

International
Institute of
Social Studies

Erasmus

GARDEN BASED NUTRITION EDUCATION

An experimental approach for learning nutrition education to
change adolescent's eating preferences

A Research Paper

By:

Subhiksha Shankarraman

(India)

MASTER OF ARTS IN DEVELOPMENT STUDIES

Major:

**Economics of Development
(ECD)**

Members of the examining committee:

**Professor Dr Arjun Singh Bedi
Professor Dr Matthias Rieger**

The Hague, The Netherlands
December 2019

Acknowledgements

First and foremost I would like to thank my childhood friend Nishal, without whom I would not have received this opportunity to teach and interact with such wonderful and brilliant students. I would also like to extend my kindest regards to the Principal, Mr A Radhakrishnan and the Academic coordinator Mrs G Anitha of PSBB school and the Principal, Mrs Stella Punitha of TSA school for giving me the opportunity to conduct this research with their students.

This research paper would not have been possible without the extensive support from my supervisors- Professor Arjun and Professor Matthias. I would like sincerely thank Professor Arjun for constantly providing me his support through all the difficult times I faced during this phase, for guiding me by taking simple baby steps and for constantly motivating me to give my best. Your support helped me stay strong and motivated even during moments when I lacked confidence in myself. I am deeply grateful to Professor Matthias for sparking my interest through his course on Human behaviour and experiments in development which nudged me to form the concept of this research. Thank you Sir, for always showing the confidence in me and encouraging my ideas.

I would also like to thank my family because of whom I am here. With my grandparents blessings and my parents strong pillar of support , I would not have been able to achieve this far. Last but not the least, I sincerely thank my best friend Sujana whose immense care, trust, support and friendship helped me power through this journey in ISS.

Contents

<i>List of Figures</i>	<i>v</i>
<i>List of Tables</i>	<i>Error! Bookmark not defined.</i>
<i>List of Annexure</i>	<i>v</i>
<i>Abstract</i>	<i>vi</i>
<i>Relevance to Development Studies</i>	<i>vii</i>
CHAPTER 1 - INTRODUCTION	0
1.1 BACKGROUND – CHANGING FOOD HABITS AND RISING RATES OF NCDs	1
CHAPTER 2: LITERATURE REVIEW	5
2.1 PARADOX OF MALNUTRITION AND DECISION MAKING MODEL FOR CONSUMERS	5
2.2 CHOICE ARCHITECTURE AND NUDGING	6
2.3 EMPOWERING PEOPLE TO MAKE BETTER FOOD CHOICES	8
2.4 GARDEN-BASED NUTRITION EDUCATION	10
CHAPTER 3: CONCEPTUAL FRAMEWORK	13
CHAPTER 4: METHODOLOGY	16
4.1 DESIGN OF THE SCHOOL ENVIRONMENT	16
4.2 GARDEN BASED NUTRITION EDUCATION INTERVENTION	18
4.3 CHOOSING THE VARIABLES	22
CHAPTER 5: DATA AND DESCRIPTIVE ANALYSIS	24
5.1 DESCRIPTIVE ANALYSIS OF PSBB SCHOOL	24
5.1.1 Demographic characteristics of the students	24
5.1.2 Physical fitness and eating behavior of the students	26
5.2 PARENT-CHILD RELATION AND CHILD BEHAVIOUR OF STUDENTS	28

5.3 KNOWLEDGE, PARENT-CHILD RELATIONSHIP & CHILD BEHAVIOUR OF STUDENTS FROM TSA SCHOOL	29
5.4 INITIAL RESULTS	31
5.4.1 Difference in means of student knowledge and awareness on nutrition and gardening between treatment and control group	31
5.4.2 Difference in means of student's food preference	32
CHAPTER 6: RESEARCH QUESTION & EMPIRICAL SPECIFICATION	33
6.1 RESEARCH QUESTION	33
6.2 EMPIRICAL SPECIFICATION	34
CHAPTER 7: RESULTS	37
7.1 RESULTS FROM THREE VARIABLES	37
7.1.1 Outcome 1: Effect of garden-based nutrition education on preference for fruits and vegetables in the Internal environment-1	37
7.1.2 Outcome 2: Effect of garden-based nutrition education on preference for fruits and vegetables in the Internal environment 2	39
7.1.3 Outcome 3: Effect of garden based nutrition education on preference for fruits and vegetables in the External environment	41
7.2 RESULTS FROM CONCEPT MAPPING AND ESSAYS	43
7.3 TRACKING EATING PATTERN FROM THE FOOD JOURNAL	44
CHAPTER 8: DISCUSSION	46
8.1 ANALYSIS OF THE TABLES IN COMPARISON WITH EXISTING STUDIES	46
8.2 LIMITATIONS AND OPPORTUNITY FOR FUTURE IMPROVEMENT	48
8.3 FUTURE SCOPE	48
CHAPTER 9: CONCLUSION	49
List of References:	52

List of Figures

Figure I: Placement of the paper objective in the conceptual framework	14
Figure II: Flow of intervention	18
Figure 3: Total number of junk food consumption per week	45

List of Tables

Table I: Demographics of the students	26
Table II: Physical fitness and eating behavior of the students by gender	28
Table III: Parent-Child relationship & child behaviour	29
Table IV: Observations of TSA School	30
Table V: Difference in means of student's knowledge and awareness on nutrition and gardening	31
Table VI: Difference in means of student's food preference	32
Table VII: Results for effect of intervention on Internal environment-1	37
Table VIII: Results for effect of intervention on Internal environment-2	39
Table IX: Results for effect of intervention on External environment	41
Table X: Results of concept mapping and essays	43

List of Appendices

Annexure I	58
Annexure II	59

Abstract

This paper studies the impact of garden based nutrition education as a method to teach nutrition education to change food preferences in adolescents aged 10-14 years. This intervention is motivated by the need to change junk food preferences in adolescents in order for them to develop a habit of healthy eating as an adult. The paper uses an intervention approach that lasted for 6 weeks and draws its sample from two schools in the Urban areas of Chennai. 249 students participated from PSBB school that caters to students from a lower-middle income families. 112 students participated from TSA school that caters to students from upper middle income families. However, the intervention took place only in PSBB and the observations made from TSA were mainly to compare the demographics, knowledge level and parent-child relationships between the different households. The results show that garden based nutrition education has led to students decrease their preference for junk food during the time of intervention by 8%. The concept mapping and essays show that students have understood almost all the topics covered in the sessions starting from impact of urbanisation, increasing consumerism, junk food consumption to the implications on health and families affordability to healthy and nutritious food. The results also show that knowledge on food pyramid significantly increases individuals preference for fruits and vegetables by 0.04 percentage points, if they are taking independent decisions. But knowledge on gardening significantly decreases their preference for fruits and vegetables. Also adolescents have a positive influence from social media advertisements as they increase preference for fruits and vegetables significantly by 0.34 percentage points. There is also difference in knowledge and parent-child relationship levels between PSBB and TSA school. Students from TSA showed more awareness in topics concerning nutrition and gardening. Parent involvement in child's eating decisions was however similar.

Relevance to Development Studies

Nutrition and health education are crucial aspects of a child's growth. Parents, teachers, friends and society influence an individual's dietary habits and shape their choices and preferences. Thus, in order to develop a healthy eating attitude and increase the preference for fruits and vegetables as an adult, the attitude for it has to be developed as an adolescent. Using social cognitive approach and making adolescents self-aware of the ways to practice a healthy diet and the reason to maintain a healthy lifestyle will empower and motivate them to change their behaviour. A policy that supports schools to follow a practical approach in teaching of health and nutrition education, with the help of interventions like garden based nutrition education, will go a long way and could positively be a step towards taking preventable measures to delay the early onset of non communicable diseases.

Keywords

Nutrition and gardening knowledge, Parent-child relations, Children eating behaviour, Non-communicable diseases

CHAPTER 1 - INTRODUCTION

India like a number of other developing countries is beginning to experience a double burden of disease – that is the effect of both communicable and non-communicable diseases. The rising rate of NCDs is predominantly caused by sedentary lifestyle habits, unhealthy diet, increased consumption of alcohol and tobacco. The influence is more prevalent amongst urban educated and wealthy communities of the population and the disease that used to occur by the age of 60 is now more prevalent among 35-40 years old people (WHO 2018). India is also becoming the next diabetic capital of the world and according to (WHO 2018), diabetes caused 71% of the 7 million deaths worldwide in 2016. Earlier, the condition of NCDs were highly prevalent in the developed country as they went through a transition in traditional dietary habits. However, with rapid globalization developing countries like India have also seen increase in NCDs due to the adverse changes in life style and food habits, where people are more inclined to easily available “junk” foods rather than traditional foods.

Malnourishment is a condition that occurs when the body lack some of necessary nutrition or have excess of unwanted nutrition (Calories). In order to have people consuming healthy food, they must have the access to it and be able to afford it. This is relevant to a new paradox on malnutrition described by Tanumihardjo et al. (2007), that links poverty, food insecurity and malnutrition with obesity. People living under these circumstances try to meet their basic nutrient requirement by resorting to the cheapest source of energy giving food fatty and oily junk food, thus making them malnourished again.

While unhealthy food choices remain as one of the main causes NCDs in India; in order to delay/ prevent the onset of NCDs, it is important to develop the attitude at an early childhood to maintain a healthy lifestyle and consume more traditional food with high intake of fruits and vegetables than fast food. A behavior altering intervention that goes beyond nudging is required to make adolescents develop such healthy eating habits. According to the literature [O'Brien and Shoemaker (2006); Parmer et al. (2009)] knowledge, accessibility and preferences are important choice altering mediums in adolescents that motivates and incentivises them to consume more home-grown fruits and vegetables.

As adolescents spend majority of their time in school, it is perhaps the most effective place to teach health and nutrition education and to monitor/correct their eating habits. Social Cognitive Theory is relevant to increase student's knowledge on nutrition and preference for fruits and vegetables. This theory postulated that by teaching students about nutrition and engaging them in a positive environment to practice a healthy behaviour, their confidence and self-efficacy can be

improved. Thus, implementing Garden-based nutrition education in schools may enhance knowledge, experience and accessibility for fresh fruits and vegetables.

This paper builds on the existing literature and focuses on whether Garden-based nutrition education increases the preference for fruits and vegetables in adolescents from Chennai, India. This paper is set in the capital city of Tamil Nadu, one of the four southern states, that also ranks second highest in the country for diabetes prevalence. Methodologically, the paper uses convenient sampling technique to identify two schools from the urban part of the city. To understand if there is any difference in knowledge/awareness levels about nutrition and gardening or parent-child relationship related to eating preferences or child eating behaviour between families from a lower-middle income and higher income, two schools that cater to these different income backgrounds were chosen. The first school, Padma Subramaniya Bala Bhavan Matriculation Higher Secondary School, caters to students from a lower-middle income background. The intervention was conducted only in this school. A total of 249 students (130 in treatment and 119 in control) participated. The Schram Academy was the second school that caters to students from upper middle income and higher income families and 112 students participated from here.

1.1 BACKGROUND – CHANGING FOOD HABITS AND RISING RATES OF NCDs

A 21st century problem is the rising rates of Non Communicable Diseases (NCD) (also known as life style or sitting diseases) which arises mainly amongst the urban population. People are trapped under sedentary life style habits which provokes a very unhealthy lifestyle. As a result, the rate of cardiovascular diseases, cancer, chronic obstructive pulmonary disease and diabetes is steadily on the rise. There is sudden influx of awareness and concern regarding this issue since, an average age of the onset of these diseases used to be 60 years or above but in recent times it has fallen down to 35-40 years, thereby increasing the number of premature deaths between the age 30-69 years. According to the WHO, life expectancy rates has gone up by 11 years and on an average a male's average life expectancy is 67.4 years and for a female it's 70.3 years, giving India world ranking of 125 (WHO 2018). But with the given scenario, if the rising life expectancy rates are impaired with QALY and DALY altering diseases then the quality of life is seriously at stake now as people are exposed to longer duration of illness. NCDs like diabetes was a cause of 71% of the 7 million deaths worldwide in 2016 and it is because of unhealthy diet, lack of physical activity, prolonged consumption of alcohol and tobacco, changing work style patterns and an unequal societal status faced by different genders (WHO 2018). It used to be a developed country problem, but recently

it has become very common in South Asian developing countries. For a developing country like India, this has become a dual burden, as the country have to fight against both Communicable and Non communicable diseases. India currently has 72 million diabetic people and is estimated to have 80 million by 2025, thereby becoming the next diabetic capital of world (IDF 2017)

India is culturally rich and has a diverse heritage. It is reflected in people's staple food and consumption pattern. The population as such has undergone drastic transitions in ecological relationships forcing changes in diet and physical activity and thereafter affecting disease patterns as well (Uusitalo et al. 2002). It is important to acknowledge the changes as it has been creating some rigorous alterations in our lifestyle. Earlier people were mostly engaged in manual labour like agriculture, construction etc, and now the work pattern has shifted to a more sedentary and mechanised style in IT industries and finance sectors. The rapid pace of urbanisation is creating more opportunities, but it has also congested the city spaces and started to occupy bigger portion of people's lives. People lead a fast-paced life striving to achieve financial and economic stability by overlooking the need to maintain a health-life balance.

Ostensibly the main drivers of this change are urbanisation and globalisation. The condition of delayed industrialisation and unequal reach of globalisation to everyone in the country has reformed the demographic, socioeconomic, health behaviour and environment situations (Reddy et al. 2005; Manjrekar et al. 2014; Oommen et al. 2014). To understand these transitions, it is also important to know how the markets have transformed as a result of consumer culture interacting with globalisation. Eckhardt and Mahi (2012) have rightly pointed out the way India has been going through a period of shifting consumer ideologies from a very traditional, socialist, agrarian economy to a more global, capitalist, technology focused one. One of the biggest challenges of rapidly expanding markets is consumerism, which has led to increasing tensions between the desire to consume more and the actual economic ability to do so (Layton and Grossbart 2006; Eckhardt and Mahi 2012).

