

**A SURVEY ON DIET DIVERSITY IN CHILDREN BETWEEN AGE OF 8 AND 12 YEARS
OF AGE DURING COVID 19 RESTRICTIONS**

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ABSTRACT

The present study deals with the critical survey on diet diversity during Covid-19 restrictions in children of 50 population of 8-12 years age where all the participants in an online survey could assess the dietary diversity. Idea behind the research was generated in view of dietary factors associated with lock down restriction correlation. COVID-19 is a period of lock down where people are being restricted to stay at home, except for those involved in essential services. Kids and adults alike were mandated to stay home to ensure maximum safety. Until few weeks back, there was freedom to move out, there was more choice to pick foods and consume convenience foods. A lot of children were also adopting and adapting the online schooling from their home. There was limited access to cafeterias, food joints and moving out for weekend meals had been curtailed. Now that home food which was most convenient and may be even a forced choice for some, what foods we choose to eat was also limited. The survey concludes and reaches to the point that the children during the lockdown period were having immune boosters, spices, condiments, stored food in their diet along with sugar content mostly seen in females and also we had outcome that people suffered to have junk street food which directly influenced their Body Mass Index.

KEYWORDS: Survey, diet, diversity, Covid-19, restrictions, sugar, food, children, household dietary diversity score (HDDS), Body Mass Index (BMI)

INTRODUCTION

The household dietary diversity questionnaire represents a rapid, user-friendly and easily administered low-cost assessment tool. Scoring and analysis of the information collected with the questionnaire is straightforward. The household dietary diversity score described in the guideline consists of a simple count of food groups that a household has consumed over the preceding 24 hours. The guideline describes the use of the dietary diversity questionnaire at the household level. The data collected can also be analyzed to provide information on specific food groups of interest. The household dietary diversity score (HDDS) is meant to reflect, in a snapshot form, the economic ability of a household to access a variety of foods. Studies have shown that an increase in dietary diversity is associated with socio-economic status and household food security (household energy availability). At the household level, diet diversity scores represent the economic ability of a household to access a variety of foods, while individual diet diversity scores aim to reflect nutrient adequacy. If inadequate food is consumed, it is unlikely that adequate quality can be met. These scores are most commonly reported for women and children.^[1]

Food biodiversity is defined as "the diversity of plants, animals and other organisms used for food, covering the genetic resources within species, between species and provided by ecosystems." Food biodiversity can be considered from two main perspectives: production and consumption. From a consumption perspective, food biodiversity describes the diversity of foods in human diets and their contribution to dietary diversity, cultural identity and good nutrition. Production of food biodiversity looks at the thousands of food products, such as fruits, nuts, vegetables, meat and condiments sourced from agriculture and from the wild (e.g. forests, uncultivated fields, water bodies). Food biodiversity covers the diversity *between species*, for example different animal and crop species, including those considered neglected and underutilized species. Food biodiversity also comprises the diversity *within species*, for example different varieties of fruit and vegetables, or different breeds of animals. Food diversity, diet diversity nutritional diversity, are also terms used in the new diet culture spawned by Brandon Eisler, in the study known as Nutritional Diversity.^[2]

Trends in food biodiversity consumption

Since 1961, human diets across the world have become more diverse in the consumption of major commodity staple crops, with a corollary decline in consumption of local or regionally important crops, and thus have become more homogeneous globally.^[3] The differences between the foods eaten in different countries were reduced by 68% between 1961 and 2009. The modern "global standard"^[3] diet contains an increasingly large percentage of a relatively small number of major staple commodity crops, which have increased substantially in the share of the total food energy (calories), protein, fat, and food weight that they provide to the world's human population, including wheat, rice, sugar, maize, soybean (by +284%^[4]), palm oil (by +173%^[4]), and sunflower (by +246%^[4]). Whereas nations used to consume greater proportions of locally or regionally important crops, wheat has become a staple in over 97% of countries, with the other global staples showing similar dominance worldwide. Other crops have declined sharply over the same period, including rye, yam, sweet potato (by -45%^[4]), cassava (by -38%^[4]), coconut, sorghum (by -52%^[4]) and millets (by -45%^[4]).^{[3][4][5]}

