A STUDY ON DIETARY DIVERSITY AMONG WOMEN OF AGE GROUP 30 TO 45 YEARS IN A RURAL SETTING OF TAMIL NADU

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CERTIFICATE

This is to certify that "A study on dietary diversity among women of age group 30 to 45 years in a rural setting of Tamil Nadu" is a bona fide work of Dr. Bincy Mary Thomas in partial fulfillment of the requirements for the M.D. Community Medicine Examination (Branch-XV) of the Tamil Nadu Dr. M. G. R. Medical University, Chennai, to be held in May 2020.

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This is to certify that this dissertation titled, "A STUDY ON DIETARY DIVERSITY AMONG WOMEN OF AGE GROUP 30 TO 45 YEARS IN A RURAL SETTING OF TAMIL NADU" is a bona fide work done by me, under the guidance of DR. JASMIN HELAN PRASAD, in partial fulfillment of the rules and regulations for the MD Branch XV (Community Medicine) Degree examination of the Tamil Nadu Dr. M. G. R. Medical University, Chennai, to be held in May 2020.

I have independently reviewed the literature, collected the data and carried out the analysis and evaluation towards the completion of the thesis.

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CERTIFICATE - II

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TABLE OF CONTENTS

INDEX OF TABLES

INDEX OF FIGURES

LIST OF COMMON ABBREVIATIONS USED

NCD	Non- Communicable Disease
DALY	Disability Adjusted Life Year
BMI	Body Mass Index
WRA	Women of Reproductive Age
NFHS	National Family Health Survey
DDI	Dietary Diversity Index
HAZ	Height for Age Z score
WAZ	Weight for Age Z score
DASH	Dietary Approaches to Stop Hypertension
MDD-W	Minimum Dietary Diversity for Women
FAO	Food and Agriculture Organisation
FHI	Family Health Approval
FFQ	Food Frequency Questionnaire
CHAD	Community Health and Development
CMC	Christian Medical College
PHC	Primary Health Centre
GVMC	Government Vellore Medical College
PTCHW	Part Time Community Health Worker
ANM	Auxiliary Nurse and Midwife
PHN	Public Health Nurse
PG	Post Graduate
HIS	Health Information System
DM	Diabetes Mellitus
HTN	Hypertension
WHO	World Health Organisation
GPAQ	Global Physical Activity Questionnaire
METs	Metabolic Equivalents
HbA1c	Hemoglobin A1c

ADA	American Diabetic Association
ACC	American College of Cardiology
OR	Odds Ratio
CI	Confidence Interval
SES	Socio Economic Status
NA	Not Applicable
INR	Indian Rupee
DDS	Dietary Diversity Score
DD	Dietary Diversity
AOR	Adjusted Odds Ratio
US	United States
GDM	Gestational Diabetes Mellitus
HDP	Hypertensive Disorders of Pregnancy

1. INTRODUCTION

India faces a double burden of malnutrition: one in the form of dietary deficiency of energy and nutrients particularly among poorer, rural populations (1), and the other in the form of non-communicable diseases (NCD) related to excessive energy, fat, sugar and salt consumption along with reduced levels of physical activity which are increasingly prevalent, especially among urban populations (2–4). The Global Burden of Disease study estimated that 1081 disability-adjusted life-years (DALYs) per 100000 population were lost in India in 2013 due to micronutrient deficiencies, while 2489 DALYs per 100000 population were lost due to high serum total cholesterol or BMI (5).

Low quality monotonous diets are the norm in resource-poor settings across the world. When diets lack fruits, vegetables, and animal-source foods and instead grain or tuber-based staple foods dominate, the risk for developing various micronutrient deficiencies is high.

The low frequency of consumption of items from food groups such as meat and fruits could be because only a few households can afford to buy such foods on a daily basis. In addition, sometimes it may be difficult to access such foods due to either a lack of production in certain regions (geographical constraints) or certain intra-household decisions on food consumption. Another important factor could be either a lack of awareness about balanced nutritional intake or specific food preferences.

Trends of the ‘nutrition transition’ in industrialized countries across continents during the last century reveal preferences for diverse diets, even across low income groups (6). Though this transition has widely increased the availability of food, there has been a resulting imbalance in the nutrient intake leading to adverse changes in health status. The need for measuring progress in dietary diversity in poor societies of low income countries is to examine the extent and occurrence of a shift away from the traditional staple-based diets, which are based on just a few food groups and contain mostly just starchy roots and coarse grains (6).

Changes in dietary patterns and living standards occur when a country undergoes rapid urbanization with consequent migration of people from rural to urban areas in a short time period. Though there has been an improvement in the socioeconomic status and means of communication which have improved the standard of living, these changes have also influenced dietary practices. While consumption of fast foods and diet high in fats is the common trend in urban areas; fried and salty foods are the more easily available food options in rural areas. Moreover the urban poor, who are victims of poorly planned urbanization, have also been affected by following improper and inappropriate dietary practices.

Globally there has been a startling rise of NCDs, such as hypertension, diabetes, cancer, stroke and other cardiovascular diseases, all of which pave way to disability or an early death. Another important problem faced by developing countries is malnutrition which includes both over and under-nutrition. Studies show that there has been an increase in the proportion of overweight/obese individuals in rural populations, especially in females (7).

Worldwide, at least 2.8 million people die each year as a result of being overweight or obese, and an estimated 35.8 million (2.3%) of global DALYs are caused by overweight or obesity. Overweight and obesity lead to adverse metabolic effects on blood pressure, cholesterol, triglycerides and insulin resistance. Risks of coronary heart disease, ischemic stroke and type 2 diabetes mellitus increase steadily with increasing body mass index (BMI) (8).

Epidemiological studies have established the role of a healthy diet in prevention and control of NCD-related morbidity and premature mortality. Furthermore, sedentary lifestyles, use of labor saving devices at home, use of motorized transport and less of physically demanding manual labor at work places, have all lead to decreased physical activity, and in turn to overweight/obesity.

Strategies for NCD prevention must focus on healthy dietary habits and proper nutrition, and other risk factors like physical activity. Globally most poor households experience lack of dietary diversity as a severe problem. Women of

reproductive age (WRA), in particular, are at high risk of inadequate micronutrient intake which from diets dominated by starchy staples. It is therefore absolutely necessary to understand the food pattern of various populations and the factors hindering them from following healthy diets. This study aims at assessing the dietary diversity and the prevalence of lifestyle diseases among women aged 30-45 years in a rural block of Vellore district.

2. JUSTIFICATION

Micronutrient malnutrition remains one of the largest nutritional problems worldwide. All people need a variety of foods to meet requirements for essential nutrients, and the value of a diverse diet has long been recognized.

Dietary diversity is a qualitative measure of food consumption which indicates household access to a variety of foods; it also serves as a proxy for nutrient adequacy of an individual's diet. Among poor populations in the developing world, lack of food diversity is a severe problem, as diets are monotonous and based predominantly on starchy staples which lack essential micronutrients and contribute to the burden of malnutrition and micronutrient deficiencies. More specifically women in the reproductive age group and children are most vulnerable to malnutrition due to low dietary intakes, inequitable distribution of food within the household, improper food storage and preparation, dietary taboos, infectious diseases, and care.

Poor health has indirect outcomes not only on women but also on their families. Women having poor health are more probable to give birth to low weight infants. Also they will less likely be able to provide food and appropriate care for their children. Furthermore, a woman's health affects the economic well-being of the household, as a woman in poor health will be less productive in the labor force.

Chronic diseases are no longer labeled as ‘diseases of affluence’, as these occur both in resource-poor countries as well as in the poor people in richer countries, with this transition occurring at a faster pace in developing countries.

Globally the expenditure incurred as a result of increase in the prevalence of NCDs has a huge impact on not only health, but on social and economic dimensions as well, with unhealthy lifestyles adding on to this crisis. These chronic diseases which are many a time partly due to unhealthy diet and poor nutrition will cause an increase in the public health burden, either in terms of disability-adjusted life years (DALYs), or as direct costs to the people and government.

The nutritional transition in low income countries has been considered as an emerging catastrophe due to its ill effects on health. Though this transition, has led to an improvement in agriculture, food supply and food processing technology, which in turn has increased the availability of food for people, it has also resulted in an imbalance in the nutrient intakes leading on to changes in health status (9). A classic example of changing health status is brought out from the nationwide surveys conducted by NFHS (2015) which maps the nutritional profile of women. The proportion of undernourished women in rural population was 26%, whereas the prevalence of overweight/obesity increased from 11% to 15% (10).

The double burden of malnutrition in India can be attributed to lifestyle changes and the nutritional transition. According to NFHS-4 data from Tamil Nadu, proportion of overweight/obese among women aged 15-49 years in rural population was 25%, while that of Diabetes Mellitus was 6.3%, and that of Hypertension was 5.5% (10). Results from cross-sectional studies done previously have shown that prevalence of diabetes among women aged 30 to 40 years in rural areas of Vellore has increased from 3.6% in 1991-94 to 10.2% in 2010-12, and overweight /obesity from 8.5% to 27% (11). The proportion of overweight/obesity in the study population was 32.1% in 2010-2012. The study found that there is increasing prevalence of overweight/obesity in rural populations, especially in females.

A major portion of the diet of the rural population is cereal-based, with little diversity in diet, leading to micronutrient deficiencies. Dietary practices mostly rely on the socio-demographic characteristics of the population in question, and differ from household to household. Also knowledge about the type and amount of individual foods consumed by a household and the frequency of consumption can help one evaluate the dietary practices of a household.

Dietary diversity is one of the most widely used indicators for evaluating healthy dietary practices. Dietary diversity can be measured using a simple count of food groups that an individual or household has consumed over the

preceding time frame. Dietary diversity can be measured at a household level or an individual level. At the household level, it is a measure of access to food (ability of a household to obtain ample quality and quantity of food to fulfill the nutritional needs of all household members for productive lives), while at individual level it refers to dietary quality (i.e., micronutrient sufficiency of a diet). Therefore, acquiring information about the household dietary diversity in a society can serve as a handy indicator for assessing individual micronutrient adequacy as well as household food insecurity.

As women are primarily involved in planning and preparing food, especially in rural households, it is hence crucial to target women for any dietary intervention programs.

Because of the perceived importance of dietary diversity for health and nutrition of women, the present study will be undertaken in assessing the dietary diversity among women and the factors affecting their quality of diet. Prevalence of NCDs like diabetes and hypertension will also be estimated in order to study the impact of dietary quality on the development of these lifestyle diseases.

3. OBJECTIVES

1. To study the proportion of women aged 30 to 45 years in Kaniyambadi block consuming diverse group of food items

2. To estimate the prevalence of obesity, diabetes mellitus and systemic hypertension among women aged 30 to 45 years in Kaniyambadi block who were previously not diagnosed to have diabetes or hypertension

3. To study the factors associated with poor dietary diversity and lifestyle diseases

4. REVIEW OF LITERATURE

4.1 QUALITY OF DIET AND HEALTH

Apart from the intrinsic value and pleasure in a diverse diet, there is ample evidence for the functional link between a diverse diet and health outcomes, and between a diverse diet and economic performance.

The most widely used method to measure dietary diversity is to capture the simultaneous consumption of food groups via “a simple count of food groups over a given reference period” (12). This can be summarized in the dietary diversity index (DDI). For a diet to qualify as diverse it must include the minimum number of food groups defined as mandatory.

Various studies using cross-sectional data for sub-Saharan African and South Asian countries, including India, show a direct link between dietary diversity and the nutritional adequacy of a diet, per capita food consumption, total per capita caloric availability of food, household per capita daily caloric availability from staple foods, and household per capita daily caloric availability from non staples (13–16).

Alderman et al. (2005), highlight the long chain between diverse childhood nutrition and cognitive development, physical stature and strength, more school attendance, greater learning, and eventually greater adult productivity (17).

For the Indian context, Menon et al. (2015) use nationally representative data (National Family Health Survey 3, 2005–06) to show that dietary diversity of children aged 6–23 months is ‘strongly and significantly associated with stunting, underweight and wasting’. Their results are robust to the inclusion of controls for household wealth (18).

Further, Steyn et al. (2006) show that dietary diversity correlates with micronutrient intake (19). Arimond and Ruel (2004) show that dietary diversity does predict height-for-weight z-scores (HAZ), weight-for-age (WAZ) z-scores, and undernutrition (20).

4.2 ASSESSING QUALITY OF DIET

In addition to micronutrient adequacy, high-quality diets are characterized by balance in intake of protein, carbohydrates and fats (21), and moderation in consumption of certain foods, which are low in nutrient density and those associated with increased risks for chronic disease (22).

A balanced diet should include macro as well as micronutrients daily; the macronutrients being carbohydrates, proteins and fats, and the micronutrients being vitamins and minerals.

The adverse effects of deficiencies in vitamin A, iron and folic acid, include night-blindness and iron-deficiency anaemia. Low intakes of these and other

nutrients, including zinc, calcium, riboflavin, vitamin B_6, and vitamin B_{12}, also have consequences for women's health, pregnancy outcome, and the health and nutritional status of breastfed children (23).

4.3 DIETARY DIVERSITY

Dietary diversity can be defined as the number of different foods or food groups consumed over a given reference period. It is a qualitative measure of food consumed which reflects household access to a variety of foods, and is also a proxy for nutrient adequacy of the diet of individuals.

4.3.1 Why is Dietary Diversity important?

Different foods and food groups are good sources for several macro- and micronutrients, so a diverse diet ensures nutrient adequacy. The principle of dietary diversity is rooted in evidence-based healthy diet patterns, like the Mediterranean diet and the “DASH” diet (Dietary Approaches to Stop Hypertension), and is asserted in all national food-based dietary guidelines. The WHO states that a healthy diet should contain vegetables, fruits, nuts, legumes and whole grains. A diverse diet is believed to meet both known and as yet unknown needs for human health. In addition to knowledge of essential fatty acid, protein, vitamin and mineral requirements, new knowledge regarding health effects of bioactive compounds continues to grow (24).

Taking into account plant foods alone, approximately 100,000 bioactive phytochemicals have been estimated, and studies state that health effects associated with vegetable, fruit, and whole grain consumption can probably be

explained by the combined action of many different phytochemicals and other nutrients (24).

4.3.2 Difference between Dietary Diversity and Diet Quality

Dietary diversity is just one dimension of diet quality, but can still lack macronutrient balance and moderation, which are other dimensions of diet quality. Diets lack balance if they are too high or too low in carbohydrate, fat, or protein. Diets lack moderation when there is excessive consumption of energy (calories), salt or free sugars. Neither does food group diversity in itself ensure balance or moderation, nor does it ensure that the carbohydrates, proteins and fats consumed are of high quality. However, dietary diversity is associated with better micronutrient density (micronutrients per 100 calories) and adequacy of diets (25).

Fruits and Vegetables - Eating a diet rich in fruit and vegetables reduces the risk of heart disease and may prevent cancer. Also being a good source of fiber, it might reduce the risk of obesity and type 2 diabetes. Women should aim to take at least 2 cup servings of vegetables and 1 cup of fruit per day (26).

Grains- Consuming whole grains help prevent constipation, maintain a healthy weight, provide varying amounts of micronutrients and anti-nutrients, and reduce the risk of heart disease. Common examples include rice, wheat, all kinds of breads, maize, sorghum, millet (26).

Protein - Protein helps body build bones, muscles, tissues, skin, cartilage, enzymes, vitamins and hormones. Foods rich in protein are poultry, meat, fish, egg, beans, soya, nuts.

Dairy - Dairy foods are important sources of high-quality protein, potassium and calcium, as well as vitamin B12 and other micronutrients. Its intake is associated with good bone health, a reduced risk of cardiovascular disease, lower blood pressure and a reduced risk of osteoporosis (26).

4.3.3 Why focus on dietary diversity for women?

When compared to men, women (especially those in the reproductive age) require diets that are higher in nutrient density, which makes them easily vulnerable to micronutrient deficiencies. Micronutrient deficiencies in turn impair health of women and of their children. Women of reproductive age (WRA) are often vulnerable nutritionally because of the physiological demands of pregnancy and lactation. Several nutrient requirements are higher for pregnant and lactating women than for adult men (26,27). Because women may be smaller and eat lesser amounts of food (less calorie intake), they require a diet which is more nutrient-dense (28).

Improper and inadequate dietary intake pattern in women of reproductive age results in nutrient deficiency which poses a threat to their physical, mental and social well-being (29). Furthermore, reproductive biology, poverty, poor education, socio-cultural traditions and dissimilarities in household contribute

to under nutrition in women (30). In other settings, women may be underprivileged in intra-household distribution of nutrient-dense foods (like animal-source foods). Women on low protein and carbohydrate diets can be severely malnourished mothers and are at increased risk of child mortality (31). Women who consume limited animal source foods, fruits and vegetables, increase their risk of micronutrient deficiencies (23).

Improving dietary diversity is one of several strategies initiated for improving micronutrient intakes for women of reproductive age.

4.4 MINIMUM DIETARY DIVERSITY for WOMEN OF REPRODUCTIVE AGE (MDD-W)

The Minimum Dietary Diversity for WRA (MDD-W) indicator (32) defined and described in this study is adapted from FAO and FHI 360. 2016. Minimum Dietary Diversity for Women: A Guide for Measurement. Rome: FAO.

It is a food group diversity indicator which has shown to reflect a key dimension of dietary quality: micronutrient adequacy, which is summarized across 11 micronutrients, namely vitamin A, thiamine, riboflavin, niacin, vitamin B6, folic acid, vitamin B12, vitamin C, calcium, iron and zinc (33).

MDD-W is a dichotomous indicator of whether or not women aged 15–49 years have consumed at least five out of ten defined food groups the previous

day or night. The proportion of women in this age group who reach this minimum in a population can be used as a proxy indicator for better micronutrient adequacy, which is an important dimension of diet quality (32).

4.4.1 What does the MDD-W indicator mean?

Though the indicator is measured by asking questions to individual women, it is designed to reveal something about micronutrient adequacy of groups of women, i.e. it is a population-level indicator.

Groups of women who achieve minimum dietary diversity (i.e. meet the threshold of five or more food groups) are more likely to have higher (more adequate) micronutrient intakes than groups of women who do not (32).

4.4.2 The Food groups

The ten food groups that are part of the MDD-W indicator according to the FAO model dietary diversity questionnaire (32) are:

1. Grains, tubers and white roots, plantains
2. Pulses (including lentils, peas and beans)
3. Nuts and seeds
4. Dairy (milk and other milk products)
5. Meat, fish and poultry
6. Eggs

7. Dark green leafy vegetables

8. Vitamin A-rich fruits and vegetables

9. Other vegetables

10. Other fruits

In addition to these 10 food groups, there are 6 optional categories and 2 required categories in the questionnaire, none of which are counted in the calculation of MDD-W.