Speaking of expanding markets, the one industry that has been showing rapid-constant growth in India is the fast food sector. Seeing it's potential to generate revenue, the government has relaxed the regulations and allowed 100% Foreign Direct Investment (FDI) in trading of food products. Even in the global market, Global Fast Food Restaurants have made a significant establishment since the last 5 years despite being battered by a weakening global economy and increasing consumer awareness on unhealthy diet hazards. According to the national restaurants association of India (NRAI) 2010 report, the fast food industry in India was estimated to be Rs 6,750 crores (851.96 million euros) - Rs 8,000 crores (1009.65 million euros) (Anitharaj 2018).

The primary reason is the changing gender roles in urban India that has positively allowed females to work and take up financial responsibilities. But this leaves them no time to prepare a healthy fresh cooked meal and with majority of the household having double income earning members, they are not limited by any affordability issues. As the disposable income increases, families do not hesitate to spend on take away or home delivery food like Swiggy and Uber eats, which is time efficient. With all the brands trying to ingrain how healthy and hygienic their food is, people are more attracted to try out new eateries and brands. This has led them to develop an attitude to spend their time and energy on something else productive rather than spending time in the kitchen. While these are the major micro economic factors giving advantage to fast food industries to exploit the food market, increase in per capita income, economic growth, large population, relaxation in rules and regulations and growth in women workforce as highlighted before are all the macro economic factors supporting the establishment and diversification of these industries (Goyal et al. 2007 3 ; Anitharaj 2018 1). This transition has brought in multinational players like McDonalds, KFC, Dominos, Pizza Hut etc., in a joint venture with Indian partners or even independently. Casual dining and cafés are coming up with innovative ways to not only give people best taste of food, but they are also taking several efforts to give unique experiences and satisfaction with respect to ambience, lighting, music, service, themes and in general a whole concept is being followed to attract and retain customers. Due to this reason, such eateries are expected to grow at a CAGR of 27% by 2020, regardless of certain persistent challenges like profit generation, retrenchment of employees, usage of environment friendly & bio degradable products which increases capital costs for the company and increasing awareness on health related issues from fast food (Anitharaj 2018).

More quantity of fruits and vegetable consumption has higher chances of reducing the risk of diabetes, obesity, heart problems and other NCDs. Accessibility and affordability to freshly grown fruits and vegetables is very important in order to have people consume more of it daily. But the cost of these goods is constantly increasing due to high petrol costs and more transportation time. Moreover, the distance between local farms and household in cities is widening due to expansion of urban spaces which also reduces accessibility to freshly grown food. One of the solutions to address the problem of less consumption of freshly grown food that is accessible and cheaper is through gardens or farming. A community garden is a space where in couple of neighbourhoods come together with self- motivation and responsibility in growing adequate vegetables that will help to sustain the need of the neighbourhood. A community farming is a space for households who are interested in the same but struggles to contribute with time and money in their own garden. In such cases, farm lands are identified closer to the neighbourhood

and maintained by dedicated farmers. People visit and participate in cultivation whenever they find time and after harvest each of the invested households will get their portion of vegetables and fruits cultivated on this farm land.

CHAPTER 2: LITERATURE REVIEW

In recent years, the method of changing eating behaviours has shifted from targeting individual to wider population level factors that involves other environmental, societal concerns and more stakeholders. The way in which a food environment is set up, it can contribute to a obesogenic environment influencing food choices (Hill and Peters 1998; Hill et al. 2003; Mikkelsen 2011). A small motivation that helps people to change towards a healthier food behaviour has the potential to reduce their risk of NCDs and even mortality risks (Bamia et al. 2007; Grunet and Wills 2007). But for example many interventions related to food behaviour that has been conducted in Europe, was successful in creating this structured informed environment for consumers which helped to raise awareness among consumers but had a minimal impact in terms of actual lifestyle changes and measurable health indicators (Grunet and Wills 2007). The solution to this as emphasized by (Johnson et al. 2012; List and Samek 2015) is that an individual can change his/her behaviour effectively only if it becomes a habit forming, which requires constant reinforcement through a structural environment so that the habit is sustained. Majority of such kind of interventions are initiated with an assumption that individuals take conscious and informed decisions (Rielbl et al. 2015). However, even such of kind of knowledge and awareness enhancing experiments are being questioned, due to subsequent rise in obesity and NCDs till date (Brambila-Macias 2011). The solution to this problem thus refers back to (Johnson et al. 2012; List and Samek 2015) that emphasizes habitual formation through routine enforcement of the behaviour.

Following this brief insight, the literature section is structured in the following manner. The discussion is initiated by first trying to understand the meaning of nutrition and the new paradoxical situation of nutrition. It then discusses the need to understand people's choice architecture and ways in which they can be empowered with the right information to make an informed decision. Lastly it discusses the benefits of garden based nutrition education in comparison to other forms of intervention that tries to change individuals dietary preferences.

2.1 PARADOX OF MALNUTRITION AND DECISION MAKING MODEL FOR CONSUMERS

Malnourishment refers to a body condition when there is lack of necessary nutrition or when there is excess of unwanted nutrition and calories (over nutrition). In urban India the traditional diet has shifted from coarse grains and millets to refined wheat, rice, oils, fats and western fast foods. There is a new paradox drawn by Tanumihardjo et al. (2007) that links poverty, food insecurity and

malnutrition with obesity. People living under lower economic status are trying to meet their basic requirement of calorie intake in order to gain more energy. The cheapest sources of energy is found in fatty and oily junk foods, thus making them sustain on poor diet quality. The argument made in (Sobal 1999) is that the new diet is composed of the same amount of meat, fibre, pulses and vegetables but they are transformed into a hamburger, burrito, spaghetti, noodles or a spicy Indian chat depending on the cultural orientation of the cook, food preparation techniques and origin of spices. Even though this new diet seems to consist of all the nutrition it also has excess amount of fat, sugar, preservative. These added calories exceed their energy requirement and they become vulnerable for chronic diseases. Thus, the condition of malnutrition needs to be broadened in order to focus on people facing undernutrition and overnutrition problems that arises for people having inadequate supply of food (Chatterjee 2002; Tanumihardjo et al. 2007).

Convincingly economic factors do shape an individual's eating choice. Based on the traditional utility maximising function, individuals as consumers try to make a trade off with the available choices to attain optimum satisfaction. Rational decision making models have helped to understand different health behaviours, consumption of addictive substances and most helpfully to understand people's food choices. Even if all consumers are considered to be informed decision makers they may still face uncertainties for their decisions and in this case the uncertainty that could result from their choices is related to health imbalances caused by weight gains and chronic illness. The limitation on standard economic model is its accuracy to explain the rapid and continuing increase in obesity (Ruhm 2012). This limitation is not surprising as people's eating behaviour is not only determined by economic decisions but also by their body type. This combined influence of economic and biological factors has been the reason for increase in consumption of cheap and readily available food. This tendency is shown under the 'dual decision model' that is built based on neurosciences and behavioural economics. Making a food choice can either be a 'deliberative' system, that takes rational decisions as per the traditional economic model of utility, or an 'affective' system that produces an instant stimuli response without considering long term consequences (Gul and Pesendorfer 2001; Ruhm 2012).

2.2 CHOICE ARCHITECTURE AND NUDGING

Trying to bring about an individualised change in behaviour is not impactful unless it becomes habit forming. And habits are formed when there is constant support and reinforcement or a complete environment change that is suitable to reveal the required behaviour. Since at this day

and age every consumer is well informed and free to make healthy choices, they face a huge burden of responsibility to look after their health.

The way variety of food choices are presented to a person in the meal environment is known as choice architecture. Altering the meal environment can have conducive effects on the required behaviour depending on whether the person wants to eat healthy or not. Designing a choice architect environment includes providing information about available food, in order to promote a rational choice; setting up the physical environment, that involves lighting, décor, placements etc.; changes in default policy regarding proportion size, free servings, additional promotions, sales, discounts; and using social norms (Pike and Leahy 2012).

Nudging is an aspect of choice architecture that is used to alter people's behaviour in a meal environment without altering the food environment, excluding any choices or changing any of the economic incentive for the desired choice (Oommen et al. 2016). Altering some product placement, introducing catchy labels, encouraging buffet style of eating are all examples of a simple nudge. There are many existing literature for example (Thorndike et al. 2014; Kroese et al. 2015; Bucher et al. 2016) that uses simple product placement and labelling to nudge people to make healthy food choices. The experiments have shown positive effects in different choice architectures like in a school canteen, railway station, grocery store.

The systematic review by (Bucher et al. 2016) identified the effect of positional changes of food products on consumer food choices and identified a positive effect through this manipulation of food placement technique to make consumers chose the desired products. Out of the eighteen studies review, sixteen of them showed a positive effect on nudging consumers to make a healthy food choice. The other two, however received a mild manipulation, hence proving that the strength of effect relies on strength of manipulation factors like order of placement, distance between the products etc. Kroese et al. (2015) conducted a field experiment at the train station. Their nudge also followed changing product positioning of healthy foods and placing them right in front of the cashier desk and moving other unhealthy food towards the back or sides. They observed the difference in purchase patterns in both nudge and non- nudge conditions; and the results reported that consumers responded favourably by purchasing more healthy products when being nudged. Even when the purpose of nudge was enclosed to consumers, it still did not affect their choice for healthy food. Similar to product positioning, another common nudge practiced is using traffic-light labels. The experiment by Thorndike et al. (2014) was set up in a hospital cafeteria. The intervention was introduced after observing baseline purchase rate for 3 months. The intervention was to help consumers make an informed decision using labels- green for healthy, yellow for less healthy and red for completely unhealthy products. Within a time period of 24

months and after comparing baseline with treatment, the impact showed significant results that purchase of red products decreases by 2% and red drinks by 7%, green items increased by 5% and green beverages by 8%. The inference from these results is that, traffic light kind of food environment manipulations can change eating behaviours in the long term.

But there is one main limitation to such kind of choice architecture manipulation oriented nudges and as Kroese et al. (2015) and Kelly et al. (2009) relevantly cites it- consumers do not get genuinely motivated to pick a healthy option. The environment allowing to make a conscious decision to pick fewer unhealthy products but nudging them to pick a more healthy product. Such kind of nudges fail in the short term and does not guarantee any habitual change. It difficult for the researcher to also claim whether the experiment motivated consumers to pick a healthy snack over an unhealthy one or the experiment just motivated them to pick their default healthy choice or if someone had picked an unhealthy snack as a compensation to the healthy one. Another gap while using food labelling is that, there is tendency for people to develop fatigue over the labels and there are chances that they might revert to their initial choices (Thorndike 2014). Thus, such experiments might be successful to allow the consumer to make an informed decision using labels etc, or making a default option due to its placement and discounts etc, but they don't guarantee that the consumer's attitude toward healthy eating has changed; it does not promise in future that the consumer might consciously pick a healthy option again if these labels were absent.

2.3 EMPOWERING PEOPLE TO MAKE BETTER FOOD CHOICES

In contrast to the methods used above, there is strong evidence from literature stating that knowledge, accessibility and preferences are important choice altering mediums in adults and especially among potential adolescents (Birch 1979; Bere 2005; Kristjansdottir et al. 2016). Probably by exposing consumers to knowledge regarding food products and nutrition for a longer time can help to fill the gap raised in the previous nudging experiments. Government is one of the key stakeholder who can monitor the nutrition status. By not just navigating the food sector, it can use alternate mediums like schools and mass media to reach out adults and adolescents more personally. As an 'honest broker' it can try and provide reliable nutrition guidance to consumers (Poston et al. 2005). Public consumer education should promote guidance on broader parameters of healthy diet. Raising the awareness for health and ways to maintain a healthy life can be done using nutritional messages on consumption on fruits and vegetables and the best place to teach children about nutritional values is schools as they spend most of their time there. It is also the

best place to influence and monitor their attitude and behaviour through education (Lineberger and Zajicek 2000).

There could be a profound effect if the awareness program starts from schools with an aim to alter young people's food choices in order to form a habit in the long run (Schmitt 2019). Certain schools in Australia have introduced school food policies to regulate the kind of food kids are allowed to consume at school. This also forces parents to form a habit of giving only nutrition rich snack and lunch. The guideline provides information on what the child can and cannot bring to school, what the parents are allowed to pack in child's lunch box and penalty if there are any offending lunch boxes (Pike and Leahy 2012; O'Flynn, 2015).

More such practices can be found in schools from England and the US where teacher particularly walk around to monitor the nutritional content present in every kid's lunch box. As discussed by (Parmer et al. 2009; Pike and Leahy 2012; O'Flynn 2015) the significance of such an awareness provoking policy will not just help to strictly maintain the diets of respective children in their school, but it also targets households with working mother and father who lack the time to properly feed their child. Governments from several countries have identified teachers as suitable target for intervention who could address the concern over obesity. But if they are asked to come across as role models to promote a healthy body image, then they too have a huge responsibility to maintain one. The Australian policy targets both primary and secondary schools and in the process of monitoring and teaching them about healthy diet, they also empower them to have healthy decision-making capacities as healthy choice-makers (Australian Curriculum Assessment & Reporting Authority (ACARA) 2014, p. 5; Leahy and Pike 2015). In addition, the government tries to encourage individuals to shape their conduct so that they are consistent with their objectives such as civility, health and enterprise which influence their choices (Rose 2000). Using the same school-teacher-students relationship, healthy eating attitude can be trained using school gardening. In (Flachs 2010) gardening is viewed as not just an intervention to teach adolescents to eat healthy but it has multitude benefits towards the environment, economy, social and political ecology and nutrition as well. Community/school gardening is a space to learn about community bonding, personal identity and food security. As gardens offer a space for vast communal gathering regardless of people's race, age, sex, religion, tradition, they form a safe space for children to learn and grow with inclusivity in mind. For instance in America, with traditional family dinners being replaced by microwave dinners and fast food, they have started to teach their children about cultural heritage and identity through food by gardening (Flachs 2010). The following literature contributed by Poston et al. (2005), O'Brien and Shoemaker (2006), Parmer et

al. (2009), Morgan et al. (2010) and Schmitt (2019) are the main sources to guide the intervention used in this research

2.4 GARDEN-BASED NUTRITION EDUCATION

Childhood is the critical period to develop healthy eating pattern particularly with fruits and vegetable (FV) consumption as this will track to adulthood. Proper nutrition is more vital for infants and children more than adults as it helps for their cognitive and physical development. Introducing a child to learn about vegetables, their benefits, taste, simple preparation techniques, can fascinate them to increase FV consumption. But trying to spark this interest in them is one the major challenges of health promotion as it is a slow process involving a lot of attitudinal changes (Morgan et al. 2010; Australia 1971; Kelder 1994; Ozer 2007).