Food biodiversity and nutrition

Promoting diversity of foods and species consumed in human diets in particular has potential co-benefits for public health as well as sustainable food systems perspective. Food biodiversity provides necessary nutrients for quality diets and is essential part of local food systems, cultures and food security. Promoting diversity of foods and species consumed in human diets has potential co-benefits for sustainable food systems. Nutritionally, diversity in food is associated with higher micronutrient adequacy of diets.^[6] On average, per additional species consumed, mean adequacy of vitamin A, vitamin C, folate, calcium, iron, and zinc increased by 3%. From a conservation point of view, diets based on a wide variety of species place less pressure on single species.

Poor nutrition can start even before birth and continue into adolescence and adult life; it may even continue for generations. Nutritional care is important for adolescents as adolescence is a time of dramatic physical growth and development and changing nutrition due to socio-cultural factors. Adolescence provides a second opportunity to catch up on growth, if environmental conditions and nutrient intake are favourable. The nutritional needs and status of adolescents, particularly of adolescent girls, are crucial as girls will be the future mothers and their health will impact future generations. Addressing their needs is an important step in breaking the inter-generational cycle of malnutrition and chronic disease. Thinness and stunting are more prevalent among adolescents. Stunting in adolescents is the result of the cumulative effect of poor nutrition, largely during the first two years of life.^{[7][8][9]}

Undernutrition in adults more truly reflects the nutritional status of a community. Developing countries with undernourished populations face the risk of low productivity and growth. Furthermore, undernutrition in women leads to poor reproductive health outcomes leading to increased preterm births, infant mortality and maternal mortality. Low body mass index in adults leads to reduced immune function and increased morbidity and mortality.^{[9][10][11]}

Body mass index (BMI) is closely related to an individual's food consumption pattern and the World Health Organization suggested that one of the main strategies to improve nutrition is increased dietary diversity at the household level. Greater emphasis has been given by the scientific community on a balanced diet, laying down dietary guidelines to ensure adequate nutrient intake by individuals. In developing countries dietary diversity is given greater importance specially to address nutritional deficiencies and there is widespread recognition that low dietary diversity is associated with chronic nutritional deficiencies. Studies have proved that low dietary diversity has negative consequences for health, immunity, mental health and reproductive and social capacities. Many studies have been conducted to understand the relationship between dietary diversity and nutritional outcome, particularly in preschool children, and micronutrient deficiency in adolescent girls and women with different physiological conditions.^{[12][13]} Unfortunately, dietary diversity has been lost during the past 50 years and dietary choices that exclude food products from animals or plants will narrow the GI microbiome further. Additional research into expanding gut microbial richness by dietary diversity is likely to expand concepts in healthy nutrition, stimulate discovery of new diagnostics, and open up novel therapeutic possibilities.^[14-24] "Eating a more diverse diet might be associated with eating a greater variety of both healthy and unhealthy foods. "Eating a variety of foods" has been a public health recommendation in the United States and worldwide for decades. While some dietary guidelines highlight greater diversity of recommended foods, there is little consensus about what so-called dietary diversity is, how it is measured and whether it is a healthy dietary goal. The statement authors conducted a thorough scientific literature review of articles published between January 2000 and December 2017. They concluded:

- There is no evidence that greater overall dietary diversity promotes healthy weight or optimal eating.
- There is some evidence that a wider variety of food options in a meal may delay people's feeling of satiation (fullness), increasing the amount of food they eat.
- Limited evidence suggests that greater dietary diversity is associated with eating more calories, poor eating patterns and weight gain in adults.