The optional categories are:

- Insects and other small protein foods
- Red palm oil
- Other oils and fats
- Savory and fried snacks
- Sweets
- Sugar-sweetened beverages

The required categories are:

- Condiments and seasonings
- Other beverages and foods

4.4.3 What the MDD-W indicator does NOT mean

1. Normal day-to-day variability:

   The indicator is calculated based on a single day, and since it is calculated without information on quantities consumed, it does not provide information about the dietary quality of individual women.

2. Lack of information on quantity:

   Even for groups of women, though the threshold of five or more food groups are met, it does not necessarily guarantee micronutrient adequacy, though it increases the probability that they are being met. Whether or not dietary intakes are adequate depends on the quantities of nutrient-dense foods consumed, as well as on the diverse food types.

For the same reasons stated above, MDD-W may not be the best indicator for many research settings and questions. Quantitative and repeated recalls, as well as locally validated food frequency questionnaires could serve as stronger measures for use in research using a variety of analytic approaches. The MDD-W indicator was not designed as a research tool (32).

4.5 MEASUREMENT OF DIETARY DIVERSITY

The most widely used method to measure dietary diversity is to capture the simultaneous consumption of food groups via “a simple count of food groups over a given reference period” (12). This can be summarized in the dietary diversity index (DDI). For a diet to qualify as diverse it must include the minimum number of food groups defined as mandatory.

4.5.1 When is it appropriate to measure and use MDD-W?

It is appropriate to measure Minimum Dietary Diversity for Women of Reproductive Age (MDD-W):

1. When a simple proxy indicator is required to describe micronutrient adequacy (which is an important dimension of women’s diet quality) in national and sub national assessments.

2. To compare with previous assessments, without the survey timing compromising for seasonality, as seasonal variations can affect the connection between food group diversity and micronutrient adequacy.

3. The indicator may be helpful in advocacy and policy settings, when a dichotomous (yes/no) indicator is often required (32).

4.5.2 When is it NOT appropriate to measure and use MDD-W?

1. When an indicator is required for screening and/or focusing on individual women.
2. Also it should not be used in isolation to make decisions targeting groups/ populations, although it may render useful descriptive information to contribute to such choices when used as part of a wider range of indicators (32).

4.5.3 Methods of MDD-W measurement

Food group diversity indicators can be measured using two main methods: open recall and list-based.

Open recall method

In this method there is no previously prepared list of foods or food groups which the enumerator lists out to the respondent. Hence, the number of rows on the questionnaire will not affect an individual's response. However, it is important that categories of foods should not be collapsed in such a way that it is not possible to capture information on the ten distinct MDD W food groups.

In addition to rows capturing information on the ten distinct MDD-W food groups, there are six optional and two required categories in the questionnaire. Although the optional categories (e.g. "Sweets", "Sugar-sweetened beverages", "Other fats and oils") may be omitted, the questionnaire must include the final

two rows, i.e., the required categories: the “Condiments and seasonings” category (a row for foods/ingredients which are usually used in very small quantities) and a row for all “other” foods and beverages.

In a qualitative open recall method, the enumerator asks the respondent a series of standard probing questions in order to help them recall all foods and drinks that were consumed the previous day and night, they are also probed for the main ingredients used in mixed dishes. The recall is called “open” because here the enumerator does not read a list of predefined foods/groups to the respondent (32).

List-based method

In this method, the enumerator reads out a list of predefined foods, in groups to the respondent. The responses, and the resulting “count” of food groups for each respondent, are influenced by the total number of categories in the questionnaire and by the choices made in disaggregating the categories. In general, if the number of questions on a list-based questionnaire is more, the number of “yes” responses also will be more, which in some cases can lead to a higher count among the ten MDD-W food groups. If users wish to compare across space or time, it is of paramount importance that the list-based questionnaires have the same number of questions or remain the same (32).

24-hour recall

Here, the respondent recollects all the different foods she had the previous day. A one-day recall is ample to represent dietary diversity for groups of women. For any individual, it is only normal that the diet would vary from day to day, so even if one day dietary diversity may be very low, it may be very high the next day. Nevertheless, when evaluating dietary diversity for groups of women, the difference in high and low diversity days for individuals balance each other, and the summary obtained at the group level is accurate.

Quantitative dietary recalls

In this recall, the respondent is asked to roughly estimate the amount of each food and ingredient consumed over a reference time period and consequently the calorie-protein requirement and deficit is calculated. A variety of food models and/or actual foods may be used to aid the respondent estimate. In populations with low literacy and numeracy, quantitative recalls can be challenging and demands for highly trained and skilled enumerators. For data processing, analysis and interpretation, detailed information on the local recipes for mixed dishes as well as nutrient content of foods is required.

Qualitative recalls

This method captures current short-term diet. It involves asking the respondents to recall the food items consumed over a defined time period,

however they are not asked to recall the amounts of the food items consumed. This type of recall is much easier to implement and to analyze.

Minimum Dietary Diversity for Women of Reproductive Age (MDDW) can be measured using a qualitative recall. It does not require a quantitative recall.

In conditions where a quantitative recall is feasible, several detailed indicators of diet quality can be generated.

Food frequency - Because a single administration of a 24HR recall is unable to account for day-to-day variation, food frequency questionnaires (FFQ) are required to estimate usual dietary intake distributions. It consists of a finite list of foods and beverages with response categories to indicate usual frequency of consumption over the time period queried and, in some cases, portion size information about food and beverage consumption over a specified period of time, like a week, month or year.

4.5.4 Challenges in measuring MDD-W

The biggest challenges in estimating food group diversity lies in the handling of mixed dishes and also in the classification of ingredients, especially those which might be consumed in trivial amounts in any one serving of a mixed dish. Foods which are prepared outside the home (i.e. not by the respondent) is another challenge.

There are various levels of challenges:

1. Making the model questionnaires suitable to new contexts.
2. Training enumerators to appropriately record mixed dishes and foods that are prepared outside the home.
3. The whole process of designing a high-quality questionnaire in a new country or geographic area for the first time is yet another challenge because of the need for suitable cultural and linguistic adaptation, as well as customization using local examples of the foods classified into each food group (32).

Mixed foods, fortified and biofortified foods

One of the biggest challenges that come across in the measurement of food group dietary diversity is the presence of mixed dishes and street foods.

Fortified foods are less challenging, as they can be categorized in to their "home" food group (for example, fortified wheat flour is categorized with grains, fortified oil with fats and oils) for the purpose of measuring food group diversity. Despite fortified products contributing to micronutrient adequacy, these foods are generally fortified with either a single micronutrient or small numbers of micronutrients. The use of these foods does not undermine the value of and need for diverse diets, which supply a far wider range of nutrients and bioactive compounds (32).

4.6 FACTORS INFLUENCING DIETARY DIVERSITY

There are a host of factors that influence the nutritional needs and intake of women. They can be categorized as being both biological and non-biological.

Biological factors include age, gender, growth, disease states, and genetic makeup.

Among the non-biological factors are:

Socio-economic - Poverty is one of the major socio-economic causes of variation in nutrient intake, and requirements. Poverty imposes constraints to live in environments that are less food secure and that have greater potential health risks. Studies on nutrition in India show that diets have become somewhat more diverse with increasing income levels over the last decades, though not much (25).

Knowledge - a lack of awareness about balanced nutritional intake or specific food preferences is a key factor to women eating less diverse diets.

Education – Socioeconomic status is a major determinant of healthy diets. Women from lower socio-economic backgrounds have a low dietary diversity, owing to several factors, like, low family income, poor accessibility to various foods.

Parasites, which are more prevalent in poor environments, cause blood loss, which increases nutrient needs.

Socio-cultural factors, such as religion, food, and social status, also influence nutritional intake and needs. Religion and culture influence what people understand to be edible foods, what they eat, and as such has an impact on which nutrients are consumed and which nutrients may be needed in higher amounts (25).

4.7 DIETARY DIVERSITY AND LIFESTYLE DISEASES

Diet is a key modifiable risk factor for various chronic conditions, with poor quality diets being a leading cause of type 2 diabetes, cardiovascular diseases and hypertension. Hence association of food diversity with lifestyle diseases needs to be studied.

Obesity

It is widely believed that poor quality of food which is high in carbohydrate, saturated fats and oil intake, and less in vegetables, fruits and proteins, is one of the important factors causing increase in body adiposity and consequently leading to diseases like diabetes, hypertension and other cardiovascular diseases. Some studies show that higher dietary diversity is observed in obese or overweight individuals, with a lower diversity among normal or underweight individuals (34).

Two other observational studies done among Chinese and US adults, of which the Chinese study done among adults aged 25-74 years reported that those with a greater diversity in intake of snacks (but not grains, vegetables, fruits, meats, or beverages), had a greater risk of being overweight (OR 1.45; 95% CI 1.06–1.98) compared with those reporting lower diversity in snack consumption (35); however the second study done in multiethnic US adults reported no significant association between total food count and change in abdominal obesity (36). However other studies and systematic reviews done to examine the association between dietary diversity and obesity outcomes have shown mixed or inconsistent results (37,38).

Diabetes Mellitus

A diet characterized by regular consumption of atleast five food groups and by greater variety of dairy, vegetables and fruits is important for a reduced risk of diabetes (39). Studies have shown that predominantly carbohydrate diets increase plasma glucose levels, insulin, triglycerides and non-esterified fatty acids, which leads to insulin resistance (40). A study done in Chennai to examine the association of dietary carbohydrates and glycaemic load with the risk of type 2 diabetes among the urban adult population above 20 years of age found that refined grain intake was positively associated with the risk of type 2 diabetes [OR 5.31 (95 % CI of 2.98 - 9.45); $P < 0.001$]. After adjusting for potential confounders, total carbohydrate [OR 4.98 (95 % CI 2.69, 9.19), $P < 0.001$] and glycaemic load [OR 4.25 (95 % CI 2.33, 7.77); $P < 0.001$] were found to be associated with type 2 diabetes. Dietary fibre intake was inversely

associated with diabetes [OR 0.31 (95 % CI 0.15, 0.62); P < 0.001]. The study concluded that total carbohydrate intake is associated with risk of diabetes (41).

Systemic Hypertension

Diets rich in high fiber, vegetables and legumes are said to have blood pressure lowering effects. A cross-sectional study done among adult residents of Saba Island, Netherlands found a significant association between a poorly diversified diet and hypertension (OR = 4.25, 95% CI = 1.47 - 12.30) (42). In another large prospective cohort study done among female nurses in the U.S. to study the association between pre-pregnancy food-based dietary diversity scores and dietary quality scores and Gestational Diabetes Mellitus (GDM) and hypertensive disorders of pregnancy (HDP), it was found that the dietary diversity scores (like MDD-W), did not predict GDM or HDPs (43).

The current literatures provide limited information regarding dietary intake pattern and nutritional status among women in rural Tamil Nadu, or the association between dietary quality and development of lifestyle diseases. The objective of this study is, therefore, to assess the dietary intake pattern by measuring the diversity in dietary behavior with regard to important and commonly consumed foods groups, and also to study the prevalence of lifestyle diseases like diabetes, hypertension and obesity due to consumption of poor quality diet.

4.8 BG Prasad Socioeconomic Scale

The BG Prasad Scale was originally devised in 1961 and was later modified by the author himself in 1968 and 1970. The modified BG Prasad Socioeconomic Scale is widely used to determine the socioeconomic status of subjects in health studies in India. It is an income-based scale and needs to be constantly updated to take inflation and depreciation of the rupee into account. The consumer price index for industrial workers is used to calculate updated income categories. The BG Prasad scale is applicable to both urban and rural areas and it utilizes per capita monthly income (44).

Other commonly used scales for measuring socioeconomic status are Modified Kuppuswamy scale and Uday Pareek scale, used for urban and rural areas, respectively.

5. METHODOLOGY

5.1 Study Design

A community based cross sectional study design was used to study the dietary diversity and prevalence of lifestyle diseases among previously undiagnosed women in the age group of 30 to 45 years.

5.2 Study Period

This study was conducted between October 2017 and September 2019.

5.3 Study Setting

The study was done in Kaniyambadi block, Vellore District, Tamil Nadu, India. There are 82 villages in Kaniyambadi block and it has a population of over 1,20,000. The Community Health and Development (CHAD) program run by the department of Community Health, Christian Medical College (CMC), Vellore is located in Bagayam. There are four government primary health centres (PHCs) located within the block in Kammavanpet, Kathalampet, Kaniyambadi and Sholavaram villages. The Government Vellore Medical College (GVMC) is also situated in the Kaniyambadi block. Apart from these, there are many private clinics and hospitals providing health care to the people of Kaniyambadi block.

The study was done in 10 villages, namely Nelvoy, Pangalathan, Kaniyambadi Puthur, Melvallam, Kilpalipet, Palathuvanan, Kesavapuram, Kattuputhur, Sathupalayam and Thuthikadu.

The CHAD programme has been functioning in Kaniyambadi block for over 40 years. It provides primary and secondary care and is at close proximity to two tertiary/quaternary care centres (CMC and GVMC). CHAD operates based on a pyramid system. At the base of the pyramid are the Part Time Community Health Workers (PTCHWS) who are local villagers who provide a vital liaison between the community and the health system. Each village has a PTCHW and they report to a Health Aide. The Health Aide is a qualified Auxiliary Nurse and Midwife (ANM) who covers 3-5 villages, which accounts to a population of 5000-7000.

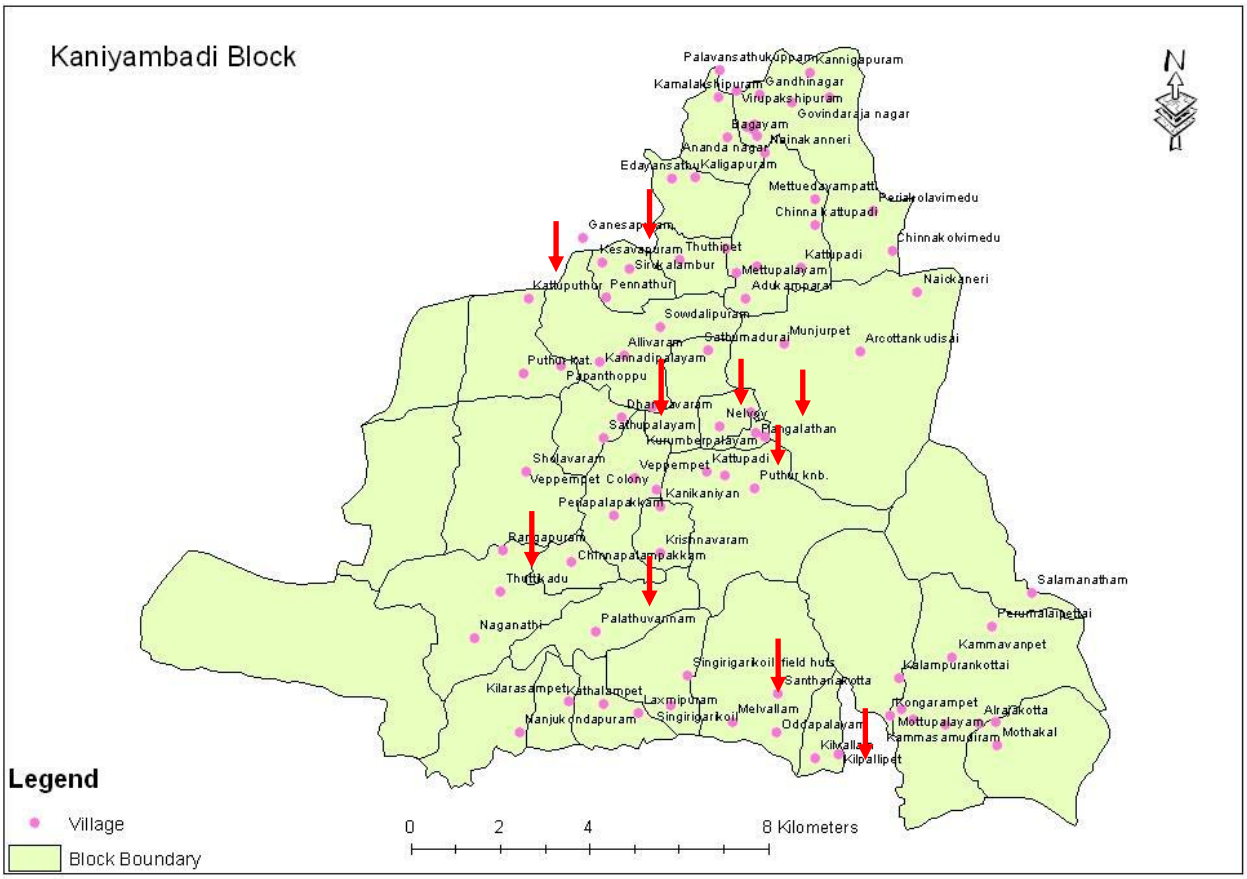
All vital events births to deaths, marriages to pregnancies are documented and reported by the Health Aides to the Public Health Nurses (PHNs). The PHNs visit the villages weekly and have a record of all pregnancies and an immunization register. A list of patients with Non-communicable disease is also maintained and updated regularly by the Health Aides in conjunction with the PHNs. Each village is visited once in 4 weeks by the area doctor (usually a Post graduate student) and health care is provided in the village. This ensures an efficient system of record maintenance and enables proper follow-up of

patients. It is in this resource rich setting that this study was embarked upon as there was a veritable void in knowledge of dietary diversity in the community.

The CHAD program has a health information system (HIS) which has information on all permanent residents of the Kaniyambadi block, which is collected by a health aide (female health worker), a public health nurse (a graduate nurse) and a doctor. The health workers are women who have been educated at least up to high school and received one-year training about the program before recruitment. The health worker gives a weekly report on births, deaths, morbidity, pregnancies, deliveries and marriages that have happened in the village under her supervision. Following this, the information is verified by the nurse and subsequently by the doctor. A periodical updating of the census of the block is done. Monthly mobile health clinics from the CHAD base hospital are held in each village, by a team consisting of a doctor, a public health nurse and a health worker. Antenatal women, as well as patients with chronic diseases such as diabetes, hypertension are seen in the mobile clinic and medications are dispensed. Home visits are made to the homes of patients who are chronically ill or bed-ridden. Any patient found to require a higher centre referral during the mobile clinic, is referred to the secondary level base hospital, CHAD. The base hospital is a 135-bedded hospital with daily out-patient departments, special clinics like diabetic, general surgery and ophthalmology clinics, a labour room, surgical theatre and laboratory services.

The following is a map of Kaniyambadi, with the study villages highlighted.