Nutrition knowledge, is a key to motivate children to easily adapt to healthy eating practices (Schmitt 2019). Nutrition guideline states that consuming minimum five fruit and vegetable per day can contribute to a healthier diet in children and prevent early onset of cancer, diabetes or heart diseases (American Cancer Society 2008; American Heart Association 2004; USDA 2004). Social Cognitive Theory has been the most effective to increase student's knowledge on nutrition and preference for fruits and vegetables. This theory postulated that by teaching students about nutrition and engaging them in a positive environment to practice a healthy behaviour gives them more confidence and thereby increasing self-efficacy. By learning about health and nutrition, they develop certain expectations on the outcome from exercising that behaviour known as outcome expectations. If schools succeed to meet this expectations, it can highly motivate a behavioural change in their students eating habits (Poston et al. 2005; O'Brien and Shoemaker 2006; Schmitt et al 2018).

Study by Schmitt et al (2018), conducted in the USA was a 6 week long intervention designed to improve children's nutrition and health knowledge and preference for FV using classroom interactive learning activities, classroom taste testing experiments and food journals. The aim was to enhance adolescent's dietary behaviours and nutrition and health knowledge. Their intervention was different from Scherr (2017) and Parmer (2009) but had similar results showing positive gains and experience by students with significant impact on nutrition and health knowledge. The intervention had a set of curriculum in the area of relevance, age appropriate activities like food tastings, projects and games and it also included a parent demographic survey that mainly reported their education and income levels. The paper by Schmitt et al (2018) conducted analysis using normal skewness and Kutosis checks and t test to find the difference

between control and treatment groups. The limitations of the paper were small sample size, making direct association between nutrition and garden education with child's food preference as however in the future even the original curriculum must be evaluated with pre and post interventions and lastly long term follow up sessions could have been done to test if the effects of intervention was maintained.

Morgan et al. (2010) used a 10-week long program, in Australia which resulted in a positive impact on the student's willingness to taste FV. It also increased their rating for FV, however there was not a significant rise in vegetable consumption as they concluded that it requires a more comprehensive and prolonged strategy. Their intervention included teaching only nutrition education for the control group and teaching garden-based nutrition education for the treatment. This study concluded that garden based nutrition education using school gardens can positively impact primary school students to taste vegetables and improve their ratings of FV, however it requires more comprehensive implementation to increase vegetable intakes.

The papers discussed so far by Schmitt et al (2018), Parmer (2009) and Morgan et al. (2010), followed several but almost similar techniques of intervention to measure students FV preferences. They used a FV survey that compiled the knowledge on food pyramid, nutrient-food association and nutrient functions. The second questionnaire tried to understand student's FV preferences. Secondly, a taste and rate method was done to know whether a student liked the food or not. This assessment was scored out of 5 based on students liking. Lunchroom observations were recorded to see what kind of food the individual is choosing from the canteen. The options were between fruits and vegetable salads and grab-and-go lunches that came in packets. Using a parent survey, their educational details were gathered.

Socio-economic models that describe behaviour say that dietary behaviours are largely influenced by the kind food environment. Individual's choices change according to different food environment as the exposure also keeps changing. The way an individual reacts to make his choices in mixed environment like retail store or supermarkets is different from his decisions in a closer environment which has restrictions in the number of available choices. At a space like environment his decisions are influenced by the individual's household sociodemographic, economic, psychological factors. And the environment at a closed spaced like home is more influenced by neighbourhood associations (Burgoine and Monsivais 2013).

Thus, by introducing gardening and nutrition education in schools, they can learn to practice eating nutritious food by growing what they eat. Garden-based nutrition education brings knowledge/awareness sharing and accessibility concerns closer thereby increasing the preference

for fruits and vegetables. There are several curriculum that can be followed to teach adolescents about gardening and nutrition but it's important to keep in mind that the outcome is to make children self-efficient and responsible in growing and consuming the food that his healthy for his/her body. For this purpose the major concepts focused by most garden-based nutrition education programs were nutritional awareness using food pyramid, rules of balanced diet, safe food environment and food etiquette, fruit and vegetable preference using taste testing and preparing self-cooked meals in school, FV consumption self-efficacy by serving fresh FV at school and tightening school policies that does not allow junk food and finally gardening self-efficacy using school gardens (Poston et al. 2005; Greer 2019; Morgan et al. 2010; Parmer et al. 2009; Klemmer et al. 2005).

From the above discussion, the literature gap identified is that, there are no studies conducted to measure adolescents food preferences in different environments of choice architecture. Also with the concept of school gardening and community gardening just gaining awareness in India, there is no solid research done to evaluate the effect of garden based nutrition education in food preferences of adolescents.

CHAPTER 3: CONCEPTUAL FRAMEWORK

The Social Cognitive Theory is the common theory used in several papers like (O'Brien and Shoemaker 2006; Parmer et al. 2009; Schmitt et al 2018) that successfully in such kind of behaviour changing programs in children.

The Social Cognitive Theory (SCT), originated during a paradigm shift in focus from behavior to cognition, in 1970s. Bandura's first book on 'Adolescent Aggression' in 1959 was followed by 'Aggression: A Social Learning Analysis'; both based on behavioural analysis and examining role models. Later this idea was extended to abstract modelling of rule-governed behaviour and disinhibition through vicarious experience after finding out that people learn by observation. This led him to publish the Social Learning Theory, in 1977, which paved a new direction in psychology. Researchers had focused that one learns through the consequences of one's own behaviour until Bandura demonstrated the self-efficacy model along with social modelling in human motivation, thought and action to show how individuals learn by generating multiple new behavior patterns in a similar environment by continuing to go beyond what they have already seen or heard. This developed the Social Cognitive Theory of human functioning, which Bandura published in his book 'Social Foundations of Thought and Action: A Social Cognitive Theory' in 1986 (Luszczynska and Schwarzer 2005).

The SCT states that, a behavioural change is possible only by a personal sense of control. If people want to change their dietary habits, they change their behaviour by believing that only they can take an action to solve it and hence become more inclined and committed to do so. They develop a sense of 'can do' cognition and self determination to achieve that action more actively (Luszczynska and Schwarzer 2005). The key constructs in SCT are self-efficacy, thought and outcome experience.

People ensure to gather a high sense of self-efficacy to maintain their agency or else they associate a low self-efficacy with depression, anxiety and helplessness. It is a major factor that makes a difference in how people feel, think and act. Strong self-efficacy also helps in better social integration. In terms of thinking, when a person is in a healthy competitive environment, it facilitates their cognitive process, helps them to perform better, make better decisions, set higher goals and achieve academic excellence. Outcome experience, the third key factor, are the beliefs about outcome from one's actions. They have distinguished physical, social and self-evaluative outcome experiences. One's belief on the outcome might alter their behaviour which may provoke bodily changes, change of relationship with others and one self. Basically this theory says that self-management is the best medicine (Luszczynska and Schwarzer 2005; Bandura 2004).

A theory on reasoned action and planned behaviour states that a person’s attitude (derived from his perceived outcomes and value of those outcomes) and social norm (derived from social peer pressure and one’s motivation to comply with them) influence their behaviour to work towards achieving outcome expectation (Bandura 2004).

Table I: Placement of the paper objective in the conceptual framework

Program strategy	Mediators	Outcome expectation
Learning nutrition & gardening	Nutrition knowledge	Increased preference for fruits and vegetables
Practicing gardening	Gardening knowledge	
Societal & environmental concerns	Health & diseases awareness	
	Cost awareness	
	Gardening self-efficacy	

With respect to understanding the relevance of garden based nutrition education in the context of SCT, Table-1 describes the program strategy and potential effect expected as outcome. Firstly, in order to make adolescents take independent and right food choices it is important that they gain expertise/self-efficacy related to nutrition and gardening knowledge. The classroom education session aims to influence student’s attitude towards FV intake by teaching them about nutrition, plants and gardening. The aim is to also make them understand the consequence of healthy eating habits that will lead to disease free healthy life style. Second strategy aims to improve their self-efficacy by creating an environment where students can practice what they learnt in the education session. By conducting gardening activities, students learn about tools and rules of planting. The session also makes them see the value of long term and short-term costs associated with eating junk food against eating their self-grown garden vegetables. The cost comparison is done based on monetary value and health cost. This enhances their gardening knowledge, gardening self-efficacy and cost benefit awareness which in turn can increase their preference for FV. The program also addresses another component, which is their social norm; learning about

nutrition by practicing gardening not only benefits oneself but is also good for the environment. Lastly, since the whole garden-based nutrition education program involves students working in different teams, it helps them to build their peer relationship. These groups are also competitive amongst one another in order to gain more points for their involvement, this aspect motivates the students to strive to learn and achieve the expected outcome.

CHAPTER 4: METHODOLOGY

The study aims to set an idea that health education should be perceived as a subject which should not require strict examination and evaluation rather only personal guidance and monitoring. Awareness on nutrition and balanced healthy life style should be raised in school using the most practical application-oriented techniques so that adolescents understand the seriousness of the subject.

The study engages with students aged 10-14 years who are being brought up in an urban setting and involve them in a garden-based nutrition education program at their school to find the impact on their food preferences. As adolescents they are constantly lured by society, friends, family, books, media and other happenings around them. Depending on their societal setting, these actions can have a positive or negative influence on their habits. Thus, introducing them to practice a healthy lifestyle at an early adolescent stage is crucial to develop the future habit and attitude for a healthy lifestyle. But these days, urban household parents are also engrossed in their busy lives with a nine-nine job, trying to attain financial security but failing to maintain health-work-life balance. This has unintentionally reduced their dedication to involve in their child's eating habits and attitude towards maintaining a nutritious active life style. They are missing out on the opportunity to make use of the first best environment, their home, to incorporate the practice of eating fresh fruits and vegetables and practicing a non-sedentary life style (Benton 2004). The second-best opportunity to inculcate these practices in children are schools, where they spend majority of their time (Schmitt et al. 2019).

4.1 DESIGN OF THE SCHOOL ENVIRONMENT

The study took place in Chennai, a metropolitan and capital city of Tamil Nadu, which is one of the five southern states in India. A motivational factor for this location setting is the rising incidence of NCD. India is growing to become the next diabetic capital of the world and the prevalence of Type 2 diabetes is highest in Southern India. Tamil Nadu, after Kerala, is the state with second highest diabetic population in the country despite it being one of the former states to have invested in integrated national programs and schemes in collaboration with the Ministry of health and family welfare and the World Bank (Reddy et. all. 2005).

The intervention was carried out in two schools were chosen. As urban population face more threat from NCDs due to the reasons discussed earlier, these school are chosen from such kind of a setting to understand the food consumption pattern and their attitude towards leading a

healthy lifestyle. Based on location, accessibility, population size of the school, principal's interest to bring a change in students' dietary habits, exam schedule, time available with the school and researcher, two schools were chosen.

Teaching students to practice healthy and nutritious lifestyle cannot be generalised to a large population at once, unless the intervention used to form the habit is highly credible. It is important to first test the credibility of the intervention: 'Garden based nutrition education' with the specific sample chosen before it is generalised to a larger mass. And for a child to make it a habit, he/she needs to be constantly reminded about the habits in an environment which supports and encourages them to exercise their learning, which is the aim of this intervention.

Several schools were approached prior to finalising the two main schools focused in this study, but many schools rejected this opportunity due to lack of time, lack of trust on the researcher, and sometimes even lack of interest in the topic of changing dietary habits for their students. Finally, two schools, Padma Subramaniam Bala Bhavan Matriculation Higher Secondary School (PSBB) and The Schram Academy (TSA) agreed after a formal presentation about the whole intervention, its motive, objective, timeline and researchers' previous teaching experience which helped to gain principals' trust on the researcher and the program. PSBB has about 1750 students enrolled from primary to higher secondary school following the matriculation Tamil Nadu state curriculum and caters to students from lower and middle income family background. The school was initially established as a trust in the year 1992, with an intention to help the society and impart quality education at a low cost to the children of the (then) village, Mangadu. They also conduct medical camps to provide subsidised medical care to the public; environment camps to educate people on plastics, burning wastes, afforestation, rain water harvesting and workshops for women on counselling and self-employment (PSBB year book 2018). TSA is an international school that follows central (CBSE) and international (IGCSE) curriculum. With 700 students enrolled from primary to higher secondary, their motto is to achieve 'Excellence in Education' for students from all communities, religious backgrounds, nationalities and to make them responsible citizens who can think creatively, reasonably and communicate effectively to develop to their best potential by learning moral and ethical values (TSA year book 2018).

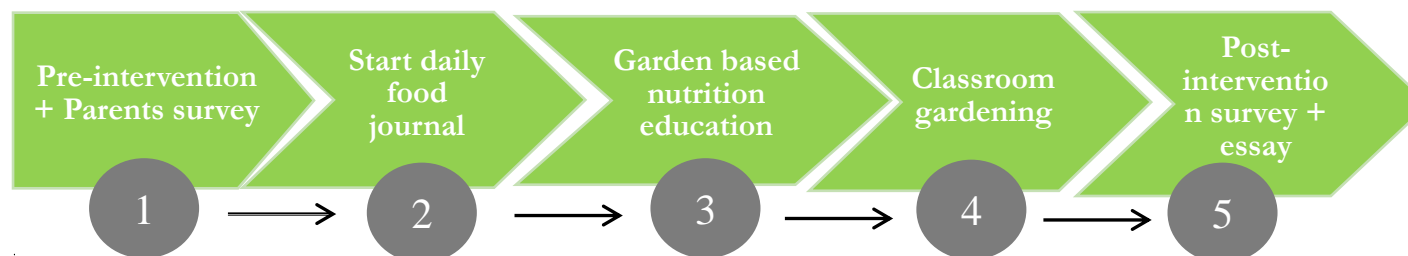
The intervention was mainly conducted in PSBB and lasted for 6 weeks. In PSBB, there were 4 sections under class 7; divided as 7A, 7C for boys and 7B, 7D for girls. Class 8 had 3 sections, divided as 8A, 8C for boys and 8B for girls. 7A, 7B, 8B and 8C were chosen randomly as treatment groups who would receive garden based nutrition education intervention and 7C, 7D, 8A were chosen as the control group who would not receive any intervention. A total of 249 students participated from PSBB school, out of which 130 were in treatment and 119 in control; 113 were

girls and 136 were boys and average age of the students was 12 years. Table 5 (in appendix) gives a descriptive regarding student's weight and Body Mass Index (BMI). Practically adolescents who do not evaluate their weights accurately cannot take appropriate action to maintain a balanced weight for their age, hence BMI was measured at the beginning of the program. According to the calculated BMI indicator, 51% of the total sample are normal weight, 39% is underweight and only 8% is overweight. However, when they were individually questioned about their body weight, 63% assumed that they are underweight and 14% assumed that they are overweight. As it can be noticed, there is a mismatch in the number of students who are actually underweight/ overweight to the assumptions made by the students through their own self-assessment. These two values need to be coherent or else the individual will continue to be under-nourished or over-nourished. Students from TSA participated only in surveys as their information will be used only for external income wise comparison and parent-child relationship between schools. 112 students submitted their responses, of which 57 were girls and 55 were boys and average age of the students was 12 years. 66% of the sample is normal weight while 26% is under weight and 7% overweight.