Instead of telling people to eat a variety of foods, the statement authors conclude that dietary recommendations should emphasize adequate consumption of plant foods,

such as fruit, vegetables, beans and whole grains, low-fat dairy products, non-tropical vegetable oils, nuts, poultry and fish, and limit consumption of red meat, sweets and sugary drinks. The American Heart Association Dietary Recommendations and the DASH Diet (Dietary Approaches to Stop Hypertension) are both examples of healthy eating patterns. "Selecting a range of healthy foods, which fits one's budget or taste, and sticking with them, is potentially better at helping people maintain a healthy weight than choosing a greater range of foods that may include less healthy items such as donuts, chips, fries and cheeseburgers, even in moderation," said Otto, who is also assistant professor of epidemiology, human genetics and environmental science at The University of Texas Health Science Center at Houston, Texas.^[25]

Simple indicators reflecting diet quality for young children are needed both for programs and in some research contexts. Measures of dietary diversity are relatively simple and were shown to be associated with nutrient adequacy and nutritional status. However, dietary diversity also tends to increase with income and wealth; thus, the association between dietary diversity and child nutrition may be confounded by socioeconomic factors. We used data from 11 recent Demographic and Health Surveys (DHS) to examine the association between dietary diversity and height-for-age Z-scores (HAZ) for children 6–23 mo old, while controlling for household wealth/welfare and several other potentially confounding factors. Bivariate associations between dietary diversity and HAZ were observed in 9 of the 11 countries. Dietary diversity remained significant as a main effect in 7 countries in multivariate models, and interacted significantly with other factors (e.g., child age, breast-feeding status, urban/rural location) in 3 of the 4 remaining countries. Thus, dietary diversity was significantly associated with HAZ, either as a main effect or in an interaction, in all but one of the countries analyzed. These findings suggest that there is an association between child dietary diversity and nutritional status that is independent of socioeconomic factors, and that dietary diversity may indeed reflect diet quality. Before dietary diversity can be recommended for widespread use as an indicator of diet quality, additional research is required to confirm and clarify relations between various dietary diversity indicators and nutrient intake, adequacy, and density, for children with differing dietary patterns.^[26] Most nutritional guidelines in the world, including in Asian countries where fermented foods are widely used, do not mention fermented foods and beverages besides yoghurt as a dairy product. Children get their gut microbioma from the stage of birth and milking and the intestinal flora remains most the same throughout their life. Fermented foods and mushroom biomass may modulate the probiotic profile of gut flora.^[27-30]

PURPOSE OF RESEARCH

The main purpose of this research was to observe the diet diversity and added sugar intake in the diet in

children between 8-10 years when they are mostly restricted to consuming home food.

Participation in the Research

Participation in this research was entirely voluntary. People had the choice to refuse to let the child undertake this survey or withdraw the child's participation at any time without any penalty. We hope to make the outcome of this research available in the public domain. Public participation in this research helped us establish trainings, support and guidance about awareness of current food consumption pattern and importance of nutritional balance. This was an online survey and did not involve any face to face interactions. The personal information was not recorded and data was anonymised. There was minimal risk in undertaking this survey and completing this online survey would need 5-8 minutes.

Survey Questionnaire

The following were the set of questions with respect to the research carried out with a choice of answers, devised for the purposes of a survey or statistical study.

1) Food consumed during last 3 days

Food is important for growth, development and protect us from ill- health and fight diseases. Being aware of what we eat helps us make conscious and healthy food choices. This survey helped in recollecting the foods from varied food groups that they had consumed over the last 3 days.

2) Date of Birth, Gender, Height, Weight (to calculate BMI)

3) Schooling (Online/Home)

4) How many times varied foods from each food groups were consumed in last 3 days?

(To answer the above questions, the participant had to count the total number of times any of the food belonging to any group consumed in the last 3 days.) E.g. Day 1 - Breakfast poha, lunch - Pulav, evening-biscuits, Dinner- Noodles= 4 times on day 1. Similarly, if on 3 times on Day 2 and 3 times on day 3, The answer would be 4+3+3= 10.

5) Consumption of CEREALS- Corn/maize, rice, wheat, sorghum, millet or any other grains or foods made from these (e.g. bread, noodles, porridge or other grain products) / local foods e.g. Poha, upma, neer dosa, porridge or pasta or other locally available grains.