Figure 5.1 Map of Kaniyambadi Block



5.4 Study Population

The eligibility criteria for the study population is mentioned below.

5.4.1 Inclusion Criteria:

All women between 30 to 45 years of age who are permanent residents of the selected villages in Kaniyambadi block.

5.4.2 Exclusion criteria:

Women with the following conditions were excluded from the study:

- Either currently pregnant or who delivered within the last 6 months
- Previously diagnosed to have diabetes or hypertension
- Those with severe mental or hearing disability

5.5 Sample size calculation

According to a study done in three South African towns, the percentage of women of reproductive age group who achieved minimum dietary diversity was **25%** (45).

The sample size was calculated by taking the prevalence rate reported in the above study as 25% and with a relative precision of 20%. The desired sample size of 300 was calculated using the formula Z^2pq / d^2

Here, p =25%, q=75%, d= 5 (relative precision of 20%)

$$N= \frac{4*25*75}{5*5} = 300$$

5.6 Sampling technique

A two stage simple random sampling technique was used.

Kaniyambadi block in Tamil Nadu (served by the Community Health Department of Christian Medical College, Vellore) has 82 villages. Among

those villages, ten villages were selected by simple random sampling in the first stage of sampling.

In the second stage, thirty eligible women from each of the ten villages were selected by simple random sampling from the census data maintained by the Health Information System of CHAD (Community Health and Development) program of the Community Health Department.

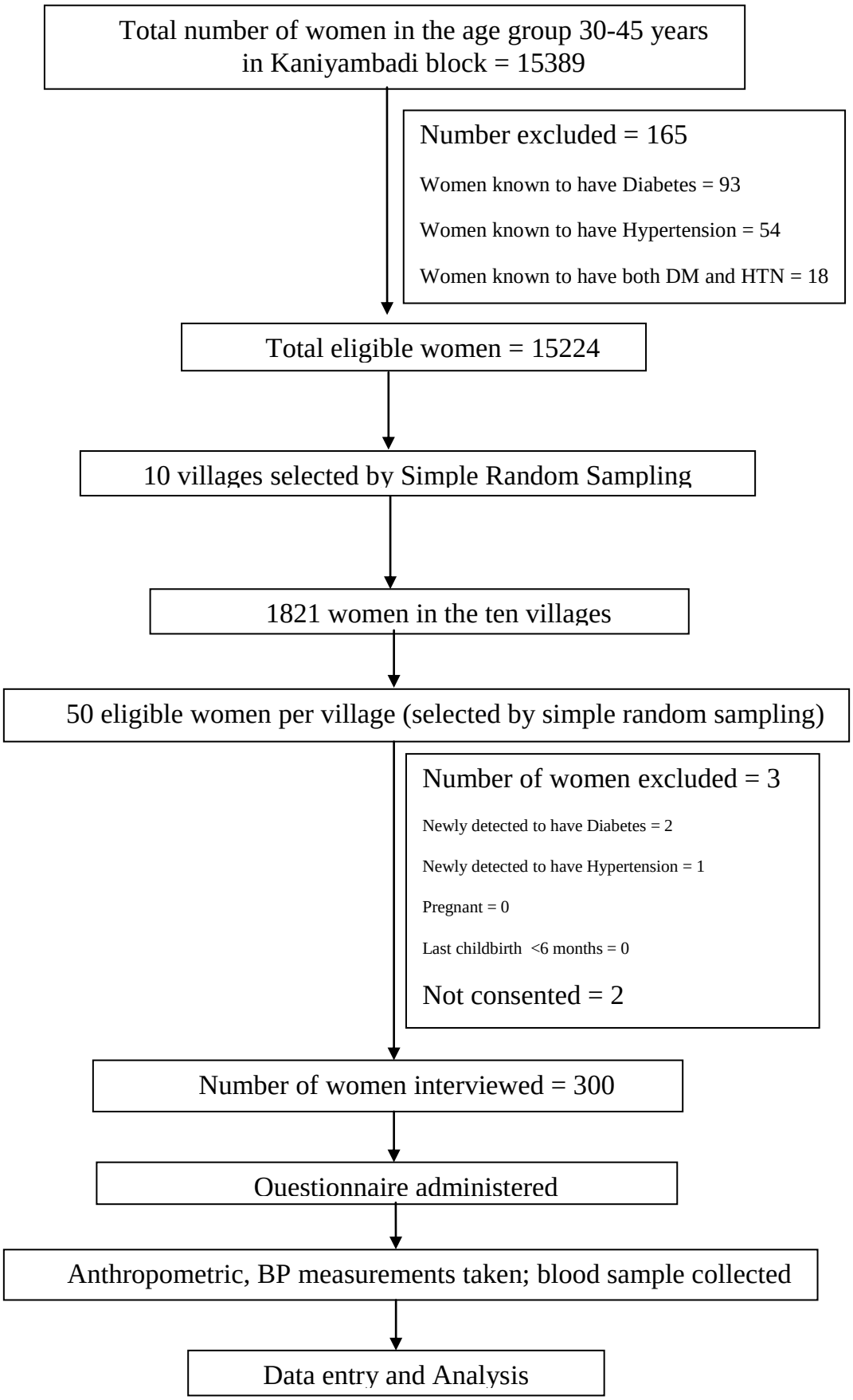
5.7 Informed consent

An information sheet (in Tamil) was given to each participant, where the purpose of the study, voluntary nature of taking part and confidentiality regarding the concerns was explained. The same information was explained verbally by the investigator, following which a written consent was obtained.

5.8 Data Collection

Each participant was interviewed at their home. Data collection was done on all days of the week during the study period, except for fasting and festival days (wherein the whole community usually consumes the same type of food items). Following each interview, anthropometric measurements and blood pressure measurements were taken and blood collection was done.

Figure 5.2: Flow chart of the study



5.9 Study tools and procedures

5.9.1 Questionnaire:

a. Socio-demographic characteristics of study population
b. FAO model questionnaire for dietary diversity
c. Individual dietary intake of the participants by 24-hour recall method
d. Food frequency of different food groups consumed
e. Global Physical Activity Questionnaire for physical activity

The study questionnaire was translated into Tamil and later translated back to English to check for errors in translation.

5.9.2 Anthropometric measurements:

Body weight was measured using a weighing scale. Precautions were taken so as to eliminate measurement errors (by zero correction and use of a flat surface). Height was measured using stadiometer.

5.9.3 Blood pressure measurement:

Blood pressure was measured in sitting position using an automatic blood pressure apparatus. In cases of a high reading, three readings were taken and the average blood pressure was calculated.

5.9.4 Data collection procedure

The study participants were interviewed at their homes after obtaining informed consent. A field worker trained by the principal investigator assisted

in identifying participants and in collecting demographic data. Anthropometric measurements and blood pressure measurements were taken, and blood sample was collected after each interview. All measurements were taken by the principal investigator to reduce the chances of error. The blood samples collected were sent to the laboratory of the base hospital of the Community Health Department, Christian Medical College, Vellore, for the estimation of Glycosylated Haemoglobin.

5.10 Study variables

5.10.1 Socio-demographic variables:

- Age
- Education of the respondent
- Occupation of the respondent
- Marital status
- Monthly income of family

5.10.2 Socio-economic status measurement

The socio-economic status of the family was determined using the Modified BG Prasad socioeconomic scale (44), which is based on the monthly family per capita income as stated below:

- Upper class: INR 7008 and above
- Upper middle class: INR 3504 – 7007
- Middle class: INR 2102 – 3503

- Lower middle class: INR 1051 – 2101
- Lower class: INR 1050 and below

5.10.3 Dietary Diversity measurement

Twenty four hour recall method was used to obtain the information on the food consumed the previous day using the FAO model dietary diversity questionnaire (32), which includes 10 food groups. If the participant had consumed ≥15 gram of a food item from a particular food group the previous day, it was considered as 'consumed' and a score of '1' was given. The maximum allowable score was '10'. According to the FAO model dietary diversity cut-off, if an individual obtained a score of '5' or more, they were considered to have good dietary diversity (32).

Also food frequency of different food groups was enquired, to know how frequently an individual consumed any item from a particular food group.

5.10.4 Body Mass Index classification

BMI was calculated from the measured weight and height of the study participants, using the formula, BMI = weight/height^2, and classified into the following categories based on the WHO classification (8):

- Underweight: Less than 18.5 kg/m^2
- Normal: 18.5 to 24.99 kg/m^2
- Overweight: 25.0 to 29.99 kg/m^2

- Obese: 30.0 kg/m^2 or higher
    - Class 1 Obesity: 30.0 – 34.9 kg/m^2
    - Class 2 Obesity: 35.0 – 39.9 kg/m^2
    - Class 3 Obesity: 40.0kg/m^2 or more

5.10.5 Physical Activity

Physical activity was measured using the Global Physical Activity Questionnaire (GPAQ), and participants were classified into the two categories based on the METs-minute per week (46):

- Sufficient : 600 METs-min per week or more
- Insufficient : less than 600 METs-min per week

5.10.6 Diabetes Mellitus

Glycosylated Haemoglobin (HbA1C) values were categorized based on the American Diabetic Association (ADA) guidelines for diagnosing diabetes (47).

- Normal : less than 5.6%
- Prediabetes : 5.7% to 6.4%
- Diabetes : 6.5% or higher

5.10.7 Systemic Hypertension

Blood pressure values were classified as follows based on American College of Cardiology (ACC) guidelines (48):

- Normal : less than 120/80 mmHg
- Elevated : 120-129/<80 mmHg
- Stage 1 Hypertension : 130-139/80-89 mmHg
- Stage 2 Hypertension : 140/90 mmHg or above

5.11 Data entry and Analysis

Data collected was entered into Epidata 3.1 and was checked for consistency and errors.

Analysis of the data was done using SPSS version 23. Association between the categorical variables was tested using Chi-square tests and Odds ratios. Multivariate logistic regression was done to adjust for confounding factors.

The following data were analyzed:

1. Descriptive statistics of the study population
2. Proportion of women with adequate dietary diversity
3. Proportion of women with lifestyle diseases
4. Factors associated with dietary diversity – using Chi-square and OR with 95% C.I.
5. Association between dietary diversity and lifestyle diseases – by Chi-square and OR with 95% C.I.

6. To adjust for confounding factors Logistic Regression was done for:

    - Factors associated with inadequate dietary diversity

    - Association between dietary diversity and lifestyle disease

5.12 Ethical considerations:

The study was reviewed by the Institutional Review Board. Information on the study procedure, importance of the study and future usage of the data were informed to the participants and informed consent was obtained.

Those who had abnormal parameters (high blood pressure, high blood sugars and very high BMI) were referred appropriately for further management.

All women in the study and the family members were advised on diet and physical activity.

6. RESULTS

Our study done on assessing dietary diversity was conducted in ten villages of Kaniyambadi block, a rural block of Vellore district, Tamil Nadu, among women aged 30 to 45 years who were permanent residents of their respective villages. There were 300 eligible women who consented to participate in the study. The study participants, as per the eligibility criteria, were women who were previously undiagnosed to have diabetes or hypertension. From the information stored in the CHAD hospital database about women in the age group of 30 to 45 years in the ten study villages, women who were already diagnosed to have diabetes were 93, women who were already diagnosed to have hypertension were 54 and those having both diabetes and hypertension were 18. These women were excluded in the initial stage itself.

6.1 DESCRIPTIVE SOCIO-DEMOGRAPHIC STATISTICS

The socio-demographic characteristics of the 300 women who participated in the study are shown in this section.

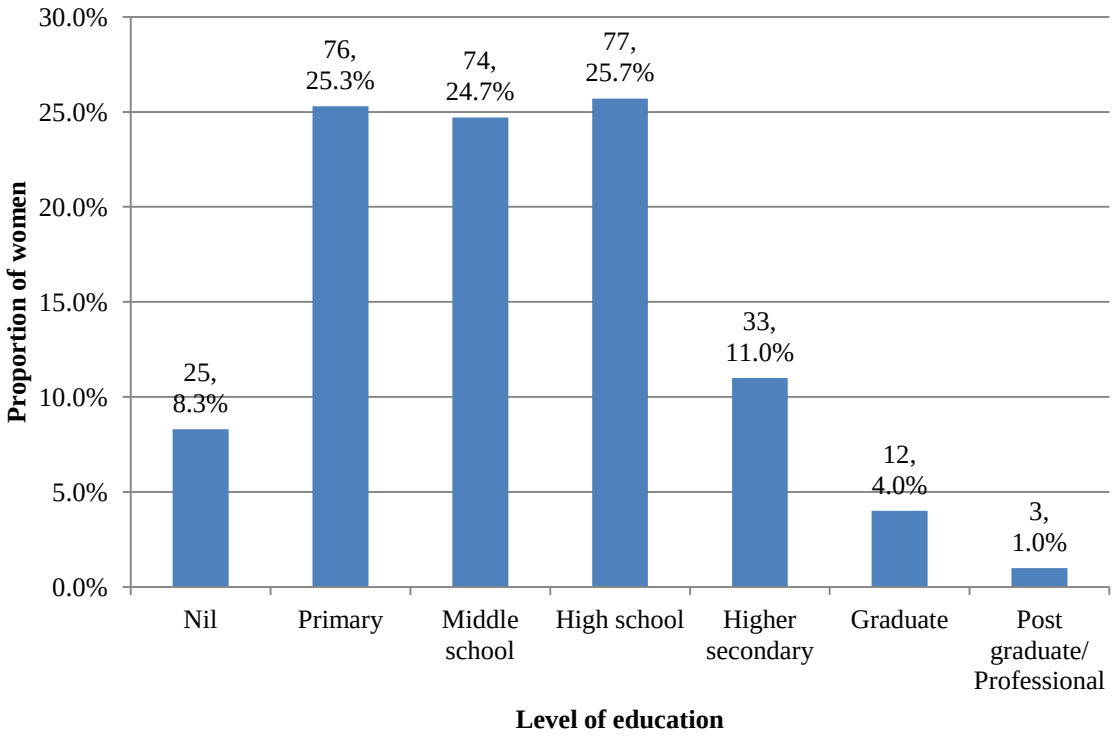
The mean age of the respondents was 37.6 $\pm$ 4.6 , the minimum age being 30 years and the maximum 45 years. Majority of the participants were currently married (90%). One-fourth of the participants (25.3%) had completed up to only eight or less years of education. 31.3% of the women were engaged in manual labor as an occupation, while a large number of the participants were homemakers (62.7%).

Table 6.1.1 Age distribution of the study population

Age group (in years)	**No.**	**%**
30-34	82	27.3
35-39	104	34.7
40-45	114	38.0
Total	**300**	**100**

The mean age of the respondents was 37.6 ± 4.6, with the minimum age being 30 and the maximum being 45 years.

Figure 6.1.1 Description of the study population by Education (n = 300)



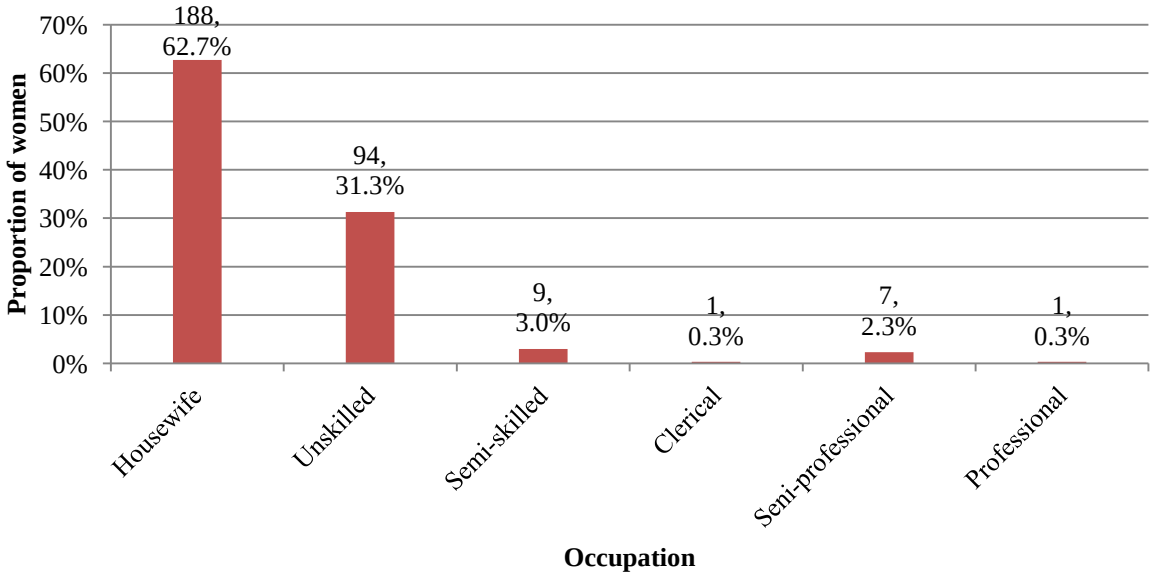
Almost equal number of the respondents had studied up to primary, middle and high school. 8.3% of the study population had no formal education and did not know how to read or write.

Table 6.1.2 Education level of the respondent's spouses

Education	**Number**	**Percentage**
Nil	17	5.6
Primary	51	17.0
Middle school	59	19.6
High school	96	32.0
Higher Secondary	33	11.0
Graduate	14	4.6
Post Graduate/ Professional	2	0.6
Not known/ NA*	28	9.3
Total	**300**	**100**

* Educational qualification of spouse is not known or relevant or details not available for those study participants who are single, widowed, separated or divorced

Figure 6.1.2 Description of the study population by Occupation (n = 300)



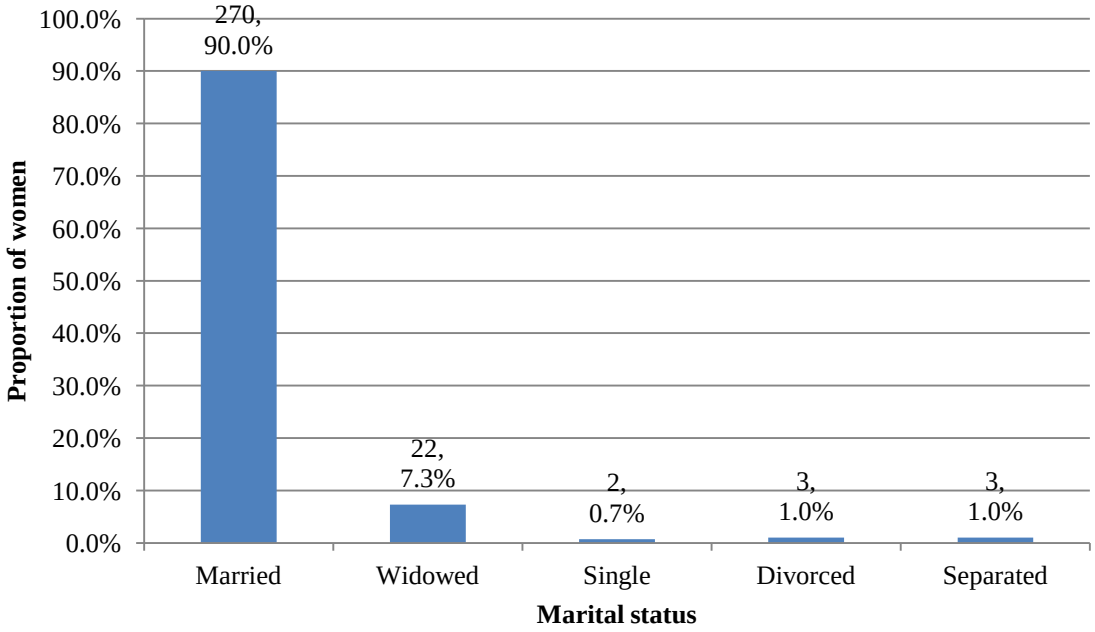
Large numbers of the study participants were housewives (62.7%), with the next common occupation being unskilled jobs (like manual labor) at 31.3%.

