

Ahmednagar District, Maharashtra, the second most populated state in India. A comparison was made between socio-economic conditions, adoption of new technologies, changing cropping pattern, and market access to identify the drivers of dietary diversity in a transitional scenario moving from subsistence agriculture in upland regions towards commercial production in lowland regions. Hilly upland region has thick forests, sparse population, small land holdings and rainfed-organic subsistence agriculture. This region has poor transport, communication, and healthcare facilities. In contrast, lowland region scores better on these development parameters. Here, cropping pattern is dictated by market trends and farmers use irrigation facilities and modern farm implements for high productivity. Through our Nutrition Awareness Programme this study also focused on analysing dietary behaviours of primary school children in the villages.

**Methods** Qualitative methods used were semi-structured interviews, seasonal calendar, 24 hrs. dietary recall and focussed group discussions. The data was quantitatively analysed using Stata 12.0 and AnthroPlus 1.0.4.

**Results** Results (at 95% confidence) indicated a high household dietary diversity score (HDDS) and Women's Dietary Diversity Score (WDDS) amongst the adult population in both the regions – Upland: HDDS 6.4, WDDS 4.0; Lowland: HDDS 7.3 and WDDS 4.7. Upland students exhibited a balanced dietary pattern of different food groups with Dietary Diversity Score (DDS) of 7 whereas for lowland it stood at 6. However, over 50% of upland students were stunted with HAZ < -2; over 10% risked being overweight; 50% were wasted with low BAZ scores. Higher percentage of upland students were malnourished despite higher DDS, especially, girls exhibited a lower DDS and were more severely wasted.

**Conclusions** The study establishes that improved irrigation, livestock ownership, crop diversification, and easy access to the markets have scope to increase dietary diversity in this region.

## Food systems

### 2 ADDRESSING NUTRITIONAL GAPS AND SUGGESTING A PRACTICAL FRAMEWORK TO REDUCE THE RISK OF MALNUTRITION AND IMPROVE NUTRITION SECURITY IN SANTHAL TRIBAL COMMUNITIES IN INDIA

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**Background** The double burden of malnutrition is a growing problem, which is disproportionately represented across the Indian population, with undernutrition dominating rural areas. This study aimed to identify nutritional gaps in traditional recipes of Santhal tribes, create a recipe book to address deficiencies and support diet diversity.

**Methods** Food Frequency Questionnaires (FFQ) were conducted to analyse dietary patterns of Santhal communities. Recipes were collected from five villages and shortlisted into 37 dishes based on availability, acceptability and popularity. Commonly consumed templates were based on FFQ findings and individual dishes. Nutritics software was used to identify nutritional gaps. In total, 24 recommended templates, were created to satisfy adequate intake of nutrients. Mann-Whitney and unpaired t-test were performed and findings were presented as mean (standard deviation(SD)) and median (25th–75th percentile).

**Results** Less than one-fifth of consumed templates met energy requirements, 27% met protein recommendations, and 4% met requirements for fibre, total fat, monounsaturated and polyunsaturated fat. Other nutrients of concern included vitamins B12, B9, iodine, calcium and iron. Recommended templates significantly increased energy (Consumed (C): 996.0kcal (930-1090); Recommended (R): 1183.0kcal(1094-1341); p<0.0001), protein (C: 25.0g(8.4); R: 40.5g(33.2-52.3); p<0.0001), total fat (C: 7.4g(6.1-8.8); R: 17.2g(14.1-22.9); p<0.0001) and fibre (C: 5.0g(4.0-6.5); R: 8.2g(5.8-11.7); p=0.0013) compared to consumed templates. Additionally, calcium (C: 108.5mg(36.0-302.5); R: 245.5mg(152.3-528.3); p=0.0121), iron (C: 5.3mg(2.1-8.2); R: 10.7mg(8.2-13.2); p=0.0002), vitamin B6 (C: 0.4mg(0.3-0.7); R: 1.1mg(0.6-1.6); p=0.0001), B9 (C: 54.5ug(36.3-172.8); R: 252ug(179.4); p=0.0026) and B12 (C: 0ug(0-0); R: 1.0ug(0-2.1); p=0.0001) were also significantly increased.

**Conclusion** This study provides a novel insight on the nutritional adequacy of indigenous Santhal recipes and highlights the need to enhance the nutrition status of these communities. Concerted efforts should be made to increase communication for nutritional advocacy, both nationally and internationally. Future research should evaluate the acceptability, practicality, and uptake of this recipe book in addressing malnutrition in rural communities.

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### 3 COSTING A NUTRITIONALLY BALANCED THALI: IS AN ORGANIC DIET AFFORDABLE?

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**Background and Objectives** Affordability is probably an impediment to improving diets in India. However, evidence for the relationship between the healthfulness of foods and price is scarce. In addition, little is known about the underlying cost taxonomies for alternate food systems. To address these gaps in the literature, the present study endeavours to determine the cost of a nutritionally balanced, healthy North-Indian vegetarian thali (platter). Further, the price differential between organic and conventional thalis has been determined.