6) Consumption of VITAMIN A RICH VEGETABLES AND TUBERS - Pumpkin, carrots, or sweet potatoes that are orange inside / other locally available vitamin-A rich vegetables (e.g. red pepper)

7) Consumption of WHITE TUBERS AND ROOTS - White potatoes, white yams, sago or other foods made from roots.

8) Consumption of DARK GREEN LEAFY VEGETABLES- Dark green/leafy vegetables, including wild ones / locally available vitamin-A rich leaves such as amaranth, methi leaves, colocasia leaves (aloo parata), spinach, spring

- onion, etc.
- 9) **Consumption of VITAMIN A RICH FRUITS** - Ripe mangoes, cantaloupe, apricots (fresh or dried), ripe papaya, dried peaches + other locally available vitamin A-rich fruits.
 - 10) **ANY OTHER FRUITS** Consumed 10 times or more.
 - 11) **OTHER VEGETABLES** - Other vegetables (e.g. tomato, onion, brinjal, lady finger), including wild vegetables.
 - 12) **LEGUMES and PULSES** - Beans, peas, lentils or foods made from these food groups.
 - 13) **NUTS AND OILSEED-** Almonds, cashew, till, peanuts.
 - 14) **MILK AND MILK PRODUCTS** - Milk, cheese, yogurt or other milk products.
 - 15) **ORGAN MEAT (IRON RICH)** -Liver, kidney, heart or other organ meat-based foods.
 - 16) **FLESH MEATS** - Beef, lamb, goat, rabbit, wild game, chicken, duck or other birds.
 - 17) **EGGS** - Chicken, duck, guinea hen or any other egg.
 - 18) **FISH** - Fresh or dried fish or shellfish
 - 19) **OILS AND FATS** - Oil, fats or butter added to food or used for cooking
 - 20) **SWEETS** - Sugar, honey, sweetened soda or sugary foods such as chocolates, candies, cookies and cakes.
 - 21) **Total number of teaspoons of Sugar / Jaggery / Honey consumed in last 3 days.**
 - 22) **SPICES, CONDIMENTS, BEVERAGES** – Spices (black pepper, salt), condiments (soy sauce, hot

- sauce), coffee, tea, alcoholic beverages or sherbats
- 23) **Any special immunity boosting food being consumed during Lock down?**
 - 24) **The top 3 foods that participants missed the most in this lock down times.**
 - 25) **LIST the foods munched upon or consumed while watching TV/ surfing social media/ playing mobile game or schooling online from home.**
 - 26) **Any outside (meal or snack) eaten or bought from outside of the home?**

RESULTS AND DISCUSSION

Demography of diet diversity chart during lockdown period is shown as in Figure No.1 and Figure No.2 represents Diet Diversity Chart of the Population during Covid-19 Lockdown period. All details and information provided by the participants and their child are kept confidential by the investigators and did not made public unless disclosure is required by law. By signing the consent form, the participants would authorize the review of records, analysis and use of the data arising from this research. The Participants were voluntarily agreed to allow the child to take part in this research and provided all necessary information to the investigators as requested. They had the choice to withdraw their children from this research by informing the investigator without giving any reason. Parent participants and their children agreed to hold them harmless from any harm or loss that may be incurred by them or their child due to their participation in the research.