Table 6.1.3 Occupation of the respondent's spouses

Occupation	**Number**	**Percentage**
Unemployed	15	5.0
Unskilled	107	35.7
Semi-skilled	57	19.0
Skilled	64	21.3
Clerical/Shop owner	25	8.3
Semi-Professional	3	1.0
Not known/ NA*	29	9.7
Total	**300**	**100**

* Occupation of spouse is not known or relevant or details not available for those study participants, who are single, widowed, separated or divorced

Figure 6.1.3 Description of study population by Marital Status (n=300)



90% of the study participants were currently married women.

Table 6.1.4 Description of the study population by Socio-economic status

(based on Modified BG Prasad scale)

SES	**Number**	**Percentage**
Lower	79	26.3
Middle Lower	110	36.7
Middle	56	18.7
Upper Middle	43	14.3
Upper	12	4.0
Total	**300**	**100**

More than one-third of the study participants (36.7%) belonged to the middle lower class according to the Modified BG Prasad classification (44). The mean

monthly family income of the study participants was found to be INR 10,068, with median being INR 8000.

Figure 6.1.4 Description of study population by Type of Family

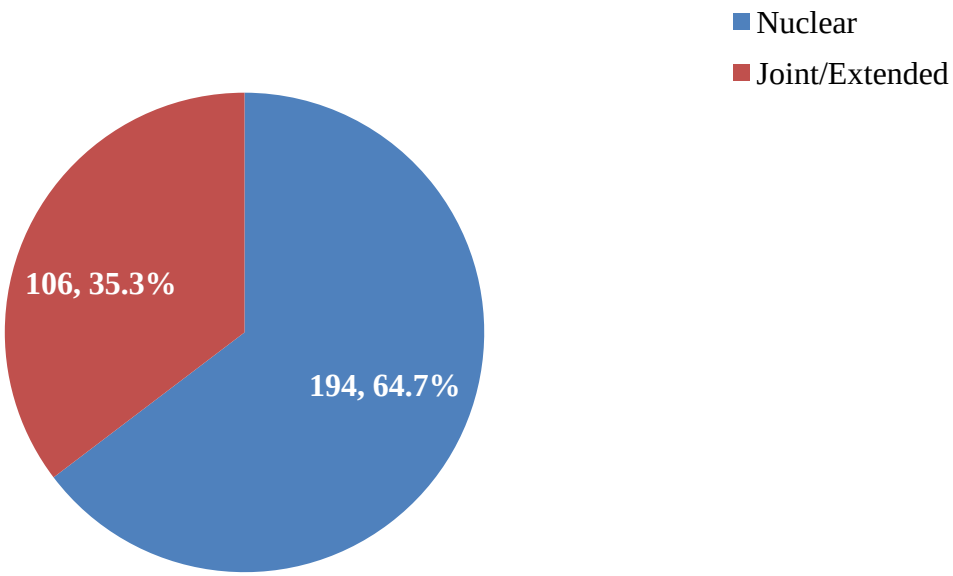


Table 6.1.5 Description of study population by number of living children at present per participant

Number of Living Children	Number	Percentage
0*	11	3.7
1	23	7.7
2	174	58.0
3	84	28.0
4	6	2.0
5	2	0.7
Total	**300**	**100**

* Two were single women, the remaining nine women had a child who died either postnatal or during infancy or childhood.

58% of the study participants had two living children, followed by 28% having three children.

Table 6.1.6 - Physical Activity in women (based on Global Physical Activity Questionnaire)

Category	**Number**	**Percentage**
Sufficient (≥600 METs-min per week)	117	39.0
Insufficient (<600 METs-min per week)	183	61.0

Large numbers of the study participants were found to have insufficient physical activity (61%). Table 6.1.7 shows the proportion of women when classified into three categories based on the different physical activity domains as per the GPAQ (46).

Table 6.1.7 - Proportion of study population when categorized based on the Physical Activity Domains (METs-min per week) as per GPAQ

Physical Activity Domain	METs-min per week	Number	Percentage
Work-related	<300	240	80.0
	≥600	60	20.0
Transport	<300	198	66.0
	300 – 600	23	7.7
	≥600	79	26.3
Recreation	<300	286	95.3
	300 – 600	6	2.0
	≥600	8	2.7
Total Physical Activity	<300	168	56.0
	300 – 600	15	5.0
	≥600	117	39.0

6.2: DIETARY DIVERSITY

Table 6.2.1 shows the proportion of women- among the 300 study participants- who had consumed a food item from each of the ten food groups the previous day.

Table 6.2.1 - Proportion of women consuming particular food groups on the previous day based on 24-hour dietary recall

Food Group	Amount of food item consumed					
	Nil		< 15 gm		≥15 gm	
	No.	%	No.	%	No.	%
Grains/Tubers	0	0	0	0	300	100.0
Pulses	26	8.7	81	27.0	193	64.3
Nuts/Seeds	175	58.3	54	18.0	71	23.7
Dairy	204	68.0	4	1.3	92	30.7
Meat/Fish/Poultry	228	76.0	3	1.0	69	23.0
Eggs	261	87.0	0	0	39	13.0
Green leafy vegetables	228	76.0	15	5.0	57	19.0
Vitamin A rich Veg/Fruits	206	68.7	2	0.7	92	30.7
Other Vegetables	190	63.3	0	0	110	36.7
Other Fruits	260	86.7	10	3.3	30	10.0

All 300 of the study participants had consumed some form of grain based food the previous day, as cereal-based staple diet is the norm in most of the South-Indian rural villages. Followed by cereals, pulses were the second most common food group consumed by the women on a regular basis, the most common item being toor dal used in sambar. A large number of these women (64.3%) had consumed more than 15grams of pulses the previous day, with the remaining of them consuming little less than 15 gram (27%) and only 8.7% of them not adding any pulses in their diet the previous day (as they had consumed some other form of curry). The most widely seen food combination in many South-Indian rural villages is rice with sambar, or dosa/idli with sambar. The other food groups consumed in decreasing order of consumption on the previous day were vegetables, dairy products, meat or poultry, nuts or seeds and eggs. Green leafy vegetables were consumed in adequate amounts by only 19% of the participants. The least consumed food group was fruits, with only 10% of the study population having consumed it the previous day.

Since the study has recorded the dietary intake of each participant based on a 24-hour recall, the exact frequency of consumption of a food group by an individual on a regular basis cannot be commented on or generalised looking at just the results in Table 6.2.1, as it gives a picture of the diet consumed by a person on only a single day. For better understanding of an individual's diet pattern, a 24-hour recall done on three or four days a week would give a clearer picture. However, as the interviews in this study were conducted every day of a

week and not on the same day of a week for all the participants, it is assumed that there wouldn't be monotonicity in the diet pattern of all participants.

After quantifying the amount of food item consumed by the participants from each food group and classifying them into the three categories as seen in Table 6.2.1, DDS (Dietary Diversity Score) for each participant was calculated, by giving a score of '1' for each of the ten food groups consumed in an amount of 15grams or more, and finally adding the individual scores. Based on the FAO-MDDW model (43), the cut-off value of the DDS is '5'. Any individual having a score of '5' or more is considered to have good dietary diversity. Table 6.2.2 shows the number of participants having adequate dietary diversity based on the DDS.

Table 6.2.2 – Proportion of women having Dietary Diversity when above or below threshold of five food groups

Dietary Diversity	**Number**	**Percentage**
Present (DD Score ≥5)	46	**15.3**
Absent (DD Score <5)	254	84.7

Only less than one-sixth of the women (15.3%) were found to have a good dietary diversity based on the DDS as shown in Table 6.2.2, while large majority of them (84.7%) had poor dietary diversity.

The mean Dietary Diversity Score was 3.51 $\pm$ 1.08, with a median of 3, minimum score of 1 and a maximum of 7.

Table 6.2.3 shows proportion of women in each category, when dietary diversity is classified into 3 groups based on the number of food groups consumed the previous day.

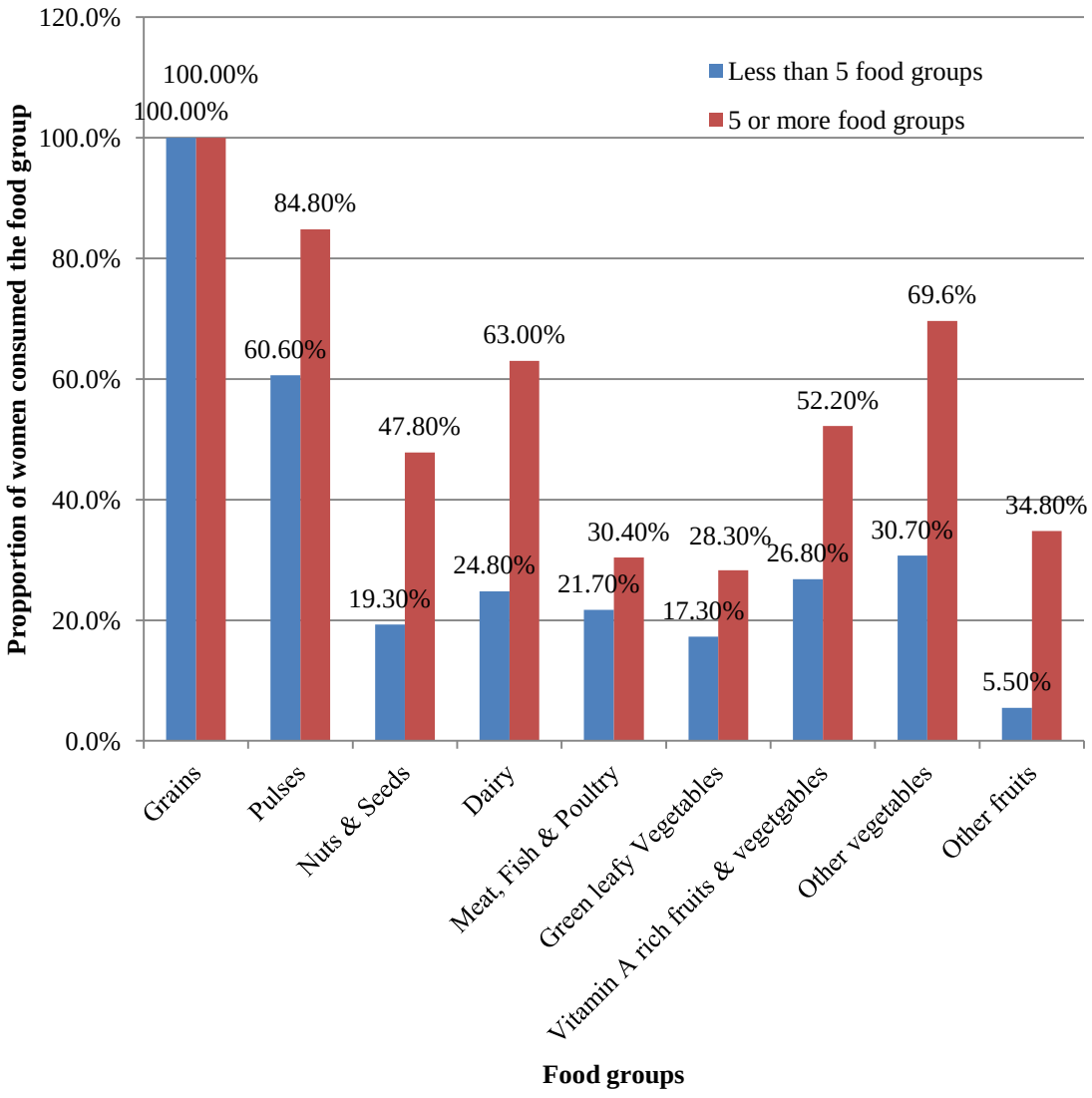
Table 6.2.3 - Dietary Diversity classified into 3 categories

Dietary Diversity	**Number of food groups consumed**	**No.**	**%**
Poor	0-2	48	16.0
Moderate	3-5	239	79.7
Good	6-10	13	4.3

When classified as in Table 6.2.3, almost 80% of the women have a moderate dietary variety, having consumed at least 3 to 5 food groups the previous day, and only 16% of them have a poor dietary diversity, with consumption of 2 or less food groups. In resource-poor settings, such a categorization as in Table 6.2.3 would be more apt as the quality of diet is poor.

Figure 6.2.1 shows proportion of women consuming foods in each of the ten food groups on the previous day based on the categorization of less or more than five food groups (poor or good diversity).

Figure 6.2.1 - Proportion of women consuming various food groups on the previous day based on 24-hour dietary recall, when above or below threshold of five food groups



As observed in Figure 6.2.1, all women in either category had consumed some grain/cereal the previous day (100%). Out of the 46 women who had good dietary diversity, the next highest consumed food group was pulses, followed by vegetables, dairy products, nuts and seeds, fruits, meat or poultry and green leafy vegetables (in that order). In the poor dietary diversity group, of the 254 women, apart from pulses being the next most consumed food group among 60% of the women, all the other food groups were consumed by only one-fourth or lesser women, with the least consumed being fruits by only 5%. However in both groups, the choice of consumption of food groups is in an almost similar manner, with cereals, pulses and vegetables being the most common choice, and green leafy vegetables and fruits being the least.

6.3 – PREVALENCE OF LIFESTYLE DISEASES

Table 6.3.1 – DIABETES MELLITUS – in participants who were previously not diagnosed to have diabetes

(Based on HbA1C values according to American Diabetic Association guidelines)

Classification	**HbA1C level**	**Number**	**Percentage**
Normal	**< 5.6%**	154	51.3
Prediabetes	**5.7% – 6.4%**	120	40.0
Diabetes	**≥ 6.5%**	26	**8.7**

Among the 300 study participants, 8.7% of them were newly detected to have diabetes. While half of the participants (51.3%) had a normal HbA1C value, 40% of them fell in the prediabetic range according to the ADA guidelines (47).

Table 6.3.2 – SYSTEMIC HYPERTENSION – in participants who were previously not diagnosed to have hypertension

(Based on American College of Cardiology guidelines)

Classification	**Blood pressure range (mmHg)**	**No.**	**%**
Normal	<120/80	153	51.0
Elevated	120-129/<80	16	5.3
Stage 1 Hypertension	130-139/80-89	77	25.7
Stage 2 Hypertension (≥140/90mmHg)	≥140/90	54	**18.0**

18% of the study population was newly detected to have hypertension, while 51% women had a normal blood pressure, and one-fourth of them (25.7%) fell in the Stage 1 Hypertension range according to the ACC hypertension guidelines (48).

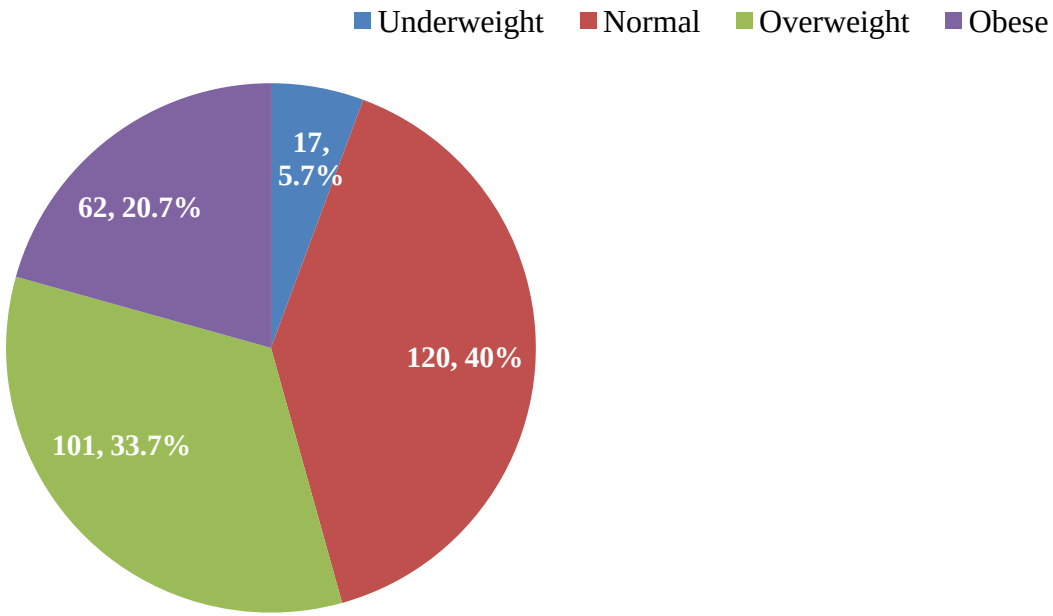
All those who were newly detected to have diabetes or hypertension were referred to the CHAD base hospital of the Community Health Department of CMC, Vellore, for further evaluation and management of the disease.

Table 6.3.3 – OBESITY

(Based on WHO classification of Body Mass Index)

Body Mass Index (**WHO classification**)	**Classification**	**Number**	**Percentage**
	Underweight (<18.5)	17	5.7
	Normal (18.5 – 24.9)	120	40.0
	Overweight (25.0 – 29.9)	101	33.7
	Obesity (≥30.0 kg/m^2)	62	20.7
	a. Class 1 Obesity (30.0 – 34.9)	*50*	*16.7*
	b. Class 2 Obesity (35.0 – 39.9)	*9*	*3.0*
	c. Class 3 Obesity (≥40.0)	*3*	*1.0*

Figure 6.3.1 Classification of BMI



More than half of the study population (54.4%) fell in the overweight/obese category based on the WHO classification of BMI (8).

