scale Variance if Item Deleted | Corrected Item-Total Correlation | Cronbach's Alpha if Item Deleted |
|---|---|---|---|---|
| Breathlessness | 168.571 | 252.952 | .386 | .962 |
| Obesity | 168.143 | 249.143 | .739 | .960 |
| Hypertension | 168.286 | 254.238 | .433 | .962 |
| PCOD/PCOS | 168.286 | 254.238 | .433 | .962 |
| Diabetes | 168.286 | 254.238 | .433 | .962 |
| Cardiac problems | 168.286 | 254.238 | .433 | .962 |
| Hypothyroidism | 168.429 | 257.619 | .258 | .962 |
| **Family history** | **168.143** | **261.476** | **.008** | **.963** |
| **Food allergies** | **168.286** | **267.238** | **-.231** | **.966** |
| Type of Activity | 168.571 | 247.952 | .620 | .961 |
| Exercise duration | 168.429 | 253.619 | .518 | .961 |
| Food type preference | 168.571 | 257.619 | .341 | .962 |
| Number of meals | 168.143 | 258.143 | .202 | .963 |
| Meals on time | 168.429 | 240.619 | .883 | .959 |
| Fruit consumption | 168.000 | 247.333 | .934 | .960 |
| GLV consumption | 168.000 | 247.333 | .934 | .960 |
| Milk consumption | 168.143 | 250.810 | .638 | .961 |
| Tea consumption | 168.286 | 255.905 | .334 | .962 |
| Oil in cooking | 168.286 | 242.238 | .778 | .960 |
| Sugar consumption | 168.286 | 242.238 | .778 | .960 |
| Frequency of fried food | 168.286 | 242.238 | .778 | .960 |
| Binging between meals | 168.571 | 244.952 | .763 | .960 |
| Frequency of eating out | 168.286 | 253.571 | .473 | .961 |
| Weight concerns | 168.143 | 251.810 | .578 | .961 |
| Weight loss trial | 168.143 | 251.810 | .578 | .961 |
| Eating breakfast | 168.429 | 252.619 | .583 | .961 |
| Breakfast options | 168.286 | 238.905 | .920 | .959 |
| Mid-morning snack frequency | 168.286 | 238.905 | .920 | .959 |
| Mid-morning options | 168.143 | 247.476 | .841 | .960 |
| Lunch frequency | 168.143 | 247.476 | .841 | .960 |
| Lunch options | 168.143 | 247.476 | .841 | .960 |
| Dessert post lunch | 168.429 | 230.619 | .889 | .959 |
| Soda with lunch | 168.429 | 230.619 | .889 | .959 |
| Evening snack frequency | 168.286 | 238.905 | .920 | .959 |
| Evening snack option | 168.286 | 238.905 | .920 | .959 |
| Dinner frequency | 168.143 | 247.476 | .841 | .960 |
| Dinner options | 168.143 | 247.476 | .841 | .960 |
| Dessert post dinner | 168.286 | 251.905 | .573 | .961 |
| Milk post-dinner | 168.429 | 254.619 | .278 | .963 |

Table 2: Item- Total Statistics of 39 Questions

| | Scale Mean if Item Deleted | Scale Variance if Item Deleted | Corrected Item-Total Correlation | Cronbach's Alpha if Item Deleted |
|---|---|---|---|---|
| Breathlessness | 159.57 | 257.619 | .398 | .968 |
| Obesity | 159.14 | 254.476 | .712 | .967 |
| Hypertension | 159.29 | 259.238 | .429 | .968 |
| PCOD/PCOS | 159.29 | 259.238 | .429 | .968 |
| Diabetes | 159.29 | 259.238 | .429 | .968 |
| Cardiac problems | 159.29 | 259.238 | .429 | .968 |
| Hypothyroidism | 159.43 | 262.619 | .256 | .969 |
| Type of Activity | 159.57 | 253.619 | .583 | .967 |
| Exercise duration | 159.43 | 258.952 | .491 | .968 |
| Food type preference | 159.57 | 262.286 | .366 | .968 |
| Number of meals | 159.14 | 263.476 | .181 | .969 |
| Meals on time | 159.43 | 245.286 | .889 | .966 |
| Fruit consumption | 159.00 | 252.333 | .925 | .966 |