4.2 GARDEN BASED NUTRITION EDUCATION INTERVENTION

The intervention was implemented using several steps. The national and state board curriculum along with Indian Nutrition Guidelines Standards (National Institute of Nutrition 2011), served as the main guidelines for nutrition and health education sessions. The same guideline was also used to frame several age appropriate activities like maintaining a food journal, classroom debates, gardening and group art projects. Figure-1 below will describe the flow intervention and the section following the chart will explain each of these steps.

Figure I: Flow of intervention



Step 1: Pre- intervention and Parents questionnaire stage

At this stage the surveys were collected from both control and treatment group. The first questionnaire tests student's knowledge on nutrition, garden/environment-based knowledge and their food preferences. It is divided into 5 major sections - student demographics, nutrition knowledge, gardening techniques, food consumption pattern, societal and environmental concerns.

- Student demographics - Name, class, age, sex, religion, height, weight, number of people in the household and parent's occupation were collected.
- Nutrition and gardening knowledge/efficacy - Questions were framed from class 5,6,7 curriculum, which included the basic essentials of nutrition and gardening like food pyramid, food chain, function of food and nutrients, identifying a seed and steps in planting and composting techniques. Fill in the blanks, true/ false, match the following type of questions were asked and these questions were graded with a point per every right answer. A sub section also tries to understand students' perception of their body weight and health in general and their engagement in physical activities.
- Food preferences - the kind of food/fruits/vegetables frequently available at their home, number of litres of water they drink in a day and their frequency of breakfast and fruits consumption were collected.
- Social and Environmental concern - Social factors like friends, relatives, parents, neighbours, environment also play a crucial role in influencing a child's eating habit, the last section tests the level of environment and societal concerns shown by the child.

The second questionnaire measures parent-child relationship in eating decisions, which was filled out by the parent. To understand a child's eating behaviour, it is important to understand their parents eating behaviour and parent's involvement in child's eating habits. But in the limited time available only the later was feasible to be observed. As children are mostly dependent on their parents for food and that ultimately parents have the capability to decide what the child gets to eat, it is important to observe how their relation bonds in such circumstances. Using the Children's Eating Behaviour Inventory (CEBI) as a guideline, this parent-child relationship survey was designed. As eating and mealtime (E/M) problems are very common in childhood, parent-child interaction can become stressful. The CEBI intends to assess E/M problems across a broad age group and in a variety of medical and non-medical disorder conditions. This survey uses a Likert

scale from 1-5 (never to always) to measure parents opinions on their child's eating attitude and the level of control they try to exercise on it (Archer et al. 1991; Maloney et al. 1988).

Step 2: Class design

In order to keep the class motivated and interested in the discussions, a small nudge was used to keep them attentive and competitive. Girls class was divided into groups of 4/5 and was asked to name themselves after a fruit. The boys class similarly named themselves after different kinds of herbivore animals. A chart with all the group names was pasted on the wall and for every group task like participation in class, maintaining class decorum, updating food journal, the respective group got a star sticker. At the end of every week, the group with highest number of stickers got a chance to elect one member from their group to be the overall class monitor for the following week. This activity enhanced their self-responsibility and collaborative skills with their peers to a great extent.

Step 3: Initiating an individual food journal

Before starting the session, every student present was guided to make their own food journal to track their eating habits for the next 6 weeks. Students updated their journal on a daily basis with information on date, breakfast, lunch, dinner and snacks along with proper quantity measurements. Half way through the intervention, it was noticed that student food choices for breakfast, lunch and dinner remained the same as it is highly dependent on what their parents can afford and are willing to prepare. Due to limitation of time, it was not possible to observe any changes in their meals as it had many other external factors affecting it. Hence student's snack preference was chosen as the main indicator for child's food preference.

The school's canteen sold low cost affordable snacks like soup, puffs, samosa, cream bun, Maaza, Appy, Frooti at a price of Rs.10 (14 cents) and chocolates, sweets, good day biscuits at Rs 2 (less than 1 cent). The students started to indicate whether they consumed snacks from their school canteen or packed/junk food purchased outside school or healthy fruits and nuts brought from home. Their options were then scored 0 (for every healthy snack consumed) or 1 (for every junk snack consumed) on a daily basis and a weekly progress was taken into account for analysis purpose. Only the treatment group maintained this journal for a period of 6 weeks, from start till the end of intervention. They were guided to start the journal soon after they filled the pre-intervention survey and made their last entry 4 days after the sessions were concluded.

Step 4: Classroom teaching sessions on health and nutrition education

Seven topics were drafted with the help of science curriculum textbooks and Indian Nutrition Guideline. Each topic was covered in two sessions for two days and each session lasted for one hour each. The topics covered ranged from non-communicable diseases to precautions that is

required to prevent the early onset of these diseases. First topic focused on bringing the students attention to the seriousness of NCD, especially diabetes, difference between NCD and CD, urbanisation and how it is linked to sedentary lifestyle problems, globalisation and its influence on our food market, lack of awareness for the vulnerable people and solutions to address sedentary life style diseases. Second topic focused on nutrition and its source using a small group activity. Every group had to write down all the lunch items of students in their group and identify different nutrients present in it. They were then asked to present their small research to the class and were peer evaluated. Third topic involved learning about food pyramid using art and crafts. Students were asked to bring as many varieties of food picture taken from magazines and newspaper for this class. They were first taught about the Indian Food Pyramid and then asked to make their own pyramid using the cut outs (refer appendix for pictures). This was one of the most fun learning and productive group activity as it made them realise the mistake of consuming wrong quantities of nutrient and minerals. Fourth topic dealt with food cycle and eating attitude. Fifth and sixth topic was about gardening and biodiversity, identifying plant parts, steps in gardening, easily available organic manure and steps in composting. The last topic was environment and societal concerns.

Step 5: School gardening activities

While the second topic was on going, students were encouraged to start classroom gardening. Due to lack of time, we had to refrain to vegetables and flowers that can be easily grown. The planting session encouraged students and school to reduce, reuse and recycle all used old plastic bottles and trays to plant the seeds. Soil and manure were prepared by the researcher beforehand to save time. Students brought variety of seeds from their home like ladies finger, fenugreek, coriander, mustard, chilly, pepper, green peas, chick peas, potato, onion, lemon, millets, sun berry, Asian pigeonwings and Crossandra (refer appendix for pictures). Majority of these plants successfully started to germinate and sprout by the end of second week. They were then replaced from the bottles to the school ground. During the 5th week while teaching students about garden and biodiversity, few more plants like some sunflowers, Tulsi and Indian Borage were planted.

After the completion of all sessions, students were made to participate in group wise debates on topics like ‘Does home gardening improve nutrition or not?’, ‘Should schools ban junk food?’, ‘Is healthy eating a luxury good?’, ‘Should body image affect teenagers?’. This was like a brainstorming session for the students to refresh and connect all their learnings of the past 6 weeks and contrast between a healthy eating behaviour and unhealthy eating behaviour that is controlled by their impulsive cravings. The debate session was conducted in the following manner: out of 7 groups in each class, every group receive a topic and had to choose if they wanted to speak for or

against the particular topic. They had to clearly discuss based on cost/price, affordability, accessibility, time and efficiency to make the food on each topics. They were given two days to prepare. The groups then put forth their arguments and debated. Finally the class with remaining students were the mediators who got to question each groups based on their arguments and finally got to decide who won the debate session. The researcher was present to navigate their discussion and provoke more questions.

Step 6: Post intervention questionnaire stage

As the intervention lasted only for a short duration of 6 weeks, it was assumed that all the other factors like prices of food, parent income in control and treatment group remained constant and unchanged. The only change expected was in education/awareness levels in students from treatment. As the control group did not receive any intervention at all, it was assumed that their education/awareness levels were also constant (mainly because the intervention lasted for only 6 weeks).

Thus, the final stage involved using the same pre intervention questionnaire to test any change in knowledge, awareness and preference post intervention with students in treatment group, assuming the control factors remain unchanged. Treatment group students were also asked to submit a concept map/essay on the topic 'My future health', which was assessed based on the presence of certain key words. These key words were in fact summarised to them at the end of each session not with any prior information that they will have to submit an essay at the end of the program. The purpose was for them to keep the key in mind as they were also introduced to many new concepts which are not yet covered in their school curriculum. These key words were: Urbanisation, Junk food, Consumerism, Sedentary lifestyle, Diseases, Nutrition, School garden, Body image, Luxury good. And answering each of these key points fetched them 4 additional points during evaluation.

4.3 CHOOSING THE VARIABLES

Since the research question and motivation are clear, five major variables were identified to measure the effect of the intervention. Firstly, the main interest is to know whether there has been any change in student preference for fruits and vegetables. But due to time and budget constraints, this outcome could not be tested using real food taste testing experiments, similar to other previous research experiments like. Instead students were provided hypothetical situations that tested their food preferences in different internal and external environments. More details about this situation set up will be discussed in the following chapter.

The idea is to see whether students found the sessions on nutrition and health education interesting as they learnt it along with gardening, which is a very practical approach of teaching the importance of maintaining a healthy lifestyle, balanced diet and importantly to raise the awareness on NCDs. Hence several questions that tested their knowledge on nutrition and planting were used as independent variables to see the effect on their FV preferences.

With the data collected from the second questionnaire on parent-child relationship and child behaviour, certain important questions were selected which would certainly have a direct impact on the preference for FV. The selection of these questions was based on their scale of impact on the FV preferences.

Demographic characteristics like age, sex, religion, household count, mother's and father's occupation were the main control variables.

CHAPTER 5: DATA AND DESCRIPTIVE ANALYSIS

This chapter begins by discussing student demographics and their family's economic background. It is followed by understanding influence of sedentary lifestyle by comparing their physical fitness, BMI indicator and eating pattern to know if they eat and exercise appropriately for their weight and body type. The second section analyses parent-child relationship and parent's remarks on their child's eating behaviour. Third section compares parent knowledge, student awareness, parent-child relationship between PSBB and TSA school. This is a cross section comparison across households from different economic status. Final section discusses some initial results by comparing mean student knowledge on nutrition and gardening from treatment and control groups and student's food preferences in PSBB school.

5.1 DESCRIPTIVE ANALYSIS OF PSBB SCHOOL

5.1.1 Demographic characteristics of the students

Table-2 discusses the descriptive statistics of students who participated in treatment and control group from PSBB school. Information on their age, sex, total members in their household, religion and their parent occupation are some of the important conditions that affect a child's eating behavior. The different columns in the table gives overall mean of different variables. Column two and three shows mean of observations pertaining to treatment and control and the last column is the p value to know the significant difference between control and treatment.

Out of a total of 249 active student participation, 130 students were randomly allocated to treatment group and the remaining 119 to the control group. As the students from different classes were not allowed to be shuffled, the number of boys and girls participation in both the groups were uneven. Thus in treatment there was 14% more girls than boys as compared to control. At school, since the girls and boys classes are separated, the students who participated in treatment and control were also kept separated from each other, all the analysis in future will be done as a comparison between girls and boys. The average age of students in the sample is 12 years across both groups. Almost 90% of the students were Hindu and this could be because the school is a Hindu school or maybe there are more Hindu community people in the locality near the school. Parents occupation is an easy way to understand the socio-economic background of the child. Parents employment determines their household economic status, income, affordability, awareness

and education levels. 73% of the mothers are housewives or 8% of them own their own small Kirana shops or another 6% of them are employed as school/tuition teachers. 20% of the fathers are small Kirana shop owners or 14% work as car/bus drivers and conductors or as engineers working as a mechanic, civil, lab assistant, technician. Another 11% of them are employed in lowest qualification required jobs like wood cutter, servant, security, astrologer, temple priest, mason, security guard (Table 1 in appendix). But for a more efficient analysis purpose, these occupations were combined and categorized based on skills possessed.

Using the International Standard Classification of Occupations set by International Labour Organisation the various occupations of parents were categorized under four skill set levels. Skill is defined as the ability to carry out a particular task and carries two dimensions. Skill level is the complexity and range of tasks to be completed and skill specification is the field of knowledge required, tools and machinery experience, work experience gained prior to undertaking a certain task. Skill level-1 involves all kind of elementary occupations that requires to perform tasks like cleaning, digging, lifting, carrying materials by hand, sorting and assembling. People working in these conditions have high level of physical endurance. Agriculture, carpentry, mason, housewife etc., come under skill-1 category, there are about 85% mothers and 47% fathers who classified their jobs under skill-1.

Skill level-2 involves more specific knowledge and expertise related to machine operation and electrical equipment, driving vehicles, ordering and storage of information. Skill level-3 involves the performance of complex task and require specific knowledge on factual, technical, procedural component pertaining to specialized field. Occupations like shop manager, laboratory assistant, broadcasting/recording technicians, sales representatives come under skill-3. Lastly skill level-4 requires high problem solving skills, decision making capabilities, unique creativity based on extensive body of theoretical knowledge like finance, medicine, law, music, teaching, nursing, theatre (International Labour Organisation 2012). A second majority of father's occupation (20%) fall under this category.