6.4 : FACTORS ASSOCIATED WITH DIETARY DIVERSITY

Table 6.4.1 - Dietary Diversity and Socio-demographic characteristics

Variable	Category	Dietary Diversity			
		Poor		Good	
		Number	Percentage	Number	Percentage
Age	30-34	74	90.2	8	9.8
	35-39	82	78.8	22	21.2
	40-45	98	86.0	16	14.0
Education	Primary and below	85	84.2	16	15.8
	Middle/High School	125	82.8	26	17.2
	Higher Secondary	32	97.0	1	3.0
	Graduate or more	12	80.0	3	20.0
Occupation	Unskilled/Skilled	93	89.4	11	10.6
	Salaried Job	7	87.5	1	12.5
	Housewife	154	81.9	34	18.1
Marital Status	Currently Married	230	85.2	40	14.8
	Others	24	80.0	6	20.0
SES	Lower	67	84.8	12	15.2
	Lower Middle	91	82.7	19	17.3
	Middle	51	91.1	5	8.9
	Upper Middle	35	81.4	8	18.6
	Upper	10	83.3	2	16.7
Family type	Nuclear	161	83.0	33	17.0
	Joint/Extended	93	87.7	46	15.3

Diversity in diet was poorest in women aged 30-34 years, with 90.2% of the participants in that age group having poor quality diet. Interestingly, it was found that among the 33 women who had studied upto higher secondary school or more, 97% of them had a poor quality diet. Among women employed in manual labor (unskilled/skilled jobs), 89.4% of them had poor dietary diversity, while 81.9% of the 188 housewives had poor diversity. 85.2% of the currently married participants had a poor diversity. Those from the middle socio-economic class had a poorer dietary quality (91.1%). Quality of diet was found to be almost the same irrespective of family type. (Table 6.4.1)

Table 6.4.2 – Association between socio-demographic characteristics and Dietary Diversity

Variable	Category	Dietary Diversity		Unadjusted OR (95% CI)	P value	AOR (95% CI)	P value
		Poor	Good				
Age (in years)	≥40	98 (86.0%)	16 (14.0%)	1.17 (0.61-2.27)	0.625	1.26 (0.63-2.48)	0.506
	<40	156 (83.9%)	30 (16.1%)				
Education	High School & below	210 (83.3%)	42 (16.7%)	0.45 (0.15-1.33)	0.142	0.38 (0.12-1.16)	0.090
	Higher Secondary School or more	44 (91.7%)	4 (8.3%)				
Occupation	Unskilled/ Skilled	93 (89.45)	11 (10.6%)	1.83 (0.89-3.79)	0.096	2.25***** (1.06-4.76)	**0.033**
	Housewife & Others[a]	161 (82.1%)	35 (17.9%)				
Marital Status	Divorced & others[b]	24 (80.0%)	6 (20.0%)	0.69 (0.26-1.80)	0.455	0.60 (0.22-1.65)	0.327
	Currently Married	230 (85.2%)	40 (14.8%)				
SES	Lower	158 (83.6%)	31 (16.4%)	0.79 (0.40-1.55)	0.503	0.78 (0.39-1.57)	0.501
	Upper	96 (86.5%)	15 (13.5%)				
Family type	Joint/Extended	93 (87.7%)	13 (12.3%)	1.46 (0.73-2.92)	0.275	1.43 (0.70-2.92)	0.325
	Nuclear	161 (83.0%)	33 (17.0%)				

[a]salaried jobs [b]divorced/separated/single/widowed *significant in multivariate analysis

In Table 6.4.2, after adjusting for confounders, it was seen that those engaged in unskilled/skilled jobs have a higher risk of having poor dietary diversity when compared to housewives and those having salaried jobs (OR 2.28, 95% CI 1.08-4.82).

6.5 : FACTORS ASSOCIATED WITH LIFESTYLE DISEASES

(1) DIABETES MELLITUS

Table 6.5.1 – Diabetes Mellitus and Socio-demographic characteristics

Variable	Category	Diabetes Mellitus (HbA1C)					
		Normal (<5.7%)		Pre-diabetes (5.7% – 6.5%)		Diabetes (≥6.5%)	
		No.	%	No.	%	No.	%
Age	30-34	54	65.9	24	29.3	4	4.9
	35-39	56	53.8	37	35.6	11	10.6
	40-45	44	38.6	59	51.8	11	9.6
Education	Primary and below	49	48.5	45	44.6	7	6.9
	Middle/High School	78	51.7	60	39.7	13	8.6
	Higher Secondary	18	54.5	12	36.4	3	9.1
	Graduate or more	9	60.0	3	20.0	3	20.0
Occupation	Unskilled/Skilled	57	54.8	40	38.5	7	6.7
	Salaried Job	3	37.5	2	25.0	3	37.5
	Housewife	94	50.0	78	41.5	16	8.5
Marital Status	Currently Married	142	52.6	103	38.1	25	9.3
	Others	12	40.0	17	56.7	1	3.3
SES	Lower	35	44.3	38	48.1	6	7.6
	Lower Middle	64	58.2	39	35.5	7	6.4
	Middle	28	50.0	22	39.3	6	10.7
	Upper Middle	26	60.5	14	32.6	3	7.0
	Upper	1	8.3	7	58.3	4	33.3
Family type	Nuclear	103	53.1	78	40.2	13	6.7
	Joint/Extended	51	48.1	42	39.6	13	12.3
Dietary Diversity	Poor	135	53.1	95	37.4	24	9.4
	Good	19	41.3	25	54.3	2	4.3
Physical Activity	Insufficient	92	50.3	75	41.0	16	8.7
	Sufficient	62	53.0	45	38.5	10	8.5
Obesity	BMI ≥25 kg/m^2	66	40.5	76	46.6	21	12.9
	BMI <25 kg/m^2	88	64.2	44	32.1	5	3.6

Table 6.5.2 – Association between Socio-demographic characteristics and Diabetes Mellitus (in participants who were previously not known to have diabetes)

Variable	Category	HbA1C		Unadjusted OR (95% CI)	P value	AOR (95% CI)	P value
		≥6.5%	<6.5%				
		No.	No.				
Age	≥40	11 (9.6%)	103 (90.4%)	1.21 (0.53-2.75)	0.636	1.20 (0.50-2.87)	0.673
	<40	15 (8.1%)	171 (91.9%)				
Education	High School & below	20 (7.9%)	232 (92.1%)	0.60 (0.22-1.59)	0.303	0.94 (0.32-2.79)	0.918
	Higher Secondary School or more	6 (12.5%)	42 (87.5%)				
Occupation	Unskilled/Skilled	7 (6.7%)	97 (93.3%)	0.67 (0.27-1.65)	0.385	0.64 (0.20-2.01)	0.447
	Housewife & Others	19 (9.7%)	177 (90.3%)				
Marital Status	Divorced/single & others[a]	1 (3.3%)	29 (96.7%)	0.33 (0.04-2.58)	0.274	0.34 (0.04-2.93)	0.332
	Currently Married	25 (9.3%)	245 (90.7%)				
SES	Lower	13 (6.9%)	176 (93.1%	0.55 (0.24-1.24)	0.151	0.56 (0.23-1.33)	0.192
	Upper	13 (11.7%)	98 (88.3%)				
Family type	Joint/Extended	13 (12.3%)	93 (87.7%)	1.94 (0.86-4.36%)	0.102	2.44 (1.01-5.86)	0.045
	Nuclear	13 (6.7%)	181 (93.3%)				
Dietary Diversity	Poor	24 (9.4%)	230 (90.6%)	2.29 (0.52-10.06)	0.258	2.02 (0.44-9.23)	0.363
	Good	2 (4.3%)	44 (95.7%)				
Physical Activity	Insufficient	16 (8.7%)	167 (91.3%)	1.02 (0.44-2.34)	0.953	0.79 (0.29-2.18)	0.658
	Sufficient	10 (8.5%)	107 (91.5%)				
Obesity	BMI ≥25kg/m^2	21 (12.9%)	142 (87.1%)	3.90***** (1.43-10.65)	**0.005**	**4.01**** (1.44-11.12)	**0.008**
	BMI <25 kg/m^2	5 (3.6%)	132 (96.4%)				

*significant in bivariate analysis ** significant in multivariate analysis [a]

After adjusting for confounders, it was found that among the study participants, those who were overweight or obese individuals had a higher risk of having diabetes when compared to those with a normal or low BMI (OR 4.01, 95% CI 1.44-11.12).

(2) SYSTEMIC HYPERTENSION

Table 6.5.3 – Factors associated with Systemic Hypertension

Variable	Category	Systemic Hypertension							
		Normal		Elevated		Stage 1		Stage 2	
		No.	%	No.	%	No.	%	No.	%
Age	30-34	46	56.1	3	3.7	18	22.0	15	18.3
	35-39	53	51.0	7	6.7	26	25.0	18	17.3
	≥40	54	47.4	6	5.3	33	28.9	21	18.4
Education	Primary	47	46.5	3	3.0	31	30.7	20	19.8
	Middle/High School	86	57.0	12	7.9	29	19.2	24	15.9
	Higher Secondary	14	42.4	1	3.0	14	42.4	4	12.1
	Graduate or more	6	40.0	0	0	3	20.0	6	40.0
Occupation	Unskilled/Skilled	61	58.7	5	4.8	26	25.0	12	11.5
	Salaried Job	5	62.5	0	0	0	0	3	37.5
	Housewife	87	46.3	11	5.9	51	27.1	39	20.7
Marital Status	Currently Married	132	48.9	14	5.2	72	26.7	52	19.3
	Others	21	70.0	2	6.7	5	16.7	2	6.7
SES	Lower	48	60.8	4	5.1	18	22.8	9	11.4
	Lower Middle	48	43.6	7	6.4	36	32.7	19	17.3
	Middle	28	50.0	4	7.1	11	19.6	13	23.2
	Upper Middle	24	55.8	0	0	10	23.3	9	20.9
	Upper	5	41.7	1	8.3	2	16.7	4	33.3
Family type	Nuclear	98	50.5	11	5.7	49	25.3	36	18.6
	Joint/Extended	55	51.9	5	4.7	28	26.4	18	17.0
Dietary Diversity	Poor	130	51.2	14	5.5	67	26.4	43	16.9
	Good	23	50.0	2	4.3	10	21.7	11	23.9
Physical Activity	Insufficient	86	47.0	10	5.5	46	25.1	41	22.4
	Sufficient	67	57.3	6	5.1	31	26.5	13	11.1
Obesity	BMI ≥25 kg/m^2	67	41.1	7	4.3	50	30.7	39	23.9
	BMI <25 kg/m^2	86	62.8	9	6.6	27	19.7	15	10.9
Diabetes Mellitus	HBA1C ≥6.5%	3	11.5	2	7.7	9	34.6	12	46.2
	HBA1C <6.5%	150	54.7	14	5.1	68	24.8	42	15.3

Table 6.5.4 – Association between Socio-demographic characteristics and other factors with Hypertension (in study participants who were previously not diagnosed to have hypertension)

Variable	Category	Hypertension		Unadjusted OR (95% CI)	P value	AOR (95% CI)	P Value
		≥140/90 mmHg	<140/90 mmHg				
Age	≥40	21 (18.4%)	93 (81.6%)	1.04 (0.57-1.91)	0.882	1.01 (0.52-1.95)	0.976
	<40	33 (17.7%)	153 (82.3%)				
Education	High School & below	44 (17.5%)	208 (82.5%)	0.80 (0.37-1.73)	0.577	1.05 (0.44-2.53)	0.899
	Higher Secondary School or more	10 (20.8%)	38 (79.2%)				
Occupation	Unskilled/Skilled	12 (11.5%)	92 (88.5%)	0.47* (0.24-0.95)	**0.034**	0.79 (0.33-1.92)	0.618
	Housewife & Others	42 (21.4%)	154 (78.6%)				
Marital Status	Divorced/single & others[a]	2 (6.7%)	28 (93.3%)	0.29 (0.06-1.29)	0.089	0.40 (0.08-1.86)	0.246
	Currently Married	52 (19.3%)	218 (80.7%)				
SES	Lower	28 (14.8%)	161 (85.2%)	0.56 (0.31-1.03)	0.061	0.64 (0.33-1.23)	0.184
	Upper	26 (23.4%)	85 (76.6%)				
Family type	Joint/Extended	18 (17.0%)	88 (83.0%)	0.89 (0.48-1.67)	0.734	0.92 (0.45-1.85)	0.818
	Nuclear	36 (18.6%)	158 (81.4%)				
Dietary Diversity	Poor	43 (16.9%)	211 (83.1%)	0.64 (0.30-1.37)	0.257	0.60 (0.26-1.37)	0.231
	Good	11 (23.9%)	35 (76.1%)				
Physical Activity	Insufficient	41 (22.4%)	142 (77.6%)	2.31* (1.17-4.52)	**0.013**	2.05 (0.89-4.70)	0.090
	Sufficient	13 (11.1%)	104 (88.9%)				
Obesity	BMI ≥25 kg/m^2	39 (23.9%)	124 (76.1%)	2.55* (1.34-4.88)	**0.004**	**2.16**** (1.09-4.25)	**0.026**
	BMI <25 kg/m^2	15 (10.9%)	122 (89.1%)				
Diabetes Mellitus	HBA1C ≥6.5%	12 (46.2%)	14 (53.8%)	4.73* (2.04-10.94)	**<0.001**	**3.99**** (1.60-9.94)	**0.003**
	HBA1C <6.5%	42 (15.3%)	232 (84.7%)				

*significant in bivariate analysis ** significant in multivariate analysis

[a] [b]divorced/separated/single/widowed

From Table 6.5.4, it was seen that amongst the study population, those at higher risk of developing hypertension were women who were overweight or obese when compared to those who had a normal or low BMI (OR 2.16, 95%CI 1.09-9.94), as well as those who were newly detected to have diabetes when compared to their counterparts who had a normal HbA1C value (OR 3.99, 95%CI 1.60-9.94). Though occupation and insufficient physical activity was significantly associated with hypertension in the bivariate analysis, after adjusting for confounders it was found not to be significant.

(3) OBESITY

Table 6.5.5 – Factors associated with Obesity

Variable	Category	BMI					
		Under-weight	Normal	Over-weight	Class 1 Obesity	Class 2 Obesity	Class 3 Obesity
		No. (%)	No. (%)	No. (%)	No. (%)	No. (%)	No.(%)
Age	30-34	6, (7.3)	32 (39.0)	26, (31.7)	13, (15.9)	3, (3.7)	2, (2.4)
	35-39	6, (5.8)	48, (46.2)	29, (27.9)	17, (16.3)	3, (2.9)	1, (1.0)
	≥40	5, (4.4)	40, (35.1)	46, (40.4)	20, (17.5)	3, (2.6)	0, (0)
Education	Primary	4, (4.0)	39, (38.6)	39, (38.6)	18, (17.8)	1, (1.0)	0, (0)
	Middle/ High	9, (6.0)	64, (42.4)	45, (29.8)	25, (16.6)	7, (4.6)	1, (0.7)
	Higher Secondary	3, (9.1)	11, (33.3)	12, (36.4)	4, (12.1)	1, (3.0)	2, (6.1)
	Graduate or more	1, (6.7)	6, (40.0)	5, (33.3)	3, (20.0)	0, (0)	0, (0)
Occupation	Unskilled/ Skilled	5, (4.8)	42, (40.4)	40, (38.5)	16, (15.4)	1, (1.0)	0, (0)
	Salaried Job	0, (0)	3, (37.5)	3, (37.5)	1, (12.5)	0, (0)	1,(12.5)
	Housewife	12, (6.4)	75,(39.9)	58, (30.9)	33, (17.6)	8, (4.3)	2, (1.1)
Marital Status	Currently Married	13, (4.8)	109, (40.4)	90, (33.3)	46, (17.0)	9, (3.3)	3, (1.1)
	Others	4, (13.3)	11, (36.7)	11, (36.7)	4, (13.3)	0, (0)	0, (0)
SES	Lower	4, (5.1)	36, (45.6)	24, (30.4)	14, (17.7)	1, (1.3)	0, (0)
	Lower Middle	5, (4.5)	44, (40.0)	35, (31.8)	21, (19.1)	3, (2.7)	2, (1.8)
	Middle	5, (8.9)	19, (33.9)	21, (37.5)	10, (17.9)	1, (1.8)	0, (0)
	Upper Middle	2, (4.7)	18, (41.9)	16, (37.2)	3, (7.0)	3, (7.0)	1, (2.3)
	Upper	1, (8.3)	3, (25.0)	5, (41.7)	2, (16.7)	1, (8.3)	0, (0)
Family type	Nuclear	10, (5.2)	74, (38.1)	70, (36.1)	32, (16.5)	7, (3.6)	1, (0.5)
	Joint/ Extended	7, (6.6)	46, (43.4)	31, (29.2)	18, (17.0)	2, (1.9)	2, (1.9)
Dietary Diversity	Poor	14, (5.5)	102,(40.2)	88, (34.6)	41, (16.1)	6, (2.4)	3, (1.2)
	Good	3, (6.5)	18, (39.1)	13, (28.3)	9, (19.6)	3, (6.5)	0, (0)
Physical Activity	Insufficient	10, (5.5)	72, (39.3)	57, (31.1)	34, (18.6)	8, (4.4)	2, (1.1)
	Sufficient	7, (6.0)	48, (41.0)	44, (37.6)	16, (13.7)	1, (0.9)	1, (0.9)

Table 6.5.6 – Association between Socio-demographic and other factors with Overweight/Obesity

Variable	Category	BMI		Unadjusted OR (95% CI)	P value	AOR (95% CI)	P value
		≥25 kg/m2	<25 kg/m2				
Age	≥40	69 (60.5%)	45 (39.5%)	1.50 (0.93-2.40)	0.092	1.51 (0.93-2.45)	0.095
	<40	94 (50.5%)	92 (49.5%)				
Education	High School & below	136 (54.0%)	116 (46.0%)	0.91 (0.49-1.69)	0.771	0.80 (0.41-1.57)	0.532
	Higher Secondary School or more	27 (56.3%)	21 (43.8%)				
Occupation	Unskilled/Skilled	57 (54.8%)	47 (45.2%)	1.03 (0.63-1.66)	0.904	1.20 (0.65-2.20)	0.555
	Housewife & Others	106 (54.1%)	90 (45.9%)				
Marital Status	Others	15 (50.0%)	15 (50.0%)	0.82 (0.38-1.75)	0.615	0.79 (0.36-1.73)	0.559
	Currently Married	148 (54.8%)	122 (45.2%)				
SES	Lower	100 (52.9%)	89 (47.1%)	0.85 (0.53-1.37)	0.518	0.92 (0.56-1.50)	0.754
	Upper	63 (56.8%)	48 (43.2%)				
Family type	Joint/Extended	53 (50.0%)	53 (50.0%)	0.76 (0.47-1.22)	0.265	0.78 (0.48-1.28)	0.330
	Nuclear	110 (56.7%)	84 (43.3%)				
Dietary Diversity	Poor	138 (54.3%)	116 (45.7%)	0.99 (0.53-1.87)	0.998	0.96 (0.50-1.84)	0.923
	Good	25 (54.3%)	21 (45.7%)				
Physical Activity	Insufficient	101 (55.2%)	82 (44.8%)	1.09 (0.68-1.74)	0.709	1.18 (0.67-2.09)	0.555
	Sufficient	62 (53.0%)	55 (47.0%)				

There was no association found between overweight/obesity and socio-demographic factors, dietary diversity or physical activity (Table 6.5.6).