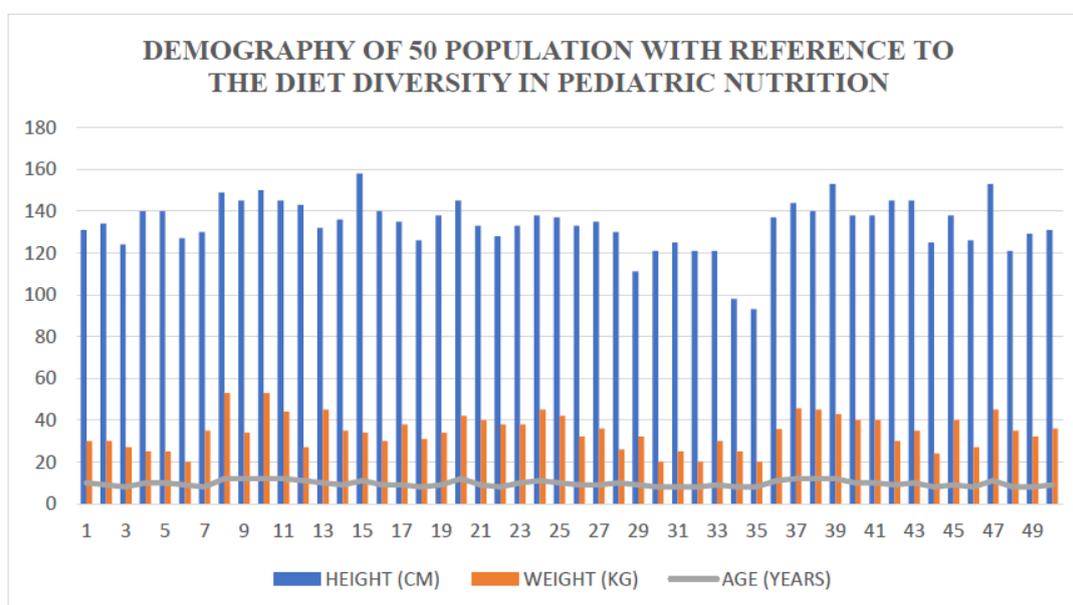


Figure No.1 Demography of Diet Diversity Chart of the Population during Covid-19 Lockdown period.

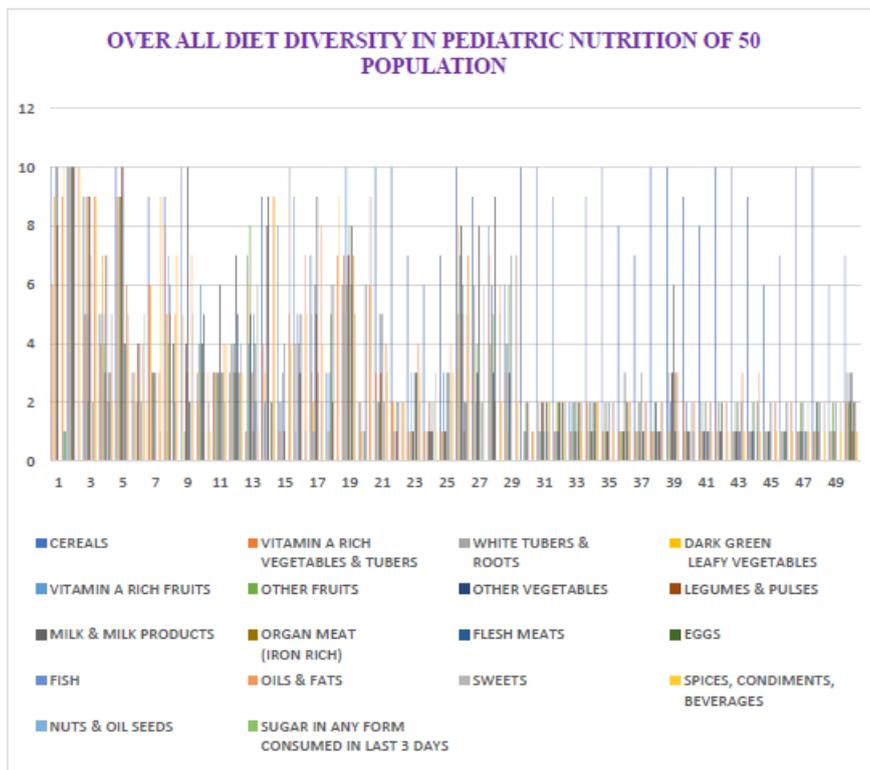


Figure No. 2 Diet Diversity Chart of the Population during Covid-19 Lockdown period.