Table II: Demographics of the students

	Total (Mean)	Treatment(Mean)	Control(Mean)	P value
Total	249	130	119	
Age	12.40	12.38	12.42	0.64
House count	4.97	5.12	4.80	0.24
Sex				
Girls	0.45	0.52	0.38	0.02
Boys	0.55	0.48	0.62	0.02
Religion				
Hindu	0.93	0.91	0.94	0.40
Muslim	0.04	0.04	0.04	0.93
Mother job				
Skill 1	0.85	0.85	0.86	0.81
Skill 2	0.02	0.01	0.03	0.27
Skill 3	0.02	0.05	0.00	0.02
Skill 4	0.11	0.10	0.12	0.66
Father job				
Skill 1	0.47	0.46	0.49	0.69
Skill 2	0.15	0.13	0.17	0.69
Skill 3	0.17	0.18	0.17	0.85
Skill 4	0.20	0.23	0.18	0.29

5.1.2 Physical fitness and eating behavior of the students

A child's physical fitness plays an active role in influencing their choice of food to eat. It is important to know the difference between a person's actual weight, their assumption about their weight and how they wish to treat their weight (Table-3 provided below). It is crucial that students from their early ages have the awareness of their actual weight as opposed to staying in any assumption and must also take necessary actions to stay fit and healthy.

Table -3 indicates the average BMI indicator of boys and girls in treatment and control group which is calculated using their height and weight measures. The Body Mass Index (BMI) is calculated by following the guidelines of Centres for Disease Control and Prevention (CDC) (Centre for Disease Control and Prevention 2015). It is calculated by dividing weight in kilograms by height in meters square (height values were converted from centimetre to meter by dividing by 100). The BMI values are then categorised under different weight status: below 18.5 as underweight, 18.5-24.9 as normal weight, 25.0-29.9 as overweight and 30.0 and above as obese. In the treatment group, 56% of the girls have accurately predicted to be underweight as opposed to 66% of the boys who are normal weight. Approximately 12% of the girls are either overweight

or obese and 8% of boys overweight. This condition is the exact opposite with the students of control group.

Depending on their BMI students must be aware of their expected ideal weight, body mass index and the correlation between the weight and BMI indicator. On an average 24% neglect body health concerns and does not take any action to maintain balanced weights. Only 11% in the whole sample were overweight and obese, but 16% of them are involved in weight reduction process. Children between the age of 10-14 years seem to be very less active than what is required for their age. On an average they have indicated that they are active for only 4 days and in the treatment group boys are barely active for only 1 day on an average.

Students eating pattern seem to be fairly similar throughout the sample. But the number of days of fruit consumption is only half of the number of days they eat breakfast which is on almost all the days. However other controls like parent income and affordability could also influences their affordability to eat fruits on a daily basis.

Table III: Physical fitness and eating behavior of the students by gender

	Treatment (Mean values)			Control (Mean values)		P value
	Total	Girls	Boys	Girls	Boys	
Physical fitness						
BMI indicator						
Underweight	0.39	0.56	0.26	0.42	0.32	0.38
Normal weight	0.51	0.31	0.66	0.51	0.55	0.34
Overweight	0.08	0.09	0.08	0.04	0.08	0.61
Obese	0.03	0.04	0.00	0.02	0.04	0.62
About weight						
Gain weight	0.37	0.41	0.21	0.51	0.39	0.05
Lose weight	0.16	0.09	0.24	0.09	0.22	0.89
Remain same weight	0.32	0.31	0.50	0.09	0.32	0.01
Not doing anything	0.14	0.19	0.05	0.31	0.07	0.41
Active days (all 7 days)	3.86	4.23	0.14	3.38	4.12	0.88
Eating pattern						
Breakfast days	6.49	6.47	6.52	6.16	6.35	0.12
Fruit days	2.94	3.57	2.82	2.07	2.97	0.04

5.2 PARENT-CHILD RELATION AND CHILD BEHAVIOUR OF STUDENTS

When it comes to understanding a child's eating decisions, their demographics, parent occupation, education background and their physical fitness are the main factors that affect the decision. Also, since a 10-14 years old adolescent is almost fully dependent on their parents for food, most of their food choices are controlled by what their parents can afford, how their parents monitor the food habits and child's attitude towards food. This section only describes this relationship in terms of median (%) value of students from treatment group as further analysis is mainly based on this group.

Table IV: Parent-Child relationship & child behaviour

Relation to the child: Mother 70%			
Parent-child relationship		Child behaviour	
Child feeding: Never	43%	Eats correct quantity for age: Always	43%
Parent upset: Always	45%	Complains at meal time: Rare	30%
Fast food when outside: Never	49%	Food habits influenced by ads: Never	59%
Give a balanced diet: Always	39%	Likes to eat packet food: Often	46%
Aware of teachings at school: Always	50%		
Junk costs more: Always	38%		
Fresh meal takes more time: Always	41%		

With reference to Table- 4, this survey was predominantly answered by 70% of mothers. And the method of monitoring a child's eating habit does differ between a mother and father which cannot be generalized. But since in this sample the majority has been answered by mothers, this comparison will not be given higher importance.

It makes a huge difference when it comes to the way a parent deals with their child's response to healthy food. When their child gets adamant and refuses to eat, 43% of the parent have answered that they neither force the child to eat nor try to feed them. 45% of the parent felt upset if the child doesn't eat appropriate healthy food. Only 39% try to provide a balanced diet every day for their child and 49% never allow their children to eat hotel food or junk food whenever they go for outing. It is good to see that 50% take efforts to always know what has been taught at school and try to practice the learnings at home. When it comes to cost and convenience of preparing a meal, only 38% always found that junk food cost more than healthy food and 41% feel tiresome to prepare fresh meal every day as it takes more time than readymade packed foods.

5.3 KNOWLEDGE, PARENT-CHILD RELATIONSHIP & CHILD BEHAVIOUR OF STUDENTS FROM TSA SCHOOL

The TSA school information was gathered mainly to compare the knowledge levels, parent-child relationship and child behaviour of students from households belonging to two different economic background. Keeping age and school board curriculum constant, the interest is to know the impact of parent occupation/education effect on their knowledge and eating behaviour patterns. Due to time limitation again, the garden-based nutrition education intervention could not be conducted.

Table V: Observations of TSA School

	Mean/%		Mean/ %
Demographics		Nutrition Knowledge	
Religion	0.78	Food pyramid	4.42
House count	4.76	Food preference	
Mother job		Internal environment 1	0.44
Skill 1	58.04	Internal environment 2	0.54
Skill 4	23.21	External environment	0.22
Father job		Parent-child relationship (in %)	
Skill 3	68.75	Aware of teachings at school: Always	0.54
Skill 4	22.32	Junk costs more: Never	0.42
Garden knowledge		Fresh meal takes more time: Always	0.51
Planted before	80.36	Child behaviour (in %)	
Plant part consumed	4.37	Food habits influenced by ads: Never	0.42
Seed to plant	4.38	Likes to eat packet food: Often	0.63

Table-5 is to know the basic characteristics of students from TSA, which caters to higher middle income and upper income families. 23% of the mothers are employed in skill level-4 jobs and 68% of the fathers are in skill level-3. On an average, students were able to answer only 4 question right about food pyramid, plant parts/planting steps and seed identification but about 80% of the class had prior planting experience. When it comes to making a healthy choice about food preference, 44% comply in internal environment-1, 54% in internal environment-2 and only 22% in external environment.

In parent- child eating relationship, it is very important that either one of the parents takes effort to know what was taught at school, so that they can practice the same at home. In TSA 54% of the parents always take that effort. It was also observed that 42% feel that junk food never costs more than healthy food and 51% feel that making a freshly cooked meal is more cumbersome and time consuming than buying packet food.

5.4 INITIAL RESULTS

5.4.1 Difference in means of student knowledge and awareness on nutrition and gardening between treatment and control group

This section provides an initial comparison of means between pre intervention and post intervention in treatment groups mainly. The baseline results from treatment and control groups are used for comparison.

Table VI: Difference in means of student's knowledge and awareness on nutrition and gardening

	Treatment				Control		P value
	Pre-Intervention		Post Intervention		Pre-Intervention		
	Female	Male	Female	Male	Female	Male	
Nutrition knowledge							
Food pyramid	0.03	0.82	8.46	4.84	0.78	0.70	0.03
Nutrient role	0.59	0.94	2.65	2.39	0.51	0.69	0.40
Garden knowledge							
Have planted before	0.85	0.58	1.00	1.00	0.87	0.91	0.05
Plant part consumed	3.77	3.47	4.43	3.57	3.60	3.19	0.10
Seed to plant	2.77	2.37	4.44	3.10	2.31	2.84	0.77

10-14 years aged students are expected to have basic knowledge about nutrition. Understanding the Indian food pyramid in itself will provide sufficient knowledge and awareness about the basics of nutrients, their function and sources that will help the students to make right food choices. With reference to Table- 6 two questions were given to test this awareness among the students and the results were scored on a scale of 0-10 for food pyramid and 0-6 for nutrient role. It was clear that before treatment on an average, students were barely able to answer one question right regarding food pyramid but post intervention, girls could answer at least 8 right questions against boys who could identify only 5 correct answers. However, both do not seem to have understood nutrient roles thoroughly as on an average they could answer only 2 questions right.

Teaching students about gardening is a process of making them self-efficient to easily grow their own food. Although students were tested on various gardening techniques, they were also taught some basic botany. For the purpose of analysis only three main questions were considered: (a) Have they have planted before, (b) identifying the plant parts and the role of each part, (c) identifying various seeds. This basic knowledge will suffice for a beginner. Pre intervention 85% of the girls and 58% of the boys had prior planting experience. Post intervention, there was not

much improvement in their understanding pertaining to plant parts however their familiarity with seeds had improved.

5.4.2 Difference in means of student's food preference

Hypothetical situations indicating different choice environments were given and students had to make a choice between healthy or junk snack in each situation.

Table VII: Difference in means of student's food preference

	Treatment				Control		P value
	Pre-intervention		Post intervention		Pre-intervention		
	Girls	Boys	Girls	Boys	Girls	Boys	
Internal environment 1	0.57	0.45	0.68	0.84	0.36	0.30	0.06
Internal environment 2	0.29	0.31	0.54	0.74	0.00	0.19	0.21
External environment	0.63	0.50	0.82	0.45	0.11	0.16	0.08

From Table- 7, Internal environment-1 describes a home environment which has both fruits from their garden and soft drinks from a supermarket and they have to make a choice between the two. Close to 11% more girls and 39% more boys have changed their preference for fruits after the garden-based nutrition education intervention.

In internal environment-2 the agency to make a choice is dependent on their peers unlike environment-1 and evaluates whether the students choice is being influenced by their friends interests or their knowledge on nutrition guidelines taught at school. 25% more girls 43% more boys increased their preference for fruits in this situation.

The external environment deals with a completely different choice architecture. The environment location is a supermarket, a place with numerous varieties and different setting. The intervention increased girls' preference for healthy fruits and vegetables/nuts and milk by 19% but for the boys it fell by 5%.

CHAPTER 6: RESEARCH QUESTION & EMPIRICAL SPECIFICATION

Based on the literature and the experiment, this paper mainly aims to answer the following research question- Can garden based nutrition education increase the preference for fruits and vegetables in adolescents. Literature such as (Schmitt et al. 2019; Morgan et al. 2010) specifies that garden-based nutrition education in school environment does have a positive impact in students' knowledge and awareness on nutrition education, gardening knowledge, health awareness and their preference for fruits and vegetables. However, due to time constraint, this paper could not measure student's food choices with practical experiments like time taste testing. Rather hypothetical situations were given to students and their food preference was measured in each of those situations pre and post intervention.

6.1 RESEARCH QUESTION

Based on Parmer et al. (2009), Morgan et al. (2010) and Schmitt (2019) paper three situations were devised.

- **Internal Environment-1:** Student's food preference in an internal environment like their home if they had the capacity to make independent choices
- **Internal Environment-2:** Student's food preference in an internal environment like their home if the capacity to make choices lay on their peers/friends,
- **External Environment:** Student's food preference in an external environment like a supermarket.

Above three situations are the three main research questions that this paper will be addressing.

Research question 1: Do adolescents increase their preference for fruits and vegetables in an internal environment (their home) if they had the agency to make their own food choice?

To understand this question, students were given a hypothetical situation: 'On a hot sunny day you are very thirsty and feel like drinking lot of water or eating some juicy fruits. In your fridge you have a box full of chickoo, mango and pomegranate which you got from your own garden. You also have some soft drinks like Sprite, Maazaa and Frooty next to it. Which one do you prefer when you are feeling extremely thirsty?' This question is a very simple situation which gives the student an option to choose between home grown fruits and packaged juice purchased from a supermarket. Comparison between juice and fruits is made just on basis of their easy o

consumption. Both are readily available to consume and on a hot day you could prefer to eat fruits or packet drinks. The place of choice is set in a home environment where they have the independence to choose what they want at that moment. The question elaborates further to make students visualize the scenario and answer based on their preference.

Research question 2: Do adolescents increase their preference for fruits and vegetables in an internal environment (their home) if their decisions are dependent on peers (friends)?

The hypothetical situation addressed to answer this question was: ‘You were just taught about eating healthy and nutritious food. Your birthday is in another four days and you are yet to buy your special cake. Your friends are asking for different kinds of chocolates and chips as snacks but you do not want to serve those to them. What will you serve at your birthday party?’ This is a straight forward question to know if the individual will prefer to buy the snacks that his/her friends prefer just for one day as it is his/her birthday or will he/she prefer to follow what was taught in school about eating healthy and nutritious food and avoid buying the snacks requested by the friends.

Research question 3: Do adolescents increase their preference for fruits and vegetables in an external environment (like supermarket) where there are many varieties and choices?

The hypothetical situation asked was: ‘After playing outside on a hot sunny day your Father takes you to a nearby supermarket to get you something to eat. He allows you to pick only five items but of your choice. What items will you pick?’ In a very direct way, this question tries to understand how an individual’s preference gets manipulated with a change in the choice architecture from the home environment where the choices are limited to a larger space like supermarket where they have higher number of options. In contrast to a home environment where they only had to make a tradeoff between limited number of healthy and junk food items, in a supermarket it might be challenging with all the options available in front of them unless they have already set their default preferences.