7. DISCUSSION

This cross-sectional survey on dietary diversity among rural women aged 30 to 45 years in Kaniyambadi block, Vellore, Tamil Nadu was conducted using the FAO model dietary diversity methodology and 24-hour diet recall. The study also looked at the prevalence of life style diseases, namely diabetes, hypertension and obesity among the same study participants who were not previously diagnosed to have diabetes or hypertension.

From this study we can see that 25% of the study population has studied till primary school and 8% were illiterate. This amounts to two-thirds of the participants having education higher than primary school, which is almost consistent with the rural female literacy rate of 64% in Tamil Nadu (49).

90% of the participants were currently married women. 35% of the participants were manual laborers. A large proportion of the study population (63%) was from the lower socioeconomic status, as per the BG Prasad classification.

The major findings from this study were the poor dietary diversity among women, with a low consumption of fruits and vegetables.

Dietary Diversity

This study found that only 15% of the women had a good dietary diversity, while major part of the participants (85%) had poor diversity, with a mean score of 3.51± 1.08.

Conversely, a study done in Ethiopia among pregnant women found a good dietary diversity among 61% of the study population (50). Another community-based cross sectional study done in Bangladesh among rural women found the mean DDS was 4.5 ± 1.1 (51); while a similar study done in West Bengal among men and women in rural as well as urban areas had a slightly more mean dietary diversity score of 6.28 ± 1.3 (52).

Dietary Diversity and Overweight/Obesity

The general assumption among nutritionists is that poor quality of food which is high in carbohydrate, saturated fats and oil intake, and less in vegetables, fruits and proteins, is one of the important factors causing increase in body adiposity and consequently leading to diseases like diabetes, hypertension and other cardiovascular diseases. But our study failed to show any association between poor quality diet and lifestyle diseases (OR 0.96; 95% CI of 0.50-1.84); one of the probable reasons being that the study population was from a rural area and so the quality of their diet is poor. However other studies and systematic reviews done to examine the association between dietary diversity and obesity outcomes have shown mixed or inconsistent results.

In one review including cross-sectional observational studies using food group count, 7 of 16 studies reported non-significant associations, 5 reported positive associations, and 4 reported inverse associations between dietary diversity scores and the prevalence of overweight and obesity (37). This review included a meta-analysis of 8 studies (with 6091 participants) showing no overall association between food group count and overweight or obesity (pooled OR 0.72; 95% CI of 0.45– 1.16).

Another review of cross-sectional observational studies evaluating associations between dietary diversity and measures of body adiposity in healthy adult populations showed mixed results (38), with 7 of 14 studies reporting non-significant associations, 3 reporting positive associations, and 4 reporting inverse associations between total dietary variety and adiposity. The same study reported that diet variety in recommended foods such as fruits, vegetables, and grains was inversely associated with body adiposity measures in some of the studies. In contrast, 6 of 9 studies reported positive associations between diet variety of non-recommended foods such as snacks and sweets and body adiposity (38). This suggests that there can be potential differences in associations of diverse diets for healthier versus less healthy foods. Evidence from cross-sectional studies is limited by the design itself, which allows no inference about the temporality of the relationships and could be influenced by reverse causation.

Two other observational studies were done among Chinese and US adults, of which the Chinese study done among adults aged 25-74 years reported that those with a greater diversity in intake of snacks (but not grains, vegetables, fruits, meats, or beverages), had a greater risk of being overweight (OR 1.45; 95% CI 1.06–1.98) compared with those reporting lower diversity in snack consumption (35); however the second study done in multiethnic US adults reported no significant association between total food count and change in abdominal obesity (36).

Yet another large prospective cohort study done among female registered U.S. nurses, to study the association between pre-pregnancy food-based dietary diversity scores and dietary quality scores and Gestational Diabetes Mellitus (GDM) and hypertensive disorders of pregnancy (HDP), showed that women having higher dietary diversity scores had higher BMI and consumed more potatoes, trans fat foods, refined grains and red meat (43).

Thus appropriately powered prospective investigations with careful consideration of relevant confounders and intermediate factors are needed to provide accurate assessment of relationships between dietary diversity and obesity end points.

Dietary diversity and diabetes

In our study after adjusting for confounders, it was found that among the study participants, those who were living in joint or extended families had a higher risk of having diabetes when compared to others who were part of nuclear families (OR 2.44, 95% CI 1.01-5.86). Also overweight or obese individuals had a higher risk of having diabetes when compared to those with a normal or low BMI (OR 4.01, 95% CI 1.44-11.12). This association may probably be explained by the fact that those women living in joint or extended families in rural areas may have an even poorer quality of diet as when compared to the other members in the house because of the number of heads she has to feed with limited resources. This may lead to inadvertent consumption of carbohydrate-rich foods (which are easily available in rural settings) causing an increase in BMI and in turn leading to lifestyle diseases such as diabetes and hypertension.

A study done in Chennai to examine the association of dietary carbohydrates and glycaemic load with the risk of type 2 diabetes among the urban adult population above 20 years of age found that refined grain intake was positively associated with the risk of type 2 diabetes [OR 5.31 (95 % CI of 2.98 - 9.45); P < 0.001]. After adjusting for potential confounders, total carbohydrate [OR 4.98 (95 % CI 2.69, 9.19), P < 0.001] and glycaemic load [OR 4.25 (95 % CI 2.33, 7.77); P < 0.001] were found to be associated with type 2 diabetes. Dietary fibre intake was inversely associated with diabetes [OR 0.31 (95 % CI

0.15, 0.62); P < 0.001]. The study concluded that total carbohydrate intake is associated with risk of diabetes (41).

Predominantly carbohydrate diets increase plasma glucose, insulin, triglycerides and non-esterified fatty acids which lead to insulin resistance (40).

Another study done among 600 Sri Lankan adults aged more than 18 years to explore association of diet diversity with obesity showed that participants who were obese and had abdominal obesity had a higher DDS compared to their non-obese and non-abdominally obese counterparts. A positive association between dietary diversity and calorie intake was seen, suggesting that consuming large number of food items may lead to excessive intake of calorie and in turn cause weight gain. A high prevalence of diabetes and its complications among Sri Lankan adults was found to be associated with starch-based meals with poor dietary variety (53).

A reduction in dietary variety of energy-rich and highly palatable foods may be an appropriate strategy to prevent and treat obesity and thereby halt the occurrence of diabetes, but at the same time, foods with low calories and high nutrients (green vegetables, low fat milk etc.) should be promoted to avoid nutrient deficiencies.

Dietary Diversity and Hypertension

Our study did not find an association between dietary diversity and hypertension (OR 0.60, 95% CI of 0.26-1.37). However a cross-sectional study done among adult residents of Saba Island, Netherlands found a significant association between a poorly diversified diet and hypertension (OR = 4.25, 95 percent CI = 1.47 - 12.30) (42).

In another large prospective cohort study done among female registered U.S. nurses, to study the association between pre-pregnancy food-based dietary diversity scores and dietary quality scores and Gestational Diabetes Mellitus (GDM) and hypertensive disorders of pregnancy (HDP), it was found that food-based dietary diversity scores (like MDD-W), did not predict conditions like GDM or HDPs. However, the dietary quality scores were found to be associated with a lower risk of GDM and a slightly lower risk of HDP which was partly accounted for by BMI. After pre-pregnancy BMI and family history of hypertension were adjusted for, in the U.S. study, the relationship between the dietary quality scores and hypertension was no longer significant (43).

Recent studies done in Australia (54) and Norway (55) recommend that strong adherence to a Mediterranean diet or prudent dietary patterns could help in reducing the occurrence of HDPs.

Our study did not find any association between dietary diversity and lifestyle diseases. This may probably be because the DDS does not account for the type of carbohydrate and fat consumed and it also favorably scores the various forms of animal protein sources. Therefore, inclusion of refined grains, red and processed meats, and saturated and trans fatty acids, which have been associated with increased risks of multiple chronic diseases may partly explain the null findings of the study with the DDS. Another possible explanation to this can be the nature of the study setting and the population in which they were tested in. The DDS may be executed better in severely under-resourced areas where dietary diversity implies achieving energy and nutrient adequacy among undernourished women of reproductive age and young children. Although in more food-abundant settings, the DDS may fail to fully differentiate between healthy and unhealthy food items, and may result in granting inappropriately high scores to certain individuals who consume ‘more of all foods’, including processed food items.

8. LIMITATIONS

1. The 24-hour dietary recall for each study participant was conducted only on one day and may not represent the usual diet of the participants.

2. Due to the short study duration, we were not able to assess the seasonal variation of dietary diversity among the participants.

3. The diversity score was limited by the fact that they were based on a simple yes/no for consumption on the previous day, regardless of the number of items consumed within a given food group, or the potential healthfulness of an item.

4. Recall bias could not be ruled out completely since dietary diversity was assessed based on responses obtained from participants recall, and this depended on memory and their ability to recall accurately.

9. SUMMARY AND CONCLUSION

The study found that only 15% of the study participants have a good dietary diversity and a large number of them (85%) do not reach to their adequate dietary diversity. The prevalence of lifestyle diseases in this previously undiagnosed study population was as follows; 8.7% newly detected to have diabetes, 18% newly detected to have hypertension 33.7% overweight and 20.7% obese. Those women involved in unskilled or skilled labor had a significant risk of having poor quality diet. Being part of a joint or extended family, and being overweight or obese had significant association with risk of developing diabetes. Being overweight or obese or having diabetes had a significant association with developing hypertension. This implies that women aged 30-45 years are at a high risk of developing NCDs like diabetes and hypertension due to poor quality of diet and because of being overweight or obese.

These findings support current public health recommendations encouraging consumption of all major food groups and also of different types of fruits, vegetables, and dairy products as part of a regular balanced diet.

Limited evidence suggests that dietary diversity may contribute to increased energy intake, suboptimal eating patterns, and weight gain in adult populations. Given the present state of the science on dietary diversity and the inadequate

data to inform recommendations on distinct aspects of dietary diversity that may be beneficial or detrimental to healthy weight, it is apt to encourage a healthy eating pattern which limits the consumption of red meats, sweets, and sugar-sweetened beverages, and emphasizes an adequate intake of protein sources, plant foods, low fat dairy products, nuts and vegetable oils.

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11. ANNEXURES

11.1 Information Sheet (English)

CHRISTIAN MEDICAL COLLEGE, VELLORE, INDIA

PATIENT INFORMATION SHEET

TITLE OF THE STUDY : A STUDY ON DIETARY DIVERSITY AMONG WOMEN OF AGE GROUP 30 TO 45 YEARS IN A RURAL SETTING OF TAMILNADU

We are doing a study on the diversity of diet of women in the age group of 30 to 45 years. We invite you to participate in this study. The following information is provided to inform you about this study and your participation in it. Please read this information carefully and feel free to ask any questions you may have about this study or about the information given below. You will be given a copy of this sheet and you will be given an opportunity to ask questions, and your questions will be answered. Your participation in this study is entirely voluntary and you are also free to withdraw from this study any time you wish. Your withdrawal will not affect any of your treatment or benefit you receive from our institution (CMC, Vellore and CHAD hospital)

1.What is the study about?

Different foods and food groups are good sources for various nutrients, so a diet which includes a variety of food groups ensures the adequacy of nutrients. Women are more likely to have poor nutrition because of decreased amount of food intake as they may eat lesser amounts in order that their family members can have sufficient food, and also because cultural practices and beliefs associated with consumption of various foods differ. Improper and inadequate dietary intake pattern in women result in the deficiency of essential nutrients posing threat to their physical, mental and social well-being. Hence their requirement of most nutrients are higher than that for adult men. This study will look at the diversity of diet that is the number of different food groups you have consumed over the last 24 hours, to know whether you are consuming a nutritious diet.

2.What will you have to do?

You will only have to answer few questions about the different foods you consume, what you know about different food groups and their health benefits, and about your physical activity.

We will also check your height, weight, blood pressure, and draw your blood sample for estimating your blood sugars.

3.Are there any risks for you if you take part in this study?

No, there are no risks of any kind if you take part in this study.

4.Do you have to pay?

No, you do not have to pay for the study. Your blood test will be done free of cost.

5.What are the benefits to you if you take part in the study?

The participant can expect to gain knowledge on what foods a diverse diet should include and how to eat right in order to prevent various nutrient deficiency disorders and long term lifestyle diseases.

6.Can you decide not to participate?

Your participation in this study is entirely voluntary and you are also free to withdraw from this study any time you wish.

7. Will there be any compensation for participation?

We will not be giving you money to answer questions or to be a part of this study.

8.Will your personal details be kept confidential?

The results of this study may be published in a medical journal, but you will not be identified by name in any publication or presentation of results. However, the questionnaire you fill up may be reviewed by people associated with the study, without your additional permission, should you decide to participate in this study.

Contact Information:

If you have any questions about this study, please feel free to contact:

[redacted] Department of community health, CMC Vellore.

Email Id: [redacted] ntact no - [redacted]

11.2 Information Sheet (Tamil)

CHRISTIAN MEDICAL COLLEGE, VELLORE, INDIA

தகவல் தாள்

ஆய்வுக்கான தலைப்பு: 30 முதல் 45 வயதுக்குட்பட்ட பெண்கள் மத்தியில் உணவு பிரிவில் உள்ள வேறுபாடுகள் பற்றி தமிழ்நாட்டில் ஒரு கிராமப்பகுதியில் நடத்தப்படுகின்ற ஆய்வு

நாங்கள் 30 முதல் 45 வயது வரையிலான பெண்களின் உணவுத்தன்மை மற்றும் வேறுபாடு பற்றி ஒரு ஆய்வு செய்கிறோம். இந்த ஆய்வில் பங்கேற்ற உங்களை வரவேற்கிறோம். இந்த ஆய்வு மற்றும் அதில் உங்கள் பங்கு பற்றி உங்களுக்கு தெரிவிக்க பின்வரும் தகவல்கள் வழங்கப்படுகின்றன. தயவுசெய்து இந்த தகவலை கவனமாக வாசித்து, இந்த ஆய்வு மற்றும் உங்களிடம் கொடுக்கப்பட்டுள்ள தகவல்களைப் பற்றி உங்களுக்கு உள்ள எல்லா கேள்விகளையும் கேட்க தயங்காதீர்கள். இநதத் தாள் உங்களுக்கு வழங்கப்படும்போது நீங்கள் உங்கள் கேள்விகளைக் கேட்க வாய்ப்பளிக்கப்படுவீர்கள். உங்கள் கேள்விகளுக்கு தகுந்த பதில் அளிக்கப்படும். இந்த ஆய்வில் நீங்கள் பங்குபெறுவது முற்றிலும் உங்கள் சுயவிருப்பமே. மேலும் நீங்கள் விரும்பும் எந்த நேரத்திலும் இந்த ஆய்விலிருந்து விலகலாம். நீங்கள் இந்த ஆய்விலிருந்து விலகினால் உங்களின் சிகிச்சை மற்றும் எங்கள் மருத்துவமனை மூலம் வரும் நன்மைகளில் எந்தவொரு மாற்றமும் ஏற்படாது. (CMC, வேலூர் மற்றும் CHAD மருத்துவமனை).

1. இந்த ஆய்வின் நோக்கம் என்ன?

வெவ்வேறு உணவுகள் மற்றும் கூட்டு உணவுகள் பல்வேறு ஊட்டச்சத்துக்களுக்கான நல்ல ஆதாரபொருட்களாக இருக்கின்னறன. எனவே பல்வேறு உணவு வகைகள் உள்ளடக்கிய ஒரு உணவு, போதுமான ஊட்டச்சத்துகள் நிறைந்தாக உள்ளது. குறைந்த அளவு உணவு கொள்ளுதல் மற்றும் சத்துகுறைவு உள்ள உணவுகளை உண்பதே பெண்களுக்கு ஊட்டச்சத்து குறைபாடு வருவதின் காரணம். போதுமான மற்றும் சரிநிலை இல்லாத உணவு பழக்கத்தால் பெண்களுக்கு உணவுசத்து குறைபாடுகள் வந்து அவர்களுடைய உடல், மனநிலை மற்றும் சமூகநிலையை பாதிக்கின்றது. ஆகவே, ஆண்களைவிட பெண்களின் உணவு சத்து தேவைகள் அதிகமாக உள்ளது. இந்த ஆய்வில் நீங்கள் 24 மணி நேரத்தில் உட்கொண்ட பலதரப்பட்ட உணவுவகைகள் பற்றி கண்டறிந்து நீங்கள் சரிவிகித உணவை உட்கொள்கின்றீரா என்று கண்டறிவோம்.

2. நீங்கள் செய்யவேண்டியது என்ன?

நீங்கள் சாப்பிடும் வெவ்வேறு உணவுகள், உணவுவகைகளைப் பற்றி உங்களுக்கு தெரிந்தவை மற்றும் உங்கள் உடற்பயிற்சி பற்றிய காரியங்களைப்பற்றி சில கேள்விகளுக்கு நீங்கள் பதிலளிக்க வேண்டும். உங்களுடைய உயரம், எடை, இரத்தஅழுத்தம் மற்றும் இரத்தத்தில் சர்க்கரை அளவு ஆகியவை பார்க்கப்படும். இரத்ததில் சர்க்கரை பார்க்க சிறிது இரத்தம் எடுக்கப்படும்.

3. நீங்கள் இந்த ஆய்வில் பங்கேற்பதினால் உங்களுக்கு ஏதேனும் ஆபத்துஉள்ளதா?

இல்லவே இல்லை. எந்தவித பாதிப்பும் இதில் பங்கேற்பதினால் இல்லை.

4. இந்த ஆய்வில் பங்கேற்க நீங்கள் பணம் செலுத்தவேண்டுமா?

இல்லவே இல்லை. இரத்தப்பரிசோதனை இலவசமாக செய்யப்படும்.