| | | | | |
|---|---|---|---|---|
| GLV consumption | 159.00 | 252.333 | .925 | .966 |
| Milk consumption | 159.14 | 255.810 | .632 | .967 |
| Tea consumption | 159.29 | 260.571 | .350 | .968 |
| Oil in cooking | 159.29 | 246.905 | .784 | .966 |
| Sugar consumption | 159.29 | 246.905 | .784 | .966 |
| Frequency of fried food | 159.29 | 246.905 | .784 | .966 |
| Binging between meals | 159.57 | 249.952 | .755 | .966 |
| Frequency of eating out | 159.29 | 259.238 | .429 | .968 |
| Weight concerns | 159.14 | 257.143 | .553 | .967 |
| Weight loss trial | 159.14 | 257.143 | .553 | .967 |
| Eating breakfast | 159.43 | 257.619 | .578 | .967 |
| Breakfast options | 159.29 | 243.238 | .939 | .965 |
| Mid-morning snack frequency | 159.29 | 243.238 | .939 | .965 |
| Mid-morning options | 159.14 | 252.143 | .853 | .966 |
| Lunch frequency | 159.14 | 252.143 | .853 | .966 |
| Lunch options | 159.14 | 252.143 | .853 | .966 |
| Dessert post lunch | 159.43 | 234.619 | .911 | .966 |
| Soda with lunch | 159.43 | 234.619 | .911 | .966 |
| Evening snack frequency | 159.29 | 243.238 | .939 | .965 |
| Evening snack option | 159.29 | 243.238 | .939 | .965 |
| Dinner frequency | 159.14 | 252.143 | .853 | .966 |
| Dinner options | 159.14 | 252.143 | .853 | .966 |
| Dessert post dinner | 159.29 | 256.905 | .567 | .967 |
| Milk post-dinner | 159.43 | 259.286 | .289 | .969 |

Table 3: Item- Total Statistics of 37 Questions

Based on the criteria, two items were discarded; hence, a questionnaire with 37 items was developed.
It was measured by correlating the scores on each item with overall test scores using SPSS v 27.0. Cut off value for an item to total score correlation is set to 0.2; any value below 0.2 is discarded [13]. Based on the criteria, two items were discarded; hence, a questionnaire with 37 items was developed.

| Cronbach's Alpha | No. of Items |
|---|---|
| 0.962 | 39 |
| 0.968 | 37 |

Table 4: Reliability Statistics

After the item analysis reliability coefficient was calculated for the questionnaire through Cronbach's alpha using SPSS v 27.0 and was found to be 0.968, indicating a high correlation level between different questionnaire items and is consistently reliable. No questions were further removed from the questionnaire. The questionnaire comprising of 37 questions became the final draft of the questionnaire and was disseminated to the required population.

**DISCUSSION AND CONCLUSION**
Globally, over 1.9 billion adults are overweight, and 650 million are obese. In comparison, 2.8 million deaths are reported because of being obese or overweight. India's contribution to obesity is 135 million adults. A pilot study was done via circulating online questionnaires as google forms. General information and medical history of obesity and related complications, dietary intake, physical activity, pattern, and anthropometric measurements of the subjects were recorded with the help of a questionnaire. The development of a reliable and validated questionnaire was done through a series of steps, namely, preparation of the structure and scope of the items in the questionnaire, elaboration of items in the questionnaire, preliminary questionnaire development, pilot study to evaluate the initial questionnaire, refining the questionnaire by item analysis, and reliability.
A total of 100 questions were designed, out of which 46 questions were pooled to frame a questionnaire. All 46 questions were identified on the Likert scale, and seven panelists marked all the questions. The rated item is thus removed. Seven items in the questionnaire needed to be validated on the CVI index and were omitted from the questionnaire. The seven panelists rated all the questions on a Likert scale of 1-5. All the panelists found the questionnaire easy to answer, and 85 % indicated good face validity. The cut-off

value for an item to total score correlation is set to 0.2; any value below 0.2 is discarded, two items were discarded, and hence a questionnaire with 37 items was developed. The Cronbach's alpha was found to be 0.968, indicating a high level of correlation between different questionnaire items and is consistently reliable.

The developed questionnaire is validated and reliable. It can be used by nutritionists, dietitians and even doctors of India to access the nutritional status and eating patterns of patients suffering from obesity. It can also help assess nutritional status of patients suffering from other metabolic disorders. This questionnaire helps in easy understanding of dietary pattern as well as lifestyle habits of the patients. Thus, making the process of lifestyle and eating habit modification easy. The questionnaire developed is easy to use and is applicable to patients of all age and gender.

**QUESTIONNAIRE**
**Declaration**
This questionnaire is required for the research. Information regarding the person's dietary intake and medical condition will be recorded for research. The investigation is to determine obesity and related complication in young adults. All personal information and responses will be kept confidential. Statistical data will be used for research purposes. Your participation is voluntary. Thank you for being so cooperative.

Date......................................

Signature.............................

**Personal Info**
1.      Name- Mr/Miss/Mrs...............................................................
2.      Address.................................................................................
3.      Age     (in years) ...........................
4.      Telephone-.........................
5.      E-mail-..............................
6.      Gender- Male              Female                  Others
7.      Height (cm) ........................
8.      Weight (Kg)........................
9.      Marital status-   Single                  Married
10.     Occupation- Student          Working          Unemployed
11.     Literacy Level- Undergraduate      Graduate        Post-Graduate    Other
12.     Family Composition-  Nuclear            Joint
13.     Number of members in the family-..............................................
14.     Income (p.a.)- ...............................................................
15.     Frequency of smoking.
Daily     1-2 times a week     3-4 times a week      Rarely        Never
16.     Frequency of drinking alcohol.
Daily     1-2 times a week     3-4 times a week      Rarely        Never
Attached below is the questionnaire. Please tick the most suitable response.