6.2 EMPIRICAL SPECIFICATION

There are three outcome variables according to three different choice architecture, but they primarily measure one effect - Adolescent’s preference for fruits and vegetables. This is a dichotomous variable which takes value 1 if the student prefers fruits and vegetables and value 0

if the preference is for junk food. To identify the effect of nutrition knowledge, garden knowledge, child behaviour and parent-child relationship on the outcome, a probit model is applied to each of the three questions. The main variables of interest are nutritionknowledge, gardenknowledge, childbehaviour and parent-childrelationship.

The following empirical specification 1 is used to test all three questions

$$Y_{ij} = \beta_1 (\text{nutritionknowledge}_{ij}) + \beta_2 (\text{gardenknowledge}_{ij}) + \beta_3 (\text{childbehaviour}_{ij}) + \beta_4 (\text{parentchildrelationship}_{ij}) + \text{age}_{ij} + \text{sex}_{ij} + \text{religion}_{ij} + \text{housecount}_{ij} + \text{wave}_{ij} + \text{motherjob}_{ij} + \text{fatherjob}_{ij} + \epsilon_{ij} \dots\dots\dots (1)$$

In this equation Y_{ij} represents number of fruits and vegetable preference made by student i to j . The $\text{nutritionknowledge}_{ij}$ is composed of two continuous variables: foodpyramid_{ij} and nutrientrole_{ij} ; which are scored to assess student's understanding of basic nutrition. The questions on Indian food pyramid and identifying nutrient roles is a basic and essential nutrition knowledge that any adolescent is expected to know according to the nutrition guideline and textbook curriculum. Thus, these two variables are considered important under this category.

The $\text{gardenknowledge}_{ij}$ is composed of three variables: $\text{plantedbefore}_{ij}$ - a dichotomous variable that values 0 if a student has planted any seed before and 1 if not; $\text{plantpartconsumed}_{ij}$ - a continuous variable that tests whether a student can identify all the plant parts and is graded out of 6; seedtoplant_{ij} - another continuous variable that tests whether a student can identify seeds to its respective plant and is scored out of 6. Only these three questions are identified to know whether a student has some basic idea about plant and planting experience.

The $\text{childbehaviour}_{ij}$ category represents two important variables: $\text{liketoeatpacketfood}_{ij}$ and $\text{liketoeatnutritiousfood}_{ij}$, that measures the individual's preferences which has direct effect on their preference for fruits and vegetables. This characteristic is answered by their parents and is measured using a Likert scale. The scale measures frequency of occurrence of certain behaviour by the child and the parent; 1 is never to 5 is always.

The $\text{parentchildrelationship}_{ij}$ category represents two variables that tries to measure the parent's involvement in child eating decisions. $\text{knowteachingsatschool}_{ij}$ and $\text{junkcostsmore}_{ij}$, tests whether the parent tries to get to know what their child learnt at school and whether they feel junk food costs more. They are also measured using the Likert scale.

Lastly age_{ij} , sex_{ij} , religion_{ij} , housecount_{ij} , wave_{ij} , motherjob_{ij} , fatherjob_{ij} are the control variables. housecount_{ij} is the number of people in the individuals house, wave_{ij} is a dummy with value 0 for pre intervention response and 1 for post intervention response, motherjob_{ij} and

fatherjobj are mother's and father's occupation that's is categorised under four different skill levels specified by (International Labour Office 2012)

CHAPTER 7: RESULTS

The motivation of the research is to find an intervention that could positively instil the habit of preferring healthy fruits and vegetables over junk food. For this, the students first required a nudge that would keep them engaged and involved throughout the program, so that this intervention can change their habits and attitude towards healthy eating in the long run. Thus garden-based nutrition education program was designed by following some of the guidelines and motives discussed in earlier chapters. This chapter is going to discuss the results from the effect of the intervention. First section will discuss on all three outcome variables, the second section will discuss on the results from concept mapping/essay and the last section on scores from food journal.

There were some missing values while running the probit model due to some zero responses under religion from students who refused to disclose it.

7.1 RESULTS FROM THREE VARIABLES

7.1.1 Outcome 1: Effect of garden-based nutrition education on preference for fruits and vegetables in the Internal environment-1

The internal environment 1, as already explained, is a hypothetical home environment for students to make a choice between consuming fruits grown from their own garden and packaged drinks from the supermarket.

Table VIII: Results for effect of intervention on Internal environment-1

	Baseline coefficient	Effect	P value significance
Nutrition Knowledge			
Food pyramid	0.11	0.04	0.03
Nutrient role	-0.07	-0.02	0.36
Plant knowledge			
Planted before	0.02	0.01	0.94
Plant part consumed	-0.39	-0.14	0.00
Identify seeds	-0.21	-0.08	0.00
Parent-child relation			
Aware of teachings at school			
Rare	-1.14	-0.41	0.03
Sometimes	-0.08	-0.02	0.85
Often	-0.11	-0.03	0.84
Always	-0.77	-0.26	0.03
Junk food costs more			

Rare	-0.47	-0.18	0.24
Sometimes	0.40	0.13	0.22
Often	-0.24	-0.09	0.60
Always	0.11	0.04	0.72
Child behaviour			
Likes to eat packet food			
Rare	-0.08	-0.03	0.83
Sometimes	-0.37	-0.14	0.28
Often	-0.49	-0.19	0.35
Always	0.20	0.07	0.52
Influenced from ads			
Rare	0.02	0.01	0.96
Sometimes	0.38	0.13	0.28
Often	-0.07	-0.03	0.89
Always	0.20	0.07	0.54
Demographics			
Wave	0.10	0.04	0.79
Age	0.48	0.17	0.01
Sex (Male)	-1.16	-0.41	0.00
Religion			
Hindu	-0.99	-0.36	0.06
Muslim	-0.52	-0.19	0.50
House count	0.12	0.04	0.04
Mother job			
Skill 2	0.00	0.00	0.00
Skill 3	0.27	0.09	0.64
Skill 4	-0.15	-0.06	0.68
Father job			
Skill 2	-0.75	-0.28	0.03
Skill 3	-0.75	-0.28	0.02
Skill 4	-0.02	-0.01	0.95
Total n= 248 observation			
R2= 0.3184			

Table-8 discusses the impact of garden based nutrition education on adolescents preference for fruits and vegetables in an internal environment where they have the agency to make their choices. There is a positive effect of knowing about food pyramid. For every right label the students learns, his/her preference for fruits and vegetables significantly increases by 0.04 percentage points. But knowledge on nutrition function and source has the opposite negative effect.

Knowledge on plant parts, planting steps and seeds shows a significant negative effect on the outcome. By understanding more about plant parts and planting steps, preference for FV has

decreased by 0.14 percentage points. But a prior plant experience does increase their preference for FV by 0.01 percentage points.

Whether a parent rarely or always tries to get to know what is being taught at school and tries to incorporate it at home resulted in a significant negative effect on their child’s preference for FV. If the parent has the habit to always learn about the teaching at school, the child’s preference for FV falls by 0.26 percentage points compared to a parent who never does that. For every parent who rarely feel that junk food costs more than healthy FV, the child’s preference for FV decreases by 0.18 percentage points compared to a parent who never feels that junk food costs more.

According to the parents report on their child’s behavior, for every child that often likes to eat packet food, their preference for FV decreases by 0.19 percentage points compared to students who never likes to eat packet foods. But if their eating habits are sometimes influenced by social advertisements, then their preference for FV increases by 0.13 percentage points as compared to a student who is never influenced by advertisements.

With every student participating in the intervention, their preference for FV increases by 0.04 percentage points compared to those who did not receive this intervention. As the students get older, their preference for FV is also increasing by 0.17 percentage points and the household size is also positively and significantly related to preference for FV. Interestingly if mothers are occupied in skill level 4 jobs, then their child’s preference for FV decreases by 0.06 percentage points as compared to mothers who are in skill level 1 jobs. The trend shows that as their skill level increases the students preference for FV decreases. Similarly whether the father is employed in skill level 2 or 3 jobs, their child’s preference for FV still declines significantly.

7.1.2 Outcome 2: Effect of garden-based nutrition education on preference for fruits and vegetables in the Internal environment 2

This environment is hypothetical situation when the individual does not really have the independence to choose what food to serve on their birthday. It is influenced by what his/her friends want but at the same time trying to practice healthy eating habits taught at school.

Table IX: Results for effect of intervention on Internal environment-2

	Baseline coefficient	Effect	P value significance
Nutrition Knowledge			
Food pyramid	0.02	0.01	0.64
Nutrient role	-0.04	-0.02	0.56
Plant knowledge			

Planted before	-0.89	-0.35	0.01
Plant part consumed	0.16	0.06	0.07
Identify seeds	-0.12	-0.05	0.08
Parent-child relation			
Aware of teachings at school			
Rare	0.22	0.09	0.67
Sometimes	0.09	0.04	0.81
Often	0.40	0.16	0.38
Always	0.08	0.03	0.82
Junk food costs more			
Rare	-0.04	-0.02	0.90
Sometimes	-0.30	-0.12	0.34
Often	-0.81	-0.30	0.05
Always	0.06	-0.05	0.62
Child behaviour			
Likes to eat packet food			
Rare	-0.34	-0.14	0.28
Sometimes	-0.60	-0.23	0.04
Often	0.09	0.04	0.84
Always	0.06	0.02	0.86
Influenced from ads			
Rare	0.39	0.14	0.32
Sometimes	0.90	0.34	0.01
Often	0.76	0.29	0.12
Always	0.36	0.13	0.24
Demographics			
Wave	0.81	0.32	0.02
Age	-0.10	-0.04	0.53
Sex (Male)	0.42	0.17	0.07
Religion			
Hindu	0.04	0.02	0.94
Muslim	0.31	0.12	0.63
House count	0.09	0.04	0.05
Mother job			
Skill 2	-0.05	-0.02	0.96
Skill 3	-0.71	-0.25	0.21
Skill 4	0.41	0.16	0.23
Father job			
Skill 2	-0.08	-0.03	0.79
Skill 3	-0.11	-0.04	0.68
Skill 4	0.01	0.01	0.96
Total n=250			
R2= 0.1913			

Increased knowledge on food pyramid increases the preference for FV by only 0.01 percentage points. If student had prior experience on planting or gardening, the preference for FV decreases significantly by 0.35 percentage points.

If the parent often takes interest to know about teaching in school, it increases students preference for FV by 0.16 percentage points compared to parents who never take interest. Even when parents often feel that junk food costs more than healthy food, their child’s preference for FV significantly decreases by 0.30 percentage points compared to those who never feel that junk food is more expensive.

Results show that adolescents, significantly decrease their preference for FV by 0.23 percentage points, if they sometimes like to eat packet food items compared those who never like to eat it. And when parents feel that their child’s food habits get influenced by social media advertisements sometimes, students preference for FV increases significantly by 0.34 percentage points compared to those parents who never feel that advertisements influence their child. Preference for FV for those students who participated in the intervention has increased significantly by 0.32 percentage points compared to those who did not participate. If the number of members in the household increases, students preference for FV is also significantly increasing by 0.04 percentage points. For those students whose parents are employed in skill level 3 jobs, then their preference for FV is decreasing by 0.25 percentage points compared to those students whose are employed in skill level 1 jobs.

7.1.3 Outcome 3: Effect of garden based nutrition education on preference for fruits and vegetables in the External environment

The results for external environment eating behaviour is presented below. The hypothetical environment is set up in a supermarket where adolescents have a numerous variety of choices compared to the home environment.

Table X: Results for effect of intervention on External environment

	Baseline coefficient	Effect	P value significance
Nutrition Knowledge			
Food pyramid	-0.03	-0.01	0.49
Nutrient role	0.11	0.04	0.11
Plant knowledge			
Planted before	-0.48	-0.18	0.14
Plant part consumed	-0.03	-0.01	0.75
Identify seeds	0.02	0.01	0.74
Parent-child relation			

Aware of teachings at school			
Rare	0.36	0.14	0.45
Sometimes	0.78	0.27	0.04
Often	-0.45	-0.18	0.31
Always	0.34	0.13	0.34
Junk food costs more			
Rare	0.18	0.07	0.61
Sometimes	0.62	0.21	0.05
Often	0.40	0.15	0.30
Always	0.13	0.05	0.63
Child behaviour			
Likes to eat packet food			
Rare	0.09	0.04	0.77
Sometimes	0.29	0.11	0.32
Often	0.72	0.23	0.09
Always	0.02	0.01	0.95
Influenced from ads			
Rare	0.40	0.16	0.28
Sometimes	0.53	0.21	0.08
Often	1.49	0.49	0.00
Always	1.04	0.38	0.00
Demographics			
Wave	0.55	0.20	0.10
Age	-0.30	-0.11	0.06
Sex (Male)	-0.03	-0.01	0.91
Religion			
Hindu	-0.15	-0.05	0.75
Muslim	-0.10	-0.04	0.88
House count	-0.03	-0.01	0.44
Mother job			
Skill 2	-	-	-
Skill 3	-0.85	-0.33	0.06
Skill 4	-0.19	-0.07	0.57
Father job			
Skill 2	0.16	0.06	0.59
Skill 3	0.00	0.00	1.00
Skill 4	0.14	0.05	0.58
Total n= 248 observations			
R2= 0.1674			

Table 10 provides the effect of garden based nutrition education. Post intervention, if a student answers one more question on nutrition function and its sources, it increases their preference for FV by 0.04 percentage points. But answering one more correct information on the food pyramid is withdrawing their preference for FV by 0.01 percentage points. Garden knowledge

related to seeds and knowledge on planting steps for different kinds of seeds has a positive effect on the preference for FV than other information on gardening. For every seed the individual identifies correctly, the preference for FV increases by meagerly by 0.01 percentage points. However, having a prior gardening experience decreases FV preference largely by 0.18 percentage points.