**Methods** This research is an exploratory attempt to quantify what it costs to prepare nutritionally balanced organic and conventional North-Indian vegetarian lunch and dinner thalis for an Indian adult male and female engaged in moderately

**Abstract 3 Table 1** Differential cost statement for an organic vis-à-vis a conventional thali (in ₹)

Cost Items	Female			Male		
	Organic	Conventional	Differential Cost	Organic	Conventional	Differential Cost
<b>Panel A: Lunch</b>						
Direct material cost	82.55	51.99	30.56	92.81	58.50	34.31
<b>Panel B: Dinner</b>						
Direct material cost	85.61	58.86	26.75	111.74	73.92	37.82
Total differential cost on meals/day (&#x20B9.)			<b>57.30</b>			<b>72.13</b>

**Note:** The differential cost between organic and conventional thali is the same for direct labour and kitchen overheads.

active work. The quantities and nutritional value of dishes are based on Nutrient Requirements for Indians (ICMR-NIN, 2020). DietCal was used for dietary calculations. Two stages of accounting led to cost accumulation and assignment to the cost object, i.e., the thalis. Further, differential costing of the organic vis-à-vis conventional thali was determined.

**Results** From a nutritional point of view, the Indian thali is a balanced meal providing both macro- and micro-nutrients. However, organically grown ingredients are relatively more expensive than conventional ones, from between 4 per cent to 358 per cent. The total cost per day of two square meals (in terms of organic thalis) is ₹215.66 for females and ₹252.05 for males. Further, the organic thalis are slightly over 50 per cent more expensive than conventional ones (table 1).

**Conclusions** The trade-off between sustainability and affordability challenges our food system. Direct organic marketing initiatives can be a win-win situation for producers and consumers, leading to a ready market and better access at lower prices. From a policy perspective, a gradual expansion of organic agriculture and the integration of best organic management practices into conventional farming is the way forward.

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## Health systems

### 4 THE MEDIATED EFFECTS OF ADIPOSITY AND GLYCAEMIA ON LOW CARBOHYDRATE DIETS AND MARKERS OF CVD RISK: FINDINGS FROM THE UK NATIONAL DIET AND NUTRITION SURVEY (NDNS) 2008–2016

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**Background** Lower total carbohydrate intakes could have beneficial effects on cardiometabolic risk markers. However, the effects of low carbohydrate diets (LCD) on lipid markers and clinical end-points remain largely unknown. This study aimed to examine the associations between LCD and cardiovascular conventional risk factors and investigate whether these associations are mediated by body mass index (BMI), waist circumference (WC) and haemoglobin A1c (HbA1c).

**Methods** We included adults aged 45–80 years from the UK NDNS programme (2008–2016) with data on dietary intake,

anthropometric and biochemical parameters. Four interventions were examined including LCD, Low Carbohydrate and High Fibre Diet (LCHF), Low Carbohydrate and High Saturated Fat Diet (LCHS), and Low Carbohydrate and High Unsaturated Fat Diet (LCHU). Obesity was measured by BMI and WC. Biochemical markers included HbA1c, total cholesterol, HDL and LDL cholesterol, triglycerides, systolic and diastolic blood pressure and C-reactive protein (CRP). BMI, WC and HbA1c were used as mediators of the effects. The analysis was adjusted for sociodemographic status, lifestyle factors and antihypertensive medication. Causal mediation analysis was used to investigate the total, indirect and direct effect of LCD on CVD markers.

**Results** BMI, WC and HbA1c fully mediated the association between LCD and triglycerides and fully mediated the effects of LCHF on LDL, although BMI and WC were sufficient to fully mediate the effects of LCHF on triglycerides and CRP. BMI alone fully mediated the effects of LCHS on HbA1c, triglycerides, LDL and CRP. None of these mediators explained the effect of LCHU on CVD risk markers.

**Conclusion** This study demonstrated that individuals on LCHF improved their CVD markers as expected, but those on LCD who increase fat intake had no effects on CVD markers mediated by obesity and diabetes. More research on the mechanisms underlying the significant increase in HDL cholesterol in people consuming LCD is needed.

### 5 CHANGE OF DIETARY AND LIFESTYLE HABITS DURING AND AFTER THE COVID-19 LOCKDOWN IN CYPRUS: REPEATED CROSS-SECTIONAL SURVEYS

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**Background** People's dietary and lifestyle habits appeared to be influenced by restrictive measures imposed in response to the COVID-19 pandemic. This study aims to examine the differences in dietary and lifestyle habits during and after the lockdown measures in Cyprus.

**Methods** Two online cross-sectional surveys were conducted, using a self-administered, anonymous questionnaire to collect information on sociodemographic and anthropometric characteristics, smoking habits, physical activity, and dietary habits. The first survey was conducted between the 6th of April 2020 until the 20th of June 2020 (during national lockdown)