**Medical History**
Have you ever been diagnosed with or have complaints regarding the below-mentioned conditions?    Y-Yes N-No
1.      Breathlessness            Y                N
2.      Obesity                   Y                N
3.      Hypertension              Y                N
4.      PCOD (females)            Y                N
5.      Diabetes                  Y                N
6.      Cardiac problems          Y                N
7.      Hypothyroidism            Y                N

**Physical Activity**
1.      What type of activity do you follow?
Walking      Aerobics      Yoga      Dance      Cycling        None
Other, Specify..............................................................
2.      Duration of exercise performed per day.
Nil        <30 minutes            30-60 minutes            >60 minutes

**Food Habits & Pattern**
1.      You are

Vegan            Vegetarian                  Eggetarian         Non-vegetarian

Other, specify…………………………………………………………

2.       Number of meals per day

1 meal              2 meals         3 meals     4    meals      5 meals

3.       Frequency of taking meals on time.

Daily     1-2 times a week    3-4 times a week     Rarely     Never

4.       How often do you eat fruits?

Daily     1-2 times a week    3-4 times a week     Rarely     Never

5.       How often do you consume green-, red- and yellow-colored vegetables?

Daily     1-2 times a week    3-4 times a week     Rarely     Never

6.       How often do you consume milk and milk-based products?

Daily     1-2 times a week    3-4 times a week     Rarely     Never

7.       Amount of tea/coffee consumed in a day.

I do not consume tea/coffee      1 -2 cups     3-4 cups      >5 cups

8.       Amount of oil used in cooking each meal.

<1 teaspoon     1 teaspoon       2 teaspoons     3 teaspoons     >3 teaspoons

9.       Amount of sugar consumed in tea/coffee/milk.

<1 teaspoon     1 teaspoon     1.5 teaspoons 2 teaspoons    >2 teaspoons    Nil

10.     Frequency of eating fried/ junk food/packed food/ ready to cook/eat food.

Daily     1-2 times a week    3-4 times a week     Rarely     Never

11.     Frequency of binging between meals.

Daily     1-2 times a week    3-4 times a week     Rarely     Never

12.     How often do you eat out?

Daily     1-2 times a week    3-4 times a week     Rarely     Never

13.     Have you ever had concerns about your weight?     Yes                    No

14.     Have you ever tried to lose weight in the past?     Yes                No

If yes, specify the type of diet followed …………………………………………………

**Breakfast Habits & Pattern**

1.       Frequency of eating breakfast.

Daily     1-2 times a week    3-4 times a week     Rarely     Never

2.       What food options do you eat for breakfast?

Cereals               Pulse              Bakery/Packed food      Egg

Fruits                Milk/Beverage          Nuts              None

Others, Specify…………………………………………………………………

**Mid-morning meal Habits & Patterns**

1.       Frequency of eating a mid-morning meal.

Daily     1-2 times a week    3-4 times a week     Rarely     Never

2.       What food do you eat for the mid-morning meal?

Fruits                     Sprouts               Nuts

Beverage               Packed food           None.

Others, Specify, …………………………………………………………………

**Lunch Habits & Pattern**

1.       Frequency of having lunch.

Daily     1-2 times a week    3-4 times a week     Rarely     Never

2.       What food options do you prefer for lunch?

Cereal + Pulse/Vegetable/ Non-veg + Curd/ Salad

Cereal + Pulse/Vegetable/Non-veg

Cereal +Pulse/Non-veg + Vegetable + Curd/ Salad

Cereal +Pulse/Non-veg + Vegetable + Curd + Salad

Pulse/Vegetable + Curd + Salad

Pulse/ Vegetable + Curd/ Salad

None

Others specify…………………………………………………………………

3.       Frequency of eating sweet dish after lunch.

Daily     1-2 times a week    3-4 times a week     Rarely     Never

4.       What frequency of consuming soda with lunch?

Daily     1-2 times a week    3-4 times a week     Rarely     Never

**Evening Snack Habits & Pattern**

1.     Frequency of eating evening snacks.
2.     Daily    1-2 times a week    3-4 times a week    Rarely    Never
3.     What food options do you eat in the evening meal?

Fruits         Sprouts         Nuts

Beverage         Packed food         None.

Other, specify………………………………………………………………………

**Dinner Habits & Pattern**

1.     Frequency of having dinner.

Daily    1-2 times a week    3-4 times a week    Rarely    Never

2.     What food options do you prefer for dinner?

Cereal + Pulse/Vegetable/ Non-veg + Curd/ Salad

Cereal + Pulse/Vegetable/Non-veg,

Cereal +Pulse/Non-veg + Vegetable + Curd/ Salad

Cereal +Pulse/Non-veg + Vegetable + Curd + Salad

Pulse/Vegetable + Curd + Salad

Pulse/ Vegetable + Curd/ Salad

None

Other, specify………………………………………………………………………

3.     Frequency of eating sweet dish after dinner.

Daily    1-2 times a week    3-4 times a week    Rarely    Never

4.     Frequency of consuming milk post dinner.

Daily    1-2 times a week    3-4 times a week    Rarely    Never

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