5. நீங்கள் படிப்பில் பங்கு பெற்றால் என்ன நன்மை கிடைக்கும்?

பல்வேறு ஊட்டச்சத்து குறைபாடுகள் மற்றும் நீண்டகால வாழ்க்கைமுறை நோய்களைத் தடுக்க வழிமுறைகள், உணவு உட்கொள்ளும் முறைகள் ஆகியவற்றைப் பற்றிய அறிவைப் பங்கேற்பாளர்கள் பெறுவார்கள்.

6. இந்த ஆய்வில் பங்கேற்க வேண்டாம் என்று முடிவு செய்யலாமா?

இந்த ஆய்வில் நீங்கள் பங்குபெறுவது முற்றிலும் உங்கள் சுயவிருப்பம். மேலும் நீங்கள் விரும்பும் எந்தநேரத்திலும் இந்த ஆய்விலிருந்து விலகுவதற்கு சுதந்திரம் உள்ளது.

7. இந்த ஆய்வில் பங்கேற்றால் பணம் தரப்படுமா?

கேள்விகளுக்கு பதிலளிக்க அல்லது இந்த ஆய்வின் ஒரு பகுதியாக இருக்க உங்களுக்கு பணம் தரப்படமாட்டாது.

8, உங்கள் தனிப்பட்ட விவரங்கள் இரகசியமாக வைக்கப்படுமா?

இந்த ஆய்வின் முடிவுகள் மருத்துவ இதழில் வெளியிடப்படலாம். ஆனால் முடிவுகளின் வெளியீடு அல்லது விளக்ககாட்சியில் உங்கள் பெயரை நீங்கள் அடையாளம் காண முடியாது. ஆயினும் இந்த ஆய்வில் உள்ள கேள்வித்தாளை, உங்கள் அனுமதியின்றி ஆய்வுடன் தொடர்புடைய நபர்களால் மதிப்பாய்வு செய்யப்படலாம்.

உங்களுக்கு ஏதாவது கேள்விகள் இருந்தால், தயவுசெய்து தொடர்பு கொள்ளவும்.

தொடர்புக்கு
டாக்டர் [redacted]
CHAD, CMC, VELLORE.
மின்னஞ்சல் முகவரி: [redacted]

அலைபேசி எண் – [redacted]

11.3 Informed Consent (English)

CHRISTIAN MEDICAL COLLEGE VELLORE INDIA

INFORMED CONSENT FORM TO PARTICIPATE IN A RESEARCH STUDY

Study Title: A STUDY ON DIETARY DIVERSITY AMONG WOMEN OF AGE GROUP 30 TO 45 YEARS IN A RURAL SETTING OF TAMILNADU

Study Number: _____

Subject's Initials: _____

Subject's Name:_____

Date of Birth / Age: _____

(i) I confirm that I have read and understood the information sheet dated _____ for the above study and have had the opportunity to ask questions. [ ]

(ii) I understand that my participation in the study is voluntary and that I am free to withdraw at any time, without giving any reason, without my medical care or legal rights being affected. [ ]

(iii) I understand that the lead investigator , the Ethics Committee and the regulatory authorities

will not need my permission to look at my health records both in respect of the current study and any further research that may be conducted in relation to it, even if I withdraw from the trial. I agree to this access. However, I understand that my identity will not be revealed in any information released to third parties or published. [ ]

(iv) I agree not to restrict the use of any data or results that arise from this study provided such a use is only for scientific purpose(s). [ ]

(v) I agree to take part in the above study. [ ]

Signature (or Thumb impression) of the Subject/Legally Acceptable

Date: _____/_____/_____

Signatory's Name: _____

Signature:

or

Representative: _____

Date: _____/_____/_____

Signatory's Name: _____

Signature of the Investigator: _____

Date: _____/_____/_____

Study Investigator's Name: _____

Signature or thumb impression of the Witness: _____

Date: _____/_____/_____

Name & Address of the Witness: _____

11.4 Informed Consent (Tamil)

CHRISTIAN MEDICAL COLLEGE, VELLORE, INDIA

ஆய்வில் பங்கேற்பதற்கான படிவம்

ஆய்வுக்கான தலைப்பு: 30 முதல் 45 வயதுக்குட்பட்ட பெண்கள் மத்தியில் உணவு பிரிவில் உள்ள வேறுபாடுகள் பற்றி தமிழ்நாட்டில் ஒரு கிராமப்பகுதியில் நடத்தப்படுகின்ற ஆய்வு

எண் _____

பெயர்_____

பிறந்த தேதி / வயது _____

i) மேற்கூறிய ஆய்வுக்காக _____ தேதியிட்ட தகவல்தாளை நான் படித்து புரிந்து கொண்டேன் என்பதை உறுதிப்படுத்துகிறேன் மற்றும ஆய்வு பற்றி கேள்விகளைக் கேட்பதற்கான வாய்ப்பு இருந்தது.

ii) ஆய்வில் எனது பங்களிப்பு தன்னார்வமாக உள்ளது என்பதையும் நான் எந்த நேரத்திலும் என் மருத்துவப்பாதுகாப்பு அல்லது சட்ட உரிமைகள் பாதிக்கப்படாமல், எந்தவொரு காரணமும் இல்லாமல் இந்த ஆய்வில் இருந்து விலகி விடுவதற்கு எனக்கு சுதந்திரம் உண்டு என்பதை புரிந்துகொண்டேன்.

iii) இந்த ஆய்வின் நோக்கம் மற்றும் அதனுடன் தொடர்புடைய எந்தவொரு ஆராய்ச்சிக்காகவும் எனது சுகாதார பதிவேடுகளை ஆராயும் முன்னணி புலனாய்வாளர்கள், ஒழுக்கவியல் குழு மற்றும் ஒழுங்குமுறை அதிகாரிகளுக்கு எனது அனுமதி தேவையில்லை என்று புரிந்து கொள்கிறேன். நான் பின்வாங்கினாலும் இது உண்மை என்று உணர்கிறேன். இருப்பினும், மூன்றாம் தரப்பினருக்கு வெளியிடப்பட்ட தகவல்கள் அல்லது கட்டுரைகளில் வெளியிடப்பட்ட தகவல்களில் எனது பெயர் வெளியிடப்படாது என்பதையும் நான் புரிந்துகொண்டேன்.

iv) விஞ்ஞான நோக்கத்துடன் பயன்படுத்தப்பட்டு வரும் இந்த ஆய்விலிருந்து எழும் எந்தவொரு தரவு அல்லது முடிவுகளின் பயன்பாட்டை நான் கட்டுபடுத்தமாட்டேன் என்று ஒப்புக்கொள்கிறேன்.

v) மேலே உள்ள ஆய்வில் பங்கேற்க நான் ஒப்புக்கொள்கிறேன்.

சட்டபூர்வமாக ஏற்றுக்கொள்ளப்பட்ட கையொப்பம் (அல்லது கை முத்திரை)

தேதி ___/___/_____

கையொப்பமிட்டவரின் பெயர்_____

கையொப்பம்

அல்லது

பிரதிநிதி_____

தேதி ___/___/_____

கையொப்பமிட்டவரின் பெயர்_____

ஆராய்ச்சியாளரின் கையொப்பம:_____

தேதி ___/___/_____

ஆய்வு ஆராய்ச்சியாளரின் பெயர்:_____

சுாட்சியின் கையொப்பம அல்லது கை ரேகை:_____

தேதி ___/___/_____

சாட்சியின் பெயர் மற்றும் முகவரி:_____

11.5 Structured Questionnaire (English)

A STUDY ON DIETARY DIVERSITY AMONG WOMEN OF AGE GROUP 30 TO 45 YEARS IN A RURAL SETTING OF TAMIL NADU

QUESTIONNAIRE

IRB NO ☐ DEPARTMENT ☐ VILLAGE ☐ SUBJECT ID ☐

DATE OF COLLECTION

☐☐☐☐ ☐☐ ☐☐

Y Y Y Y M M D D

DEMOGRAPHGIC DETAILS:

AGE: _____ years

WEIGHT: _____ kg HEIGHT: _____ cm

MARITAL STATUS: _____

HUSBAND'S AGE: _____ years

AGE AT MARRIAGE: _____ years

AGE OF HUSBAND AT MARRIAGE: _____ years

AGE AT FIRST CHILDBIRTH: _____ years

NO. OF CHILDREN: _____

OCCUPATION OF SELF: _____

HIGHEST LEVEL OF EDUCATION OF SELF : _____

HUSBAND'S OCCUPATION: _____

HUSBAND'S EDUCATION: _____

MONTHLY INCOME: Rs. _____

TYPE OF FAMILY ☐ NUCLEAR ☐ EXTENDED

TYPE OF HOUSE ☐ KATCHA ☐ PAKKA

SOCIO ECONOMIC STATUS: _____

INVESTIGATION:

HBA1C: ☐ %

BLOOD PRESSURE: ☐ mmHg

MDD-W QUESTIONAIRRE BASED ON FAO AND FHI 360. 2016. MINIMUM DIETARY DIVERSITY FOR WOMEN: A GUIDE FOR MEASUREMENT. ROME: FAO.

	Food Category	Description	Consumed	Quantity	Frequency		
					Daily	Weekly (1/2/3)	Monthly (1/2/3)
A	**Foods made from grains**	Rice, chappathi, bread, noodles,	___ yes (1) ___ no (0)				
B	**White roots and tubers and plantains**	White potatoes, white yams, tubers, plantains	___ yes (1) ___ no (0)				
C	**Pulses (beans, peas and lentils)**	Beans, peas, lentils, gram, soybeans	___ yes (1) ___ no (0)				
D	**Nuts and seeds**	Groundnut, peanut, walnut, certain seeds	___ yes (1) ___ no (0)				
E	**Milk and milk products**	Milk, cheese, curd or other milk products (NOT including butter, ice cream, cream or sour cream)	___ yes (1) ___ no (0)				
F	**Organ meat**	Liver, kidney, heart or other organ meats or blood-based foods	___ yes (1) ___ no (0)				
G	**Meat and poultry**	Beef, pork, lamb, goat, rabbit, chicken, duck or other birds	___ yes (1) ___ no (0)				
H	**Fish and seafood**	Fresh or dried fish, shellfish or seafood	___ yes (1) ___ no (0)				
I	**Eggs**	Eggs from poultry or any other bird	___ yes (1) ___ no (0)				
J	**Dark green leafy vegetables**	Any medium-to-dark green leafy vegetables, including leaves	___ yes (1) ___ no (0)				
K	**Vitamin A-rich vegetables, roots and tubers**	Pumpkin, carrots, sweet potatoes, yam, tapioca	___ yes (1) ___ no (0)				
L	**Vitamin A-rich fruits**	Ripe mango, ripe papaya, apricot	___ yes (1)				

			___ no (0)				
M	**Other vegetables**	Cauliflower, ladies finger, brinjal	___ yes (1) ___ no (0)				
N	**Other fruits**	Orange, lemon, melon	___ yes (1) ___ no (0)				

Optional:							
	Food categories	**Description/examples to be adapted**	**Consumed** Yes = 1 No= 0	**Quantity**	**Frequency**		
					Daily	Weekly (1/2/3)	Monthly (1/2/3)
O	**Insects and other small protein foods**	Insects, insect larvae, insect eggs, sea snails	___ yes (1) ___ no (0)				
P	**Red palm oil**	Red palm oil	___ yes (1) ___ no (0)				
Q	**Other oils and fats**	Oil; fats or butter added to food or used for cooking, including extracted oils from nuts, fruits and seeds; and all animal fat	___ yes (1) ___ no (0)				
R	**Savoury and fried snacks**	Crisps and chips, fried dough or other fried snacks	___ yes (1) ___ no (0)				
S	**Sweets**	Sugary foods, such as chocolates, candies, cookies/sweet biscuits and cakes, sweet pastries or ice cream	___ yes (1) ___ no (0)				
T	**Sugar-sweetened beverages**	Sweetened fruit juices and "juice drinks", soft drinks/fizzy drinks, chocolate drinks, malt drinks, yoghurt drinks or sweet tea or coffee with sugar	___ yes (1) ___ no (0)				

A STUDY ON DIETARY DIVERSITY AMONG WOMEN OF AGE GROUP 30 TO 45 YEARS IN A RURAL SETTING OF TAMIL NADU

Required							
	Food categories	**Description**	**Consumed**	**Quantity**	**Frequency**		
					Daily	Weekly (1/2/3)	Monthly (1/2/3)
U	**Condiments and seasonings**	Chilies, spices, herbs, fish powder, tomato paste, flavour cubes or seeds	___ yes (1) ___ no (0)				
V	**Other beverages and foods[a] (optionally, specify if not listed)**	Tea or coffee if not sweetened, clear broth, alcohol Pickles, olives and similar	___ yes (1) ___ no (0)				

AGGREGATION OF ITEMS IN QUESTIONNAIRE TO CONSTRUCT MDD-W FOOD GROUPS

Groups/items/rows on questionnaire[22]		**10 food groups in MDD-W**	**SCORE**
A. B.	Foods made from grains White roots and tubers and plantains	Grains, white roots and tubers, and plantains	
C.	Pulses (beans, peas and lentils)	Pulses (beans, peas and lentils)	
D.	Nuts and seeds	Nuts and seeds	
E.	Milk and milk products	Dairy	
F. G. H.	Organ meat Meat and poultry Fish and seafood	Meat, poultry and fish	
I.	Eggs	Eggs	
J.	Dark green leafy vegetables	Dark green leafy vegetables	
K. L.	Vitamin A-rich vegetables, roots and tubers Vitamin A-rich fruits	Other vitamin A-rich fruits and vegetables	
M.	Other vegetables	Other vegetables	
N.	Other fruits	Other fruits	

TOTAL SCORE ____

MORE THAN OR EQUAL TO 5 ☐ 1. YES 2. NO

LESS THAN 5 ☐ 1. YES 2. NO

PHYSICAL ACTIVITY QUESTIONNAIRE
(From the Global Physical Activity Questionnaire)

1. Does your work involve :
   a) Vigorous-intensity activity that causes large increases in breathing or heart rate like [carrying or lifting heavy loads, digging or construction work] for at least 10 minutes continuously? ___YES ___ NO
   b) Moderate-intensity activity, that causes small increases in breathing or heart rate such as brisk walking [or carrying light loads] for at least 10 minutes continuously? ___YES ___NO

2. In a typical week, on how many days do you do these activities as part of your work? _____

3. How much time do you spend doing these activities at work on a typical day? _____hours : ____minutes

4. Do you walk or use a bicycle for at least 10 minutes continuously to get to and from places? ____ YES ____NO

5. In a typical week, on how many days do you walk or bicycle for at least 10 minutes continuously to get to and from places? _____

6. How much time do you spend walking or bicycling for travel on a typical day? _____hours : _____minutes

7. Do you do any sports, fitness or recreational (leisure) activities that cause a small increase in breathing or heart rate such as brisk walking, [cycling, swimming, volleyball] for at least 10 minutes continuously? ____YES ____NO

8. In a typical week, on how many days do you do sports, fitness or recreational (leisure) activities? _____

9. How much time do you spend doing sports, fitness or recreational (leisure) activities on a typical day? ____hours : ____minutes

10. How much time do you usually spend sitting or reclining on a typical day? ____hours : ____minutes

11.6 Structured Questionnaire (Tamil)

30 முதல் 45 வயதுக்குட்பட்ட பெண்கள் மத்தியில் உணவு பிரிவில் உள்ள வேறுபாடுகள் பற்றி தமிழ்நாட்டில் ஒரு ஊரகப்பகுதில் நடத்தப்படுகின்ற ஆய்வு

கேள்வித்தாளை

IRB எண் ☐ துறை ☐ கிராமம் ☐

பங்கேற்பாளர் எண் ☐

சேகரிப்பு தேதி ☐

பங்குபெறுபவர்க்குறித்த விவரங்கள்:

வயது: ____ ஆண்டுகள்

எடை

உயரம்

திருமண நிலை

கணவரின் வயது: ____ஆண்டுகள்

திருமணத்தின் போது வயது:_____ஆண்டுகள்

திருமணத்தின் போது கணவன் வயது: _____ ஆண்டுகள்

முதல் குழந்தை பிறந்த போது வயது: _____ ஆண்டுகள்

குழந்தைகளின் எண்ணிக்கை

தொழில்:

நிறைவு கல்வி

கணவரின் வேலை

கணவரின் கல்வி

மாத வருமானம்

குடும்பம் ☐ தனிக்குடும்பம் ☐ குழு குடும்பம்

வீட்டின் அமைப்பு ☐ கட்சா வீடு ☐ பக்கா வீடு

சமூக பொருளாதார நிலை

30 முதல் 45 வயதுக்குட்பட்ட பெண்கள் மத்தியில் உணவு பிரிவில் உள்ள வேறுபாடுகள் பற்றி தமிழ்நாட்டில் ஒரு ஊரகப்பகுதில் நடத்தப்படுகின்ற ஆய்வு

பரிசோதனை முடிவுகள்

HBA1C:

இரத்த அழுத்தம் mm/hg

MDD-W **கேள்வித்தாள்** FAO மற்றும் FHI 360 அடிப்படையிலானது. 2016. **பெண்களின்** குறைந்தபட்ச உணவு வேறுபாடு: அளவீட்டுக்கான ஒரு வழிகாட்டி. ரோம்:FAO

	உணவு வகை	விளக்கம்	சாப்பிட்டேன் ஆம்- 1, இல்லை- 0	தினசரி	வாராந்திர (1/2/3)	மாதாந்திர (1/2/3)
A	தானியங்களில் இருந்து தயாரிக்க படும் உணவுகள்	அரிசி, சப்பாத்தி, ரொட்டி, நூடுல்ஸ்	ஆம்(1) இல்லை(0)			
B	வெள்ளை வேர்கள், கிழங்குகளும் மற்றும் தாவரங்கள்	வெள்ளை உருளைக்கிழங்கு, வெள்ளை சாம்பல், கிழங்குகளும், தாவரங்களும்	ஆம்(1) இல்லை(0)			
C	பருப்பு வகைகள் (பீன்ஸ், பட்டாணி மற்றும் பருப்புகள்)	பீன்ஸ், பட்டாணி, பருப்புகள், கிராம், சோயா பீன்ஸ்	ஆம்(1) இல்லை(0)			
D	கொட்டைகள் மற்றும் விதைகள்	நிலக்கடலை, வேர்க்கடலை, வாதுமை கொட்டை, மற்ற விதைகள்	ஆம்(1) இல்லை(0)			
E	பால் மற்றும் பால் பொருட்கள்	பால், சீஸ், தயிர் அல்லது மற்ற பால் பொருட்கள்	ஆம்(1)			