Students preference for FV increases to a large extent by 0.27 percentage points if their parents talk to them at least sometimes to get to know what they learnt at school and try to practice the same habits at home as compared to the parents who never take this effort. Also when sometimes majority of the parents feel that junk food

Interestingly, the more a parent feels that their child’s food choices are often influenced by social media advertisements, the child shows significantly higher preference for FV by 0.49 percentage points compared to those children whose choices are never influenced by advertisements.

Therefore post intervention, for every garden based nutrition education session attendee, their preference for FV increases by 0.20 percentage points compared to a child who has not received the intervention. The elder a student gets by age, his/her preference for FV falls by 0.11 percentage points. And if the mother is occupied in a job that qualifies to be at skill level 3, it then decreases their child’s preference for FV by 0.33 percentage points in comparison to a parent who is employed in a skill level 1 job sector. But the opposite is true for a father. If he is employed even in a skill level 4 job, his child’s preference for FV increases by 0.05 percentage points as compared to a father who is employed in skill level 1 job.

7.2 RESULTS FROM CONCEPT MAPPING AND ESSAYS

After the classroom teaching and gardening sessions, students were asked to write a concepts mapping or essay on the topic ‘ My future health’ using the key words discussed during class. This material is to subjectively interpret their learnings and understanding from these sessions. Since the questionnaire only focused on nutrition and garden knowledge and food preference, it did not capture the factor on why they should maintain a healthy diet and its impact on health etc. Thus this result is used to only substantiate post intervention survey.

Table XI: Results of concept mapping and essays

S.no		Post treatment results	
		Girls	Boys
1	Urbanisation	1.94	1.79
2	Junk food	2.07	2.53

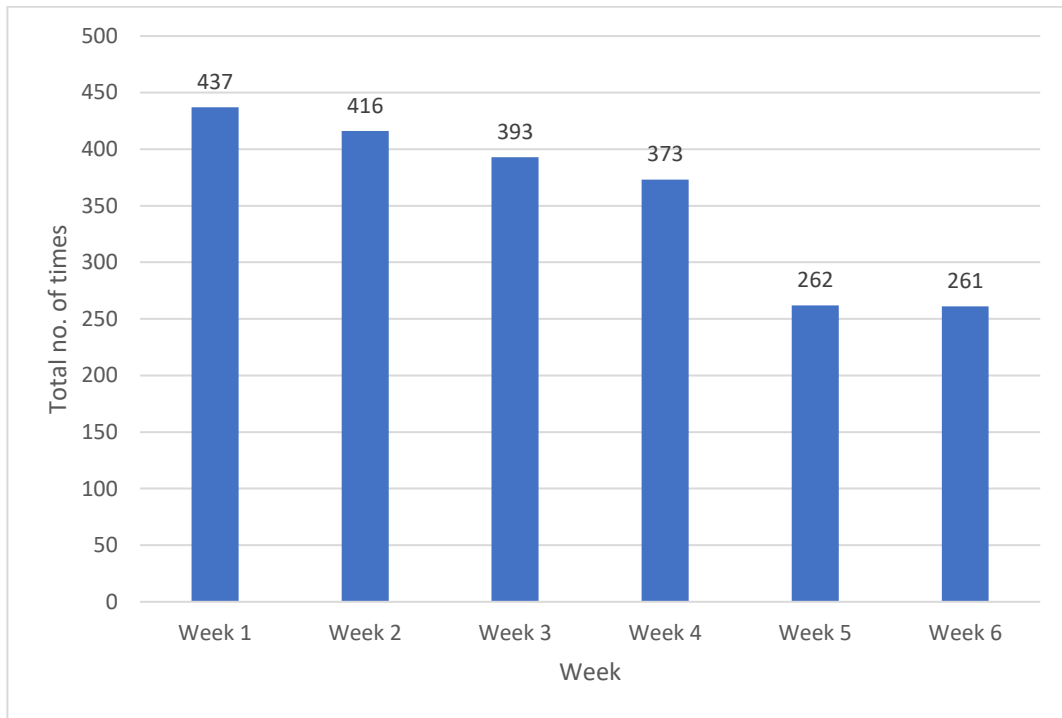
3	Consumerism	0.53	0.63
4	Sedentary lifestyle	1.66	1.44
5	Disease	1.53	1.58
6	Nutrition	1.97	1.50
7	School garden	1.40	1.23
8	Body image	1.13	0.86
9	Luxury good	1.22	0.79
	Total	13.46	12.34

Each of these topics were carried 4 points each as students were given the space to write at most 4 things they learnt under each of these topics. From the table, it can be observed that on an average students were able to relate and connect to almost all the topics. They were able to score 2 points on an average regarding junk food however they had difficulty in understanding consumerism as on an average they and couldn't state even 1 point about it. Boys have also not understood the sessions on body image and whether healthy eating is a luxury good or not. Overall girls and boys scored almost similar by answering on an average 13 and 12 points respectively.

7.3 TRACKING EATING PATTERN FROM THE FOOD JOURNAL

Students were asked to maintain a food journal to track the food taken during snacks break. The evaluation of this food journal is already briefed in the methodology chapter. 0 points for the days when they eat a healthy snack and 2 points for days when they ate junk food. It is scored this way because in the short period of time, it was not possible to measure change in consumption towards healthy food however the decrease in junk food can be measured from the journal. Thus the main outcome variable in this research question was set to understand preference for FV and the food journal was used to observe if the intervention has reduced the rate of junk food consumption or not.

Figure II: Total number of junk food consumption per week



Total number of junk food consumption was calculated by multiplying number of days of junk food consumption between 0-7 with the number of people falling under each category and summing it up for each week. As it is clearly visible, the consumption of junk food is gradually falling from Week 1 to Week 6. The last two weeks have however shown drastic decrease in consumption of junk food. In terms of percentage, consumption of junk food fell from 20% to 12% in 6 weeks.

CHAPTER 8: DISCUSSION

The current chapter will discuss the results from the study. The first section discusses interpretation of results in comparison to the literature and analyses the essays written by students. The following section moves on to discuss the limitations and areas for future improvement in this study. The final section outlines the future scope of the research paper.

8.1 ANALYSIS OF THE TABLES IN COMPARISON WITH EXISTING STUDIES

Intervention has shown a positive impact on students nutrition and gardening knowledge and food preferences. Seeing the initial results derived from simple mean comparison between pre and post intervention, student's knowledge on food pyramid has increased for good but knowledge on nutrient roles and gardening did not increase much. Drawing from (Guthrie et al. 2015), that emphasizes on the importance of knowledge on food pyramid , it is good to see the rise in familiarity of students with the Indian food pyramid, as it has all the sufficient guide to lead a healthy diet. Second results compare the means of food preferences in the three hypothetical environments. Preference for FV has increased in all the situations except for boys in external environment which has reduced by 5%.

Knowledge on nutrition, most importantly regarding food pyramid has led to an increase in preference for FV among adolescents in Internal environment 1 and 2, than knowledge on nutrient roles and source. In internal environment 1, where they have the space to make an independent choice, knowledge on food pyramid significantly increases preference for FV by 0.04 percentage points. But in an external environment like the super market nutrition knowledge decreases their preference for FV by 0.04 percentage points. This is probably because of the influence of a different choice architecture as mentioned in. Since an environment like a supermarket has more options and different setting all together, it might take a longer time to change adolescents preferences in such kind of an environment.

Contrastingly, knowledge on gardening, plant life, plant parts has a negative effect on adolescents preference for FV. Prior experience with planting also has a significant negative effective in preference for fruits in Internal environment 1 by 0.14 percentage points and positive impact on external environment by 0.01 percentage points. This mixed result shows that over all plant knowledge or gardening knowledge or gardening experience has not made any changes to their preference for FV. the reason could be because of the short duration of research. Class room

teaching sessions on nutrition involved more activities for which they were able to relate to the results immediately whereas gardening took time. Therefore for this sample it seems like intervention using gardening requires more time to create an impact. This finding is in contrast with.

When adolescents get to make to independent decisions at home, then parent awareness on teachings at schools does not have an impact of preference for fruits. They reduce the consumption for fruits and prefer aerated drinks instead. But when their decisions are dependent on their peers or I they have to make choices in an external environment like at a supermarket, then parent involvement does increase preference for FV by 0.16 and 0.27 percentage points respectively. Overall, even if the parent feels that junk food costs more than healthy food, students still chose to reduce preference for FV.

Child behavior reported by parents say that, their child likes to eat packet food, then their preference for fruits decreases by 0.19 and 0.27 percentage points in an independent and dependent decision making environment respectively. Social media largely has a positive effect on all three environments. Parents feel that their child's eating habits are positively influence by advertisements. Which is also seen in the results as adolescents preference for fruits by 0.13 percentage points in internal environment 1 and significantly by 0.34 percentage points in internal environment 2 and by 0.49 percentage points in external environment.

Interpreting concept mapping girls were able to connect and write relevance between eight out of nine topics, while the boys were able to write on sic topics. The topics that showed clear understanding from the students were based on the key words Urbanisation, Junk food, Sedentary life style habit, Diseases and Nutrition. Majority of the students wrote in an essay format and only 10% of the total managed to draw a concept map. Their argument mainly focused on the following: 'they see their future health burdened and suppressed by sedentary lifestyle patterns that is getting inevitable. Urbanisation of their communities, globalization of the food markets and rising consumer demand are all paving way for more disease burdened lives. After knowing the seriousness of NCDs in our community the transition to adapt a healthier lifestyle should be initiated from within ourselves and first step is to avoid junk food and start consuming nutritious food'. The students were honestly able to replicate their feelings regarding the changing lifestyle patterns and this realization is the most crucial result for this research.

Tracking the consumption rate of junk food from week 1 to week 6 has shown a positive effect form the intervention. From start to end student's junk food consumption has declined by 6%.

8.2 LIMITATIONS AND OPPORTUNITY FOR FUTURE IMPROVEMENT

Analogous to (Parmer 2009), (Morgan et al. 2010) and (Schmitt et al. 2019) this study faced some similar limitations. This study was not a randomized control trial. The schools were chosen through convenience sampling and hence the results cannot be generalised. In future, by trying to expand the coverage by increasing the sample size will help to prove more credibility for the intervention. Secondly, the 24 hour dietary recall food journal that was maintained on a daily basis was probably best suited for a short term intervention like this, but in order to measure the impact over longer duration of time, then this journal is not right indicator of long term health effects of vegetable preference on diseases. Lastly, due to time constraint, it was not sufficient to teach students on gardening its tools and rules. It would have been better if students were able to grow more fruits and vegetable plants rather than small saplings. It would have also been better if there was time to go back and do a follow-up study to measure if the effect retained or not.

8.3 FUTURE SCOPE

The novelty in this paper is applying garden based nutrition education in an Indian context to easily teach students about nutrition and health and hence try to change their preference from unhealthy food to healthy food. This study present the following four areas of scope for future research: To find out age wise consumption of junk food rate and device a separate intervention targeting each age groups, find the age wise change in dependency of parent -child relationship and find their change in preference for FV, how does the perceptions on body image, weight affect adolescents consumption patterns.

CHAPTER 9: CONCLUSION

Developing country like India, is suffering from double burden of diseases due to rising incidence of communicable and non-communicable diseases. Non-communicable diseases (NCDs) are caused by sedentary lifestyle practices that is characterized by lack of physical activity, increase in consumption of fast foods, alcohol and tobacco consumption, lack of sleep and mental stress. Prevalence of NCDs is higher in the urban population due to their rapidly changing lifestyle routines. Fortunately with advancements healthcare and medication the average life expectancy of people in India has gone up to 67 years for male and 70 years for a female. But under the given scenario, this rising life expectancy is paired with longer years of diseases thus disrupting the quality of life. Amongst all factors, unhealthy food choices is one of the main causes of NCDs. Malnourishment is a condition associated to two situations: when there is lack of necessary nutrition and when there is excess of unnecessary nutrition (calories). This research is motivated to address the problem of early onset of NCDs. In recent years, individuals between 35-40 years have started to suffer from NCDs. In order to delay or completely prevent the onset of NCDs, it is significant to find an early intervention that can help change individual's eating attitude. Childhood is the critical period to develop a healthy eating pattern particularly to get them acquainted with fruits and vegetables. However, the challenge is to spark their interest in consuming a healthy diet as it requires a lot of attitudinal changes.

With reference to Social Cognitive Theory, this paper tries to answer the question whether garden based nutrition education can increase the preference for fruits and vegetables in adolescents in an internal and external environment setting. The six week long intervention focused on adolescents aged 10-14 years; aimed to enhance student's knowledge and awareness regarding health and nutrition education using school gardening techniques, concept mapping and 24 hour recall food journals. It was held in two schools from Chennai, which were selected based on the different income population they cater to.

Results from this intervention depict that, nutritional knowledge gained mainly through food pyramid had a positive impact and led to increase in preference for fruits and vegetable (FV) in the Internal environment setting but led to decrease in FV preference in the external environment. School gardening and garden based knowledge did not help to increase the preference for FV due to the short duration of intervention. Students found the session on nutrition education easily relatable than the sessions on gardening as the gardens took time to grow and all the seeds planted were not only fruits and vegetables but there were also some flowers. When it comes to parent-child relationship, if the parent is more aware of the teachings at school,

it lead to an increase in preference for FV in the internal environment 2 and external environment. Social media and advertisements also show a positive effect on a child's eating habit as it led to more consumption of FV. Over all using the 24 hour recall food journal, student's preference for junk food did reduces by 8% from Week 1 to Week 6 of the intervention process. Students were able to reflect on majority of the topics discussed during the classroom sessions and found this method of garden based nutrition education more applicable and convenient to learn.

This mode teaching the children re-emphasises the purpose of education. Often education is only seen as an end goal to score marks. And hence during the teaching and learning process, it is often forgotten to create an environment where students can also apply their learnings. All it takes to spark the student's interest is to engage them, help them practice what they learnt and ensure they learn for the purpose of bringing a positive/desired change in their attitude and not for an end goal like marks and grading.

