CENTRE FOR BIOINFORMATICS
MAHARSHI DAYANAND UNIVERSITY
ROHTAK-124001 (HARYANA)

Dated: 10/06/16

CERTIFICATE

This is to certify that the dissertation report entitled **"Prediction Of Allergenic Proteins & Mapping of IgE Epitopes in Chickpea Using Computational Approaches"** submitted by **Priya Batra** to the Centre For Bioinformatics, Maharshi Dayanand University, Rohtak for the partial fulfillment of the requirement of the degree of Master of Science in Bioinformatics, is a bonafide work carried out by her at Bioinformatics Infrastructure Facility, Sri Venkateswara College, University of Delhi, New Delhi and Centre For Bioinformatics, Maharshi Dayanand University, Rohtak under our guidance and supervision.

The results contained in this report have not been submitted in part or full to any other university or institute for the award of any degree or diploma.

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Activity: Faculty:

Student Projects/Internships

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3. The Guidelines stated that every project must be student-centric. The students must be regular undergraduate/postgraduate student of the college. They should not be the doctoral student/Research Associate/Project Fellow of any individual teacher associated with the project. At least 8-10 students must be involved with every project, each carrying out a specific objective independently.

a. **Number of students involved;6**

1. Himanshi Sharma
2. Karan Kagathara
3. Abhishek Garg
4. Rohan Kapahi
5. Shivam Maurya
6. Swati Tanwar

b. **The courses /prouamme they are pursuina:;**

1. Karan Kagathara - (B.Sc (H) Biochemistry lll yr)
2. Abhishek Garg - (B.Sc (H) Biochemistry lll yr)
3. Rohan Kapahi - (B.Sc (H) Biochemistry lll yr)

4. Shivam Maurya - (B.Sc (H) Biochemistry II yr)
5. Himanshi Sharma - (B.Sc (H) Biochemistry II yr)
6. SwatiTanwar- (B.Sc (H) Biological Sciences III yr)

c. Responsibilities undertaken;

- Preparation and autoclaving of media, buffers and reagents
- Experimental work
- Record keeping and Data analysis
- Lab reports and presentations
- Lab maintenance

Six students were split into teams of 2 to handle one cloning experiment each.

1. Construction of pGEMT::pknB KD(Swati Tanwar and Karan Kagathara) 2. Construction of pGEMT::pknK KD (Abhishek and Himanshi)
3. Construction of pPROEX-htb-mRuby2::pkn8 (full) (Shivam and Rohan)

Routine progress was followed through lab meetings (every 15 days). Students were asked to submit lab reports once a month.

Besides their individual experiments, all students participated in regular maintenance and functioning of the lab such as autoclaving, replenishing tips, tubes etc and making solid / liquid LB media.

Certificate

On the basis of declaration made by the student **Prateek Kumar,** I/we hereby certify that the project report entitled **"MOLECULAR MODELING AND DOCKING STUDIES OF CANDIDATE DRUG TARGET IMPLICATED IN TYPE 2 DIABETES"** submitted by **Prateek Kumar** to the Department of Computer Science, Jamia Millia Islamia, New Delhi, for the partial fulfillment of the requirements of the degree of **M.Sc.(Bioinformatics)**, is carried out by him under my/our guidance and supervision. The report has reached the requisite standards for submission.

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Mapping the urban unskilled migrant labor in National Capital Region:

An exploration into the socio-economic profile and health status

Sri Venkateswara College
University of Delhi
New Delhi
Project Code-SVC-315

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CERTIFICATE

This is to certify that the Project entitled "Mapping the urban unskilled migrant labor in National Capital Region of India: An exploration into the socio-economic profile and health status.is an original work done by our students from the department of Biochemistry, Economics and BA (Program) under the guidance of Dr,Nandita Narayanasamy, Mr Krishna Kumar and Dr.Shailaja Thakur with mentors- Dr. Jesim Pais as a part of the Innovative project sanctioned by University of Delhi-SVC- 315 for a period of Jan 2016- Nov 2016.

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MAPPING THE URBAN UNSKILLED MIGRANT LABOUR IN

NATIONAL CAPITAL REGION:

AN EXPLORATION INTO THE SOCIO-ECONOMIC PROFILE AND HEALTH STATUS

Co-investigators in the project:

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The research project on **"Mapping the Urban Unskilled Labour in the National Capital Region; An Exploration into the Socioeconomic Status and Health Status" (SVC 315)**, supported by the Delhi University Innovation Project Grant was witness to a large creative interaction between the disciplines of economics and biochemistry. Students of both the disciplines got an opportunity to understand and learn about issues relating to migrant labour through the surveys done. It gave the members of the project a good exposure to the livelihood problems confronted by the migrant labour in the city. Apart from the major objective of trying to look at the various factors which result in loss of workdays and productivity, the project was one of the studies which tried to locate the issue of pollution and exposure on labour through pulmonary fitness tests.

On the outset, we express our gratitude to the University of Delhi for supporting this research project through the issue of grant under the Delhi University Innovation Programme for colleges. We express our gratitude and thanks to the Principal Dr P Hemalatha Reddy for the support extended to the project. The institutional support from the college, in particular, from the part of the laboratory staff as well as the administrative staff is gratefully acknowledged. The support from the Accounts section which has processed the bills on time for payments to the concerned parties is appreciated.