		(வெண்ணெய், ஐஸ் கிரீம் உட்பட, கிரீம் அல்லது புளிப்பு கிரீம்)	இல்லை(0)			
F	இறைச்சி	கல்லீரல், சிறுநீரகம், இதயம் அல்லது இரத்தம் சார்ந்த உணவு	- ஆம் (1) - இல்லை (0)	-	-	-
G	இறைச்சி மற்றும் கோழி	மாட்டிறைச்சி, பன்றி இறைச்சி, ஆட்டு இறைச்சி, வெள்ளாடு, முயல், கோழி, வாத்து அல்லது மற்ற பறவைகள்	- ஆம் (1) - இல்லை (0)			
H	மீன் மற்றும் கடல் உணவு	வறுத்த அல்லது உலர்ந்த மீன்கள், மட்டி அல்லது கடல் உணவு	- ஆம் (1) - இல்லை (0)	-	-	-
I	முட்டைகள்	கோழி பண்ணையில் இருந்து கிடைக்கும் முட்டைகள் அல்லது பிற பறவைகள்	- ஆம் (1) - இல்லை (0)	-	-	-
J	கரும் பச்சை இலை காய்கறிகள்	ஏதாகிலும் சராசரி இல் இருந்தது கரும் பச்சை இலை காய்கறிகள், இலைகளும் உட்பட	- ஆம் (1) - இல்லை (0)	-	-	-
K	வைட்டமின் எ - நிறைந்த காய்கறிகள், வேர்கள் மற்றும் கிழங்குகளும்	பூசணி, கேரட், இனிப்பு உருளைக்கிழங்கு, கருணை கிழங்கு, மரவள்ளிக்கிழங்கு	- ஆம் (1) - இல்லை (0	-	-	-
L	வைட்டமின் எ - நிறைந்த	பழுத்த மாம்பழம், பழுத்த பப்பாளி,	- ஆம் (1) - இல்லை	-	-	-

30 முதல் 45 வயதுக்குட்பட்ட பெண்கள் மத்தியில் உணவு பிரிவில் உள்ள வேறுபாடுகள் பற்றி தமிழ்நாட்டில் ஒரு ஊரகப்பகுதில் நடத்தப்படுகின்ற ஆய்வு

	பழங்கள்	பாதாமி	(0			
M	மற்ற காய்கறிகள்	காலிஃபிளவர், வெண்டைக்காய், கத்திரிக்காய்	- ஆம் (1) - இல்லை (0	-	-	-
N	மற்ற பழங்கள்	ஆரஞ்சு, எலுமிச்சை, முலாம்பழம்	- ஆம் (1) - இல்லை (0)	-	-	-
கட்டாயமற்ற						
	உணவு வகை	விளக்கம்	சாப்பிட்டேன் ஆம்- 1, இல்லை- 0			
O	பூச்சிகள் மற்றும் பிற சிறிய புரத உணவுகள்	பூச்சிகள், பூச்சி லார்வாக்கள், பூச்சி முட்டை, கடல் நத்தைகள்	- ஆம் (1) - இல்லை (0)	-	-	-
P	சிவப்பு பனை எண்ணெய்	சிவப்பு பனை எண்ணெய்	- ஆம் (1) - இல்லை (0)	-	-	-
Q	மற்ற எண்ணெய்கள் மற்றும் கொழுப்புகள்	எண்ணெய்கள், கொழுப்பு அல்லது வெண்ணெய் உணவுக்கு அல்லது சமையலுக்கு பயன்படுத்தப்படுகிறது கொட்டைகள், பழங்கள் மற்றும் விதைகள் இருந்து பிரித்தெடுத்த எண்ணெய் உட்பட;	- ஆம் (1) - இல்லை (0)	-	-	-
R	தின்பண்டங்கள்	எண்ணெய் பலகாரங்கள்	- ஆம் (1) - இல்லை (0)	-	-	-

S	இனிப்பு வகைகள்	கேக் , பிஸ்கட் , ஐஸ் கிரீம்	- ஆம் (1) - இல்லை (0)	-	-	-
T	சர்க்கரை சேர்க்கப்பட்ட பானங்கள்	காபி மற்றும் டீ (சர்க்கரை சேர்த்து), பிரூய்ட் ஜூஸ், குளிர் பானங்கள்	- ஆம் (1) - இல்லை (0)	-	-	-
தேவை						
U	சுவையூட்டும் **உணவு சேர்க்கைகள்**	வாசனைக்கு சிறிய அளவுகளில் பயன்படுத்தப்படும் பொருட்கள். மிளகாய் மசாலா, மூலிகைகள், மீன் பொடி, தக்காளி விழுது, சுவை க்யூப்ஸ் அல்லது விதைகள் போன்றவை	- ஆம் (1) - இல்லை (0)	-	-	-
V	மற்ற பானங்கள் மற்றும் உணவுகள்	டீ அல்லது காபி, தெளிவான குழம்பு, மது ஊறுகாய், ஆலிவ் மற்றும் ஒத்த வகைகள்	- ஆம் (1) - இல்லை (0)	-	-	-

மேற்கண்ட உணவு பொருட்களை , சேர்த்து உணவு குழுக்களாக சேர்க்கும் படிவம்

கேள்வித்தாளில் உள்ள உணவுகள் மற்றும் குழுக்கள்		10 உணவு குழுக்கள்- MDD-W	SCORE
A	தானியங்களில் இருந்து தயாரிக்க படும் உணவுகள்	தானியங்கள் , வெள்ளை வேர்கள், கிழங்குகளும் மற்றும் தாவரங்கள்	
B	வெள்ளை வேர்கள், கிழங்குகளும் மற்றும்		

30 முதல் 45 வயதுக்குட்பட்ட பெண்கள் மத்தியில் உணவு பிரிவில் உள்ள வேறுபாடுகள் பற்றி தமிழ்நாட்டில் ஒரு ஊரகப்பகுதில் நடத்தப்படுகின்ற ஆய்வு

	தாவரங்கள்		
C	பருப்பு வகைகள் (பீன்ஸ், பட்டாணி மற்றும் பருப்புகள்)	பருப்பு வகைகள் (பீன்ஸ், பட்டாணி மற்றும் பருப்புகள்)	
D	கொட்டைகள் மற்றும் விதைகள்	கொட்டைகள் மற்றும் விதைகள்	
E	பால் மற்றும் பால் பொருட்கள்	பால் வகைகள்	
F G H	இறைச்சி இறைச்சி மற்றும் கோழி மீன் மற்றும் கடல் உணவு	 இறைச்சி , கோழி மற்றும் மீன்	
I	முட்டைகள்	முட்டைகள்	
J	கரும் பச்சை இலை காய்கறிகள்	கரும் பச்சை இலை காய்கறிகள்	
K L	வைட்டமின் எ - நிறைந்த காய்கறிகள், வேர்கள் மற்றும் கிழங்குகளும் வைட்டமின் எ - நிறைந்த பழங்கள்	இதர வைட்டமின் A அதிகம் உள்ள கனிகள் மற்றும் காய்கறிகள்	
M	மற்ற காய்கறிகள்	மற்ற காய்கறிகள்	
N	மற்ற பழங்கள்	மற்ற பழங்கள்	

மொத்த மதிப்பெண் _____

5 அல்லது 5க்கு மேல். 1.YES 2.NO

5 க்கு கீழ் 1.YES 2.NO

30 முதல் 45 வயதுக்குட்பட்ட பெண்கள் மத்தியில் உணவு பிரிவில் உள்ள வேறுபாடுகள் பற்றி தமிழ்நாட்டில் ஒரு ஊரகப்பகுதில் நடத்தப்படுகின்ற ஆய்வு

உடல்செயல் திறன்

(குளோபல் பிஸிக்கல் அக்டிவிட்டி கேள்வித்தாள்)

1. உங்களுடைய வேலையில்

A. குறைந்த பட்சம் 10 நிமிடங்கள் மேல் தொடர்ந்து மிக தீவிரமான (மூச்சு அதிகம் வாங்குதல் , படபடப்பு ,அதிக வேர்வை) வேலை (அதிகமான எடை உள்ள பொருட்கள் தூக்குதல் மற்றும் எடுத்து செலுத்தல் , கட்டிட பணி போன்றவைகள்) செய்வீர்களா

ஆம் இல்லை

B.குறைந்த பட்சம் 10 நிமிடங்கள் மேல் தொடர்ந்து மித தீவிரமான (லேசான மூச்சு மற்றும் படபடப்பு)வேலை (வேகமாய் நடத்தல் , மிதமான பளு எடுத்து செல்லுதல்) செய்வீர்களா

ஆம். இல்லை

2.ஒரு வாரத்தில் எத்தனை நாட்கள் மேலே குறிப்பிடபட்ட செயல்களை செய்வீர்கள் ?

_____

3. ஒரு நாளில் மேல் குறிப்பிடபட்ட செயல்களை எவ்வளவு நேரம் செய்வீர்கள் ?

___ மணி ___ நிமிடங்கள்

4. நீங்கள் ஓர் இடத்திற்கு செல்லும்போது 10 நிமிடங்கள் மேல் நடந்து செல்லவோ அல்லது சைக்கிள் பயன்படுத்துவீர்களா ?

ஆம் இல்லை.

5. ஒரு வாரத்தில் எத்தனை முறை ஒரு இடத்திற்கு செல்வதற்கு 10 நிமிடங்கள் மேல் நடப்பீர்கள் அல்லது சைக்கிள் பயன்படுவீர்கள் ?

_____

6. ஒரு நாளில் எவ்வளவு நேரம் நடப்பீர்கள் அல்லது சைக்கிள் உபயோகிப்பீர்கள் ?

ஆம் இல்லை.

30 முதல் 45 வயதுக்குட்பட்ட பெண்கள் மத்தியில் உணவு பிரிவில் உள்ள வேறுபாடுகள் பற்றி தமிழ்நாட்டில் ஒரு ஊரகப்பகுதில் நடத்தப்படுகின்ற ஆய்வு

7. நீங்கள் ஏதேனும் விளையாட்டு , உடற்பயிற்சி அல்லது பொழுது போக்கு காரியங்களில் 10 நிமிடங்கள் மேல் ஈடுபடுகிறீர்களா ?

ஆம் இல்லை.

8.ஒரு வாரத்தில் எத்தனை நாள் மேல் கூறிய காரியங்களில் ஈடுபடுகிறீர்கள் ?

_____

9. ஒரு நாளில் எவ்வளவு நேரம் விளையாட்டு , உடற்பயிற்சி அல்லது பொழுது போக்கு காரியங்களில் ஈடுபடுகிறீர்கள் ?

___ மணி ___ நிமிடங்கள்

10. நீங்கள் ஒரு நாளில் எவ்வளவு நேரம் அமர்ந்தோ அல்லது ஓய்வு எடுத்து கொண்டோ இருப்பீர்கள் ?

___ மணி ___ நிமிடங்கள்

11.7: IRB Approval Letter

OFFICE OF RESEARCH
INSTITUTIONAL REVIEW BOARD (IRB)
CHRISTIAN MEDICAL COLLEGE, VELLORE, INDIA

Dr. B.J. Prashantham, M.A., M.A., Dr. Min (Clinical)
Director, Christian Counseling Center,
Chairperson, Ethics Committee.

Dr. Anna Benjamin Pulimood, M.B.B.S., MD., Ph.D.,
Chairperson, Research Committee & Principal

Dr. Biju George, M.B.B.S., MD., DM.,
Deputy Chairperson,
Secretary, Ethics Committee, IRB
Additional Vice-Principal (Research)

March 22, 2019

Dr. [redacted],
Post Graduate Registrar
Department of Community Health,
Christian Medical College,
Vellore – 632 002.

Sub: **Fluid Research Grant: New Proposal:**
A study on dietary diversity among women of age group 30 to 45 years in a rural setting of Tamil Nadu.

Dr. [redacted] Emp No [redacted], Post Graduate Registrar, Community Health, Dr. Jasmine Helan Prasad, Employment Number: 20080, Community Health, S. Janani Iswarya, Employment Number: 32056, Clinical Biochemistry.

Ref: IRB Min. No. 11562 [OBSERVE] dated 01.10.2018,

I enclose the following documents:-

1. Institutional Review Board approval 2. Agreement

Could you please sign the agreement and send it to Dr. Biju George, Addl. Vice Principal (Research), so that the grant money can be released.

With best wishes,

Dr. Biju George
Secretary (Ethics Committee)
Institutional Review Board

Dr. BIJU GEORGE
MBBS., MD., DM.
SECRETARY - (ETHICS COMMITTEE)
Institutional Review Board,
Christian Medical College, Vellore - 632 002.

Cc: Dr. Jasmine Helan Prasad, Dept. of Community Health, CMC, Vellore 1 of 4

OFFICE OF RESEARCH
INSTITUTIONAL REVIEW BOARD (IRB)
CHRISTIAN MEDICAL COLLEGE, VELLORE, INDIA

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Ref: IRB Min. No. 11562 [OBSERVE] dated 01.10.2018

Dear Dr. [redacted],

The Institutional Review Board **(Blue**, Research and Ethics Committee) of the Christian Medical College, Vellore, reviewed and discussed your project titled "A study on dietary diversity among women of age group 30 to 45 years in a rural setting of Tamil Nadu" on October 01st 2018.

The Committee reviewed the following documents:

1. IRB application format
2. Patient Information Sheet and Consent Form (English , Tamil)
3. Questionnaire (English and Tamil)
4. Cvs of Dr. Bincy Mary Thomas, Jasmine Helan Prasad, S. Janani Iswarya
5. No. of documents 1- 5.

The following Institutional Review Board (Blue, Research & Ethics Committee) members were present at the meeting held on October 01st 2018 in the C K Job Hall, Christian Medical College, Vellore 632 004.

Ethics Committee Blue, Office of Research, 1st Floor, Carman Block, Christian Medical College, Vellore, Tamil Nadu 632 002
Tel: 0416 – 2284294, 2284202 Fax: 0416 – 2262788, 2284481 E-mail: research@cmcvellore.ac.in

Dr. B.J. Prashantham, M.A., M.A., Dr. Min (Clinical)
Director, Christian Counseling Center,
Chairperson, Ethics Committee.

Dr. Anna Benjamin Pulimood, M.B.B.S., MD., Ph.D.,
Chairperson, Research Committee & Principal

Dr. Biju George, M.B.B.S., MD., DM.,
Deputy Chairperson,
Secretary, Ethics Committee, IRB
Additional Vice-Principal (Research)

Name	Qualification	Designation	Affiliation
Dr. Biju George	MBBS, MD, DM	Professor, Haematology, Research), Additional Vice Principal , Deputy Chairperson (Research Committee), Member Secretary (Ethics Committee), IRB, CMC, Vellore	Internal, Clinician
Dr. B. J. Prashantham	MA(Counseling Psychology), MA(Theology), Dr. Min(Clinical Counselling)	Chairperson, Ethics Committee, IRB. Director, Christian Counseling Centre, Vellore	External, Social Scientist
Mr. C. Sampath	BSc, BL	Advocate, Vellore	External, Legal Expert
Ms. Grace Rebekha	M.Sc., (Biostatistics)	Lecturer, Biostatistics, CMC, Vellore	Internal, Statistician
Mr. Samuel Abraham	MA, PGDBA, PGDPM, M. Phil, BL.	Sr. Legal Officer, CMC, Vellore	Internal, Legal Expert
Dr. Ratna Prabha	MBBS, MD (Pharma)	Associate Professor, Clinical Pharmacology, CMC, Vellore	Internal, Pharmacologist
Mrs. Sheela Durai	MSc Nursing	Professor, Medical Surgical Nursing, CMC, Vellore	Internal, Nurse
Dr. Sathish Kumar	MBBS, MD, DCH	Professor, Child Health, CMC, Vellore	Internal, Clinician
Mrs. Sophia Vijayananthan	MSc Nursing	Addl. Deputy Dean CMC, Vellore	Internal, Nurse
Rev. Joseph Devaraj	BSc, BD	Chaplaincy Department, CMC, Vellore	Internal, Social Scientist
Dr Sneha Varkki	MBBS, DCH, DNB	Professor, Paediatrics, CMC, Vellore	Internal, Clinician
Mrs. Pattabiraman	BSc, DSSA	Social Worker, Vellore	External, Lay Person

Ethics Committee Blue, Office of Research, 1st Floor, Carman Block, Christian Medical College, Vellore, Tamil Nadu 632 002
Tel: 0416 – 2284294, 2284202 Fax: 0416 – 2262788, 2284481 E-mail: research@cmcvellore.ac.in

Dr. B.J. Prashantham, M.A., M.A., Dr. Min (Clinical)
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Chairperson, Research Committee & Principal

Dr. Biju George, M.B.B.S., MD., DM.,
Deputy Chairperson,
Secretary, Ethics Committee, IRB
Additional Vice-Principal (Research)

Dr. Jayaprakash Muliyil	BSC, MBBS, MD, MPH, Dr PH (Epid), DMHC	Retired Professor, CMC, Vellore	External, Scientist & Epidemiologist
Mrs. Nirmala Margaret	MSc Nursing	Addl. Deputy Nursing Superintendent, College of Nursing, CMC	Internal, Nurse
Dr. Asha Solomon	MSc Nursing	Associate Professor, Medical Surgical Nursing, CMC, Vellore	Internal, Nurse
Dr. Santhanam Sridhar	MBBS, DCH, DNB	Professor, Neonatology, CMC, Vellore	Internal, Clinician
Dr. Ajith Sivadasan	MD, DM	Professor, Neurological Sciences, CMC, Vellore	Internal, Clinician
Dr. Barney Isaac	M.B.,B.S. D.N.B (Respiratory Diseases)	Associate Professor, Pulmonary Medicine, CMC, Vellore	Internal, Clinician

We approve the project to be conducted as presented.

Kindly provide the total number of patients enrolled in your study and the total number of Withdrawals for the study entitled: "A study on dietary diversity among women of age group 30 to 45 years in a rural setting of Tamil Nadu" on a monthly basis. Please send copies of this to the Research Office (research@cmcvellore.ac.in).

Fluid Grant Allocation:

A sum of **1,23,370**/- *INR (Rupees One Lakh twenty three thousand three Hundred and seventy Only) will be granted for 12 Months.*

Yours sincerely,

Dr. BIJU GEORGE
MBBS., MD., DM.
SECRETARY - (ETHICS COMMITTEE)
Institutional Review Board,
Christian Medical College, Vellore - 632 002.

Dr. Biju George
Secretary (Ethics Committee)
Institutional Review Board

IRB Min. No. 11562 [OBSERVE] dated 01.10.2018 4 of 4