Table No. 1 Demography and Statistical analysis of 50 population

HEIGHT (CM)	WEIGHT (KG)	AGE (YEARS)
131	30	10
134	30	9
124	27	8
140	25	10
140	25	10
127	20	9
130	35	8
149	52.9	12
145	34	12
150	53	12
145	44	12
143	27	11
132	45	10
136	35	9
158	34	11
140	30	9
135	38	9
126	31	8
138	34	9
145	42	12
133	40	9
128	38	8
133	38	10
138	45	11
137	42	10
133	32	9
135	36	9
130	26	10
111	32	9

121	20	8
125	25	8
121	20	8
121	30	9
98	25	8
93	20	8
137	35.6	11
144	45.7	12
140	45	12
153	42.8	12
138	40	10
138	40	10
145	30	9
145	35	10
125	24	8
138	40	9
126	27	8
153	45	11
121	35	8
129	32	8
131	36	9
Sum	6688	1714
Average	262	67
Count Number	50	50
Maximum	158	53
Minimum	93	20
SD	12	8

Table No. 2 P VALUE SUMMARY OUTPUT OF 50 POPULATION WITH REFERENCE TO AGE AND WEIGHT.
SUMMARY OUTPUT

<i>Regression Statistics</i>	
Multiple R	0.661597
R Square	0.437711
Adjusted R Square	0.425997
Standard Error	1.059245
Observations	50

ANOVA

	<i>Df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>				
Regression	1	41.92396	41.92396	37.36535	1.69E-07				
Residual	48	53.85604	1.122001						
Total	49	95.78							
	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95.0%</i>	<i>Upper 95.0%</i>	
Intercept	5.794935	0.643435	9.006242	6.94E-12	4.501222	7.088649	4.501222	7.088649	
WEIGHT (KG)	0.111583	0.018254	6.112721	1.69E-07	0.07488	0.148286	0.07488	0.148286	

Table No. 3 P VALUE SUMMARY OUTPUT OF 50 POPULATION WITH REFERENCE TO AGE AND HEIGHT.
SUMMARY OUTPUT

<i>Regression Statistics</i>	
Multiple R	0.730825
R Square	0.534106
Adjusted R	

Square	0.5244
Standard Error	0.964185
Observations	50

ANOVA

	<i>Df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>				
Regression	1	51.15665	51.15665	55.02767	1.69E-09				
Residual	48	44.62335	0.929653						
Total	49	95.78							
	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95.0%</i>	<i>Upper 95.0%</i>	
Intercept	-1.39106	1.490608	-0.93322	0.355379	-4.38813	1.606007	-4.38813	1.606007	
HEIGHT (CM)	0.08232	0.011097	7.418064	1.69E-09	0.060007	0.104632	0.060007	0.104632	

SUMMARY AND CONCLUSION

We were interested in understanding "Observing Diet diversity in Children between the age group of 8 years to 12 years while home schooling during to COVID 19 restrictions.". For this study, the participants and their child would be presented with questionnaire and asked to answer some questions about the food intake over past 3 days. The recorded responses were kept completely confidential. The study had taken around 5-8 minutes to complete for each response amongst the population. The participation in this research was voluntary. The participants had the right to withdraw at any point during the study. The survey concluded that the participants were taking immune booster in their regular diet viz., Chawanprash, Turmeric, Lemon, Oranges, Ginger, Zinc supplements, Multivitamins, Vitamin-C, Neem, Eggs. Sugar, jaggery, honey was consumed 1 tablespoon at the least and 25 tablespoons at the highest among the participants within the duration of every 3 days of diet. We have also come across that many participants have missed outside junk food viz., Pizza, burger, momos, fries, panipuri and almost all sort of street foods. Participants have also responded that they had snacks and tea every now and then with loads of sugar consumption. However, Carbs were the primary diet for males and whereas in females snacky, chocolate were prominent. The Principal Investigator of the current study is the authors itself, can be communicated via email. Statistical analysis and entire demographic data related to the survey have been included in Fig no. 1-2 and table no. 1-3

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