List of References:

- American Heart Association (2004) 'Food pyramid guidelines', 1 June 2004. <<http://www.deliciousdecisions.org/>>.
- Anitharaj M.S. (2018) 'Global fast food retailing in India- A way ahead', *IOSR Journal of Business and Management (IOSR-JBM)*, 20(2), pp.38-43.
- Assembly, U.G., Resolution adopted by the General Assembly on 25 September 2015 70/1. Transforming our world: the 2030 Agenda for Sustainable Development. 2030.
- AUSTRALIA, C.S. (1971) 'Commonwealth Scientific and Industrial Research Organization', 23rd Annual Report, 1970/71. *Commonwealth Scientific and Industrial Research Organization, 23rd Annual Report, 1970/71*.
- Bamia, C., D. Trichopoulos, P. Ferrari, K. Overvad, L. Bjerregaard, A. Tjønneland, J. Halkjær, F. Clavel-Chapelon, E. Kesse, M.C. Boutron-Ruault and P. Boffetta (2007) 'Dietary patterns and survival of older Europeans: the EPIC-elderly study (European Prospective Investigation into Cancer and Nutrition)', *Public health nutrition*, 10(6), pp.590-598.
- Bandura, A. (2004) 'Health promotion by social cognitive means', *Health education & behavior*, 31(2), pp.143-164.
- Bandura, A. (2004) 'Health promotion by social cognitive means', *Health education & behavior*, 31(2), pp.143-164.
- Barker, D.J.P. (1994) 'Mothers, babies, and disease in later life', (pp. 14-36). London: *BMJ Publishing Group*.
- Bere, E. and K.I. Klepp (2005) 'Changes in accessibility and preferences predict children's future fruit and vegetable intake', *International Journal of Behavioral Nutrition and Physical Activity*, 2(1), p.15.
- Birch, L.L. (1979) 'Preschool children's food preferences and consumption patterns', *Journal of Nutrition Education*, 11(4), pp.189-192.
- Brambila-Macias, J., B. Shankar, S. Capacci, M. Mazzocchi, F.J. Perez-Cueto, W. Verbeke and W.B. Traill (2011) 'Policy interventions to promote healthy eating: a review of what works, what does not, and what is promising', *Food and nutrition bulletin*, 32(4), pp.365-375.

- Centers for Disease Control and Prevention (Last updated 2015) 'Assessing Your Weight' (a webpage of US Department of Health & Human Services). Accessed November 12 2019 <<https://www.cdc.gov/healthyweight/assessing/index.html>>.
- Chatterjee, P. (2002) 'India sees parallel rise in malnutrition and obesity', *The Lancet*, 360(9349), p.1948.
- CO, C. (2008) 'Cancer Prevention & Early Detection Facts & Figures 2008', *Atlanta, Georgia, USA: American Cancer Society*.
- Drewnowski, A. and B.M. Popkin (1997) 'The nutrition transition: new trends in the global diet', *Nutrition reviews*, 55(2), pp.31-43.
- Eckhardt, G.M. and H. Mahi (2012), 'Globalization, consumer tensions, and the shaping of consumer culture in India', *Journal of Macromarketing*, 32(3), pp.280-294.
- Flachs, A. (2010) 'Food for thought: The social impact of community gardens in the greater Cleveland area', *Electronic Green Journal*, 1(30).
- Goyal, A. and N.P. Singh (2007) 'Consumer perception about fast food in India: an exploratory study', *British Food Journal*, 109(2), pp.182-195.
- Greer, A.E., K. Rainville, A. Knausenberger and C. Sandolo (2019) 'Opportunities for School Garden-Based Health Education in a Lower-Income, Diverse, Urban School District', *American Journal of Health Education*, pp.1-10.
- Grunert, K.G. and J.M. Wills (2007) 'A review of European research on consumer response to nutrition information on food labels', *Journal of public health*, 15(5), pp.385-399.
- Gul, F., W. and Pesendorfer (2001) 'Temptation and self-control', *Econometrica*, 69(6), pp.1403-1435.
- Guthrie, J., L. Mancino and C.T.J. Lin (2015) 'Nudging consumers toward better food choices: policy approaches to changing food consumption behaviors', *Psychology & Marketing*, 32(5), pp.501-511.
- Hill, J.O. and J.C. Peters (1998) 'Environmental contributions to the obesity epidemic', *Science*, 280(5368), pp.1371-1374.
- Hill, J.O., H.R. Wyatt, G.W. Reed and J.C. Peters (2003) Obesity and the environment: where do we go from here?', *Science*, 299(5608), pp.853-855.
- International Labour Office (2012) 'International Standard Classification of Occupations 2008 (ISCO-08): Structure, group definitions and correspondence tables', *International Labour Office*.

- Johnson, E.J., S.B. Shu, B.G. Dellaert, C. Fox, D.G. Goldstein, G. Häubl, R.P. Larrick, J.W. Payne, E. Peters, D. Schkade and B. Wansink, (2012) 'Beyond nudges: Tools of a choice architecture', *Marketing Letters*, 23(2), pp.487-504.
- Kaushik, J.S., M. Narang and A. Parakh (2011) 'Fast food consumption in children', *Indian pediatrics*, 48(2), pp.97-101.
- Kelder, S.H., C.L. Perry, K.I. Klepp and L.L. Lytle (1994) 'Longitudinal tracking of adolescent smoking, physical activity, and food choice behaviors', *American journal of public health*, 84(7), pp.1121-1126.
- Keys, A., J. Brožek, A. Henschel, O. Mickelsen and H.L. Taylor (1950) 'The biology of human starvation', (2 vols).
- Klemmer, C.D., T.M. Waliczek and J.M. Zajicek (2005) 'Growing minds: The effect of a school gardening program on the science achievement of elementary students', *HortTechnology*, 15(3), pp.448-452.
- Kristjansdottir, A.G., I. Thorsdottir, I. De Bourdeaudhuij, P. Due, M. Wind and K.I. Klepp (2006) 'Determinants of fruit and vegetable intake among 11-year-old schoolchildren in a country of traditionally low fruit and vegetable consumption', *International Journal of Behavioral Nutrition and Physical Activity*, 3(1), p.41.
- Kroese, F.M., D.R. Marchiori and de D.T. Ridder (2015) 'Nudging healthy food choices: a field experiment at the train station', *Journal of Public Health*, 38(2), pp.e133-e137.
- Kuh, D. and Y.B. Shlomo (Eds) (2004) 'A life course approach to chronic disease epidemiology', (No. 2), *Oxford University Press*.
- Leahy, D. and J. Pike (2016) 'Just say no to pies: Food pedagogies, health education and governmentality', In *Food pedagogies* (pp. 169-182). Routledge.
- Lineberger, S.E. and J.M. Zajicek (2000) 'School gardens: Can a hands-on teaching tool affect students' attitudes and behaviors regarding fruit and vegetables?', *HortTechnology*, 10(3), pp.593-597.
- List, J.A. and A.S. Samek (2015), 'The behavioralist as nutritionist: Leveraging behavioral economics to improve child food choice and consumption', *Journal of health economics*, 39, pp.135-146.
- Luszczynska, A. and R. Schwarzer (2005) 'Social cognitive theory', *Predicting health behaviour*, 2, pp.127-169.

- Luszczynska, A. R. and Schwarzer (2005) 'Social cognitive theory', *Predicting health behaviour*, 2, pp.127-169.
- Manjrekar, S.S., M.S. Sherkhane and J.V. Chowti (2014) 'Behavioral risk factors for noncommunicable diseases in working and nonworking women of urban slums', *Journal of mid-life health*, 5(3), p.143.
- Mikkelsen, B.E. (2011) 'Images of foodscapes: Introduction to foodscape studies and their application in the study of healthy eating out-of-home environments', *Perspectives in Public Health*, 131(5), pp.209-216.
- Morgan, P.J., J.M. Warren, D.R. Lubans, K.L. Saunders, G.I. Quick and C.E. Collins (2010) 'The impact of nutrition education with and without a school garden on knowledge, vegetable intake and preferences and quality of school life among primary-school students', *Public health nutrition*, 13(11), pp.1931-1940.
- National Institute of Nutrition, 2011. Dietary guidelines for Indians: a manual.**
- Nishida, C., R. Uauy, S. Kumanyika and P. Shetty (2004) 'The joint WHO/FAO expert consultation on diet, nutrition and the prevention of chronic diseases: process, product and policy implications', *Public health nutrition*, 7(1a), pp.245-250.
- O'Flynn, G. (2015) 'Food, obesity discourses and the subjugation of environmental knowledge', *Australian Journal of Environmental Education*, 31(1), pp.99-109.
- Ogden, J. (2011) 'The psychology of eating: From healthy to disordered behavior' *John Wiley & Sons*.
- Oommen, A.M., V.J. Abraham, K. George and V.J. Jose (2016) 'Prevalence of risk factors for non-communicable diseases in rural & urban Tamil Nadu', *The Indian journal of medical research*, 144(3).
- Ozer, E.J. (2007) 'The effects of school gardens on students and schools: Conceptualization and considerations for maximizing healthy development', *Health Education & Behavior*, 34(6), pp.846-863.
- Padma Subramaniya Bala Bhavan Matriculatin Higher Secondary school (2019) 'Year book 2019', Padma Subramaniya Bala Bhavan Matriculatin Higher Secondary school
- Parmer, S.M., J. Salisbury-Glennon, D. Shannon and B. Struempfer (2009) 'School gardens: an experiential learning approach for a nutrition education program to increase fruit and vegetable knowledge, preference, and consumption among second-grade students', *Journal of nutrition education and behavior*, 41(3), pp.212-217.

- Pearson, T.A. and K. Pyorala (1989) 'Section III—Trends in CHD in Selected Countries—Overview', *International Journal of Epidemiology*, 18(Supplement_1), pp.S99-S100.
- Phillips, D.R. (1993) 'Urbanization and human health', *Parasitology*, 106(S1), pp.S93-S107.
- Pi-Sunyer, X. (2003) 'A clinical view of the obesity problem', *Science*, 299(5608), pp.859-860.
- Pike, J. and D. Leahy (2012) 'School food and the pedagogies of parenting', *Australian Journal of Adult Learning*, 52(3), p.434.
- Popkin, B.M. (2002) 'The shift in stages of the nutrition transition in the developing world differs from past experiences!', *Public health nutrition*, 5(1A), pp.205-214.
- Poston, S.A., C.A. Shoemaker and D.A. Dzewaltowski (2005) 'A comparison of a gardening and nutrition program with a standard nutrition program in an out-of-school setting', *HortTechnology*, 15(3), pp.463-467.
- Reddy, K.S., B. Shah, C. Varghese and A. Ramadoss (2005) 'Responding to the threat of chronic diseases in India', *The Lancet*, 366(9498), pp.1744-1749.
- Riebl, S.K., P.A. Estabrooks, J.C. Dunsmore, J. Savla, M.I. Frisard, M.A. Dietrich, Y. Peng, X. Zhang, and B.M. Davy (2015) 'A systematic literature review and meta-analysis: The Theory of Planned Behavior's application to understand and predict nutrition-related behaviors in youth', *Eating behaviors*, 18, pp.160-178.
- Rose, N. (2000) 'Government and control', *British journal of criminology*, 40(2), pp.321-339.
- Ruhm, C.J. (2012) 'Understanding overeating and obesity', *Journal of Health economics*, 31(6), pp.781-796.
- Scherr, R.E., J.D. Linnell, M. Dharmar, L.M. Beccarelli, J.J. Bergman, M. Briggs, K.M. Brian, G. Feenstra, J.C. Hillhouse, C.L. Keen and L.L. Ontai (2017) 'A multicomponent, school-based intervention, the Shaping Healthy Choices Program, improves nutrition-related outcomes', *Journal of nutrition education and behavior*, 49(5), pp.368-379.
- Schmitt, S.A., L.M. Bryant, I. Korucu, L. Kirkham, B. Katare and T. Benjamin (2019) 'The effects of a nutrition education curriculum on improving young children's fruit and vegetable preferences and nutrition and health knowledge', *Public health nutrition*, 22(1), pp.28-34.
- Sobal, J. (1999) 'Food system globalization, eating transformations, and nutrition transitions', *Food in global history*, pp.171-93.
- Tanumihardjo, S.A., C. Anderson, M. Kaufer-Horwitz, L. Bode, N.J. Emenaker, A.M. Haqq, J.A. Satia, H.J. Silver and D.D. Stadler (2007) 'Poverty, obesity, and malnutrition: an

international perspective recognizing the paradox', *Journal of the American Dietetic Association*, 107(11), pp.1966-1972.

The Schram Academy (2018) 'Year book 2018', *The Schram Academy*.

Thorndike, A.N., J. Riis, L.M. Sonnenberg and D.E. Levy (2014) 'Traffic-light labels and choice architecture: promoting healthy food choices', *American journal of preventive medicine*, 46(2), pp.143-149.

U.S. Department of Agriculture (2004) 'The food guide pyramid: A guide to daily food choices', 1 June 2004.

United Nations. Department of Public Information (2009) 'Millennium Development Goals Report 2009 (Includes the 2009 Progress Chart)', *United Nations Publications*.

Uusitalo, U., P. Pietinen and P. Puska (2002) 'Dietary transition in developing countries: challenges for chronic disease prevention', *Globalization, diets and non-communicable diseases*, World Health Organisation. 1, p.25.

World Health Organisation (Last updated 2018) 'World Health Rankings: Live Longer Live Better India: Life Expectancy'. Accessed July 2019 <<https://www.worldlifeexpectancy.com/india-life-expectancy>>.

World Health Organization (2003) 'Globalization, diets and noncommunicable diseases'.

World Health organization (2018) 'Noncommunicable Disease, Countries Profile', Geneva: *World Health Organization*.

Annexure I

Descriptive table

Table 12: BMI indicator, Body weight assumption and Solution to take care of body weight made by the child

This table is a comparison between students actual BMI indicator with their assumption of weight and how take care of their body weight. The students must be a good judge of their body weight at any point in time so that they know the right nutrient intake that is required for their body. If not they will be malnourished.

	%
Total sample	249
BMI indicator	
Under weight	39
Normal weight	51
Over weight	8
Obese	3
Assumption about body weight	
Under weight	63
Normal weight	17
Over weight	14
Obese	6
Solution to maintain balanced weight	
Lose weight	37
Gain weight	16
Stay the same weight	32
Not trying to do anything	14

Annexure II

Pictures taken during the Field Work



Planting sessions in classroom



Classroom with all the samplings at the back and 2 pictures of the students who were part of the intervention



Learning Indian food pyramid through group activity