Apart from the ten students who were part of the core tram of the project, the study benefited also from many others who had volunteered to work for the same. Our trips to the various locations in the city of New Delhi like Rangpuri Pahadi, Bhawar Singh Camp, Mayapuri Industrial Cluster and Kidwai Nagar, and the interaction with the labour working in these sites was a great learning experience . The interaction with trade union leaders in the area was also rewarding. It enhanced our understanding of the issues of the labour in the informal sector. Despite the pressing academic pre-occupations, the students made it possible to conduct the survey in a systematic manner. The short life histories of the informal sector labourers made by them on the basis of extensive interaction with them are reflective of the exposure they had in the project.

A part of this study was presented in the International Conference on Environment and Development, where the paper was well received. We acknowledge the words of appreciation from Dr Randeep Guleria from AIIMS. Two of our students accompanied the mentor Dr Jesim

Pais for a workshop of Hunger Index, which was conducted in collaboration with FAO and UNDP.

Last but not the least, we benefited substantially from the mentor of this project, Dr Jesim Pais, who was there throughout with us, from the formulation of the questionnaire, and our visits to the different worksites. We express our appreciation for all his efforts.

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CHAPTER I

INTRODUCTION

There have been many plausible explanations for the phenomenon of rural- urban migration. While development literature focuses more on the rural- urban wage differential and the existence of surplus labor in agriculture (Lewis, Harris- Todaro), sociological explanations (Wood) tend to place a greater emphasis on the impact of village based networks on stimulating and sustaining such migration. Hence, understanding the patterns of such migration from rural to urban areas has to draw from both sociological theories of segmented markets and institutional economics to supplement the standard neoclassical explanation.

Since the decade of 1980s, when the huge influx of rural Chinese population into the towns and cities started posing a severe challenge to the urban infrastructure, the issue of migration became very pertinent. Similarly, the migration of Mexicans to United States provided a fertile ground for such discussions. In India, even as other areas are catching up as areas of migration, Mumbai and Delhi continue to be important destinations of migrant labour. It is estimated by Forbes that around two lakh people make Delhi their home each year which undoubtedly poses a huge burden to the already overburdened social and physical infrastructure.

In order to ebb this flow, the concept of National Capital Region was floated wherein districts from Delhi and three adjoining states of Rajasthan, Uttar Pradesh and Haryana were to develop as ‘counter magnets’ and pull away some pressure of migrants from Delhi, but this was not to be and the pace of migration of labour especially from Bihar, Uttar Pradesh and Madhya Pradesh continues unabated. Moreover, the flagship programs like the MGNREGA have had a rather insignificant impact on dissuading such migration.

Given that the NCR is an important link in the global value chain, which has emerged in the course of the increasing process of fragmentation of production in the international economy, it is only logical that Delhi and the NCR region continues to attract a large number of migrant labor. The unskilled migrant labor makes a rather positive contribution to construction, manufacturing and services sectors in the urban areas. It is the lower cost of such labor as also the reluctance of native labor to engage in low paying and so called ‘low status’ jobs that makes migrant labor much desirable in urban areas. But, while this labor is desired, its presence is not. The migrants face inferior socio- economic status and poor working conditions at their destinations and are also openly resented by the natives. They are seen to be adding pressure

to the infrastructure of these areas and also contributing to the rising crime in the cities. The urban migrant labor hence bear high economic and social costs of such migration to cities like Delhi, which affect their productivity and have negative output spillovers.

In the backdrop of the campaigns related to *Make in India,* there has been a focus on policies based on larger labor market flexibility, with intent on enhancing the ease of doing business. Some of the studies argue that the firms refuse to increase the number of labour employed in them beyond a particular number, fearing the costs involved in meeting social security expenses. The "missing middle" of mid-sized firms in India is attributed to the same. For studies in this genre, see Sarkar and Mazumdar (2009) For a perspective which argues to the contrary to and critical of theories based on labor market flexibility, see Bhattacharjea(2006) and Roychowdhury (2014). However efficiency wage models of Stiglitz and others argue that increases in nutritional intake would have a favorable effect in bolstering the productivity of labor. Higher wage is expected to translated into increased nutritional intake and is expected to have positive impact on the productivity of the labor. This is the basis for the disdainful attitude towards the minimum wage legislation existent in the country asserting it would do more harm than good. However, greater urban cost of food grains, non-availability of staple food and poor hygienic conditions of residence further has a deleterious impact on the health status of the labor force increasing their susceptibility to nutritional deficiencies and infections which in turn have a negative impact on their productivity and salary earned.

But, apart from the above, we hypothesize that there is an "urban conditioning effect", which has a pulling down effect on the productivity of the urban unskilled labor. This effect tentatively seems to work through two directions: one, the overstretched social and physical infrastructure, which fails to provide access to health services, education and other basic amenities, lack of social security and work related benefits since the predominance of such labor is in the unorganized sector (NCEUS Report); and the deleterious impact of the growing toxicity of air and lack of clean drinking water on the other, that reduces the efficiency at workplace through higher level of absenteeism and reduced contribution to the labor processes. The increasing share of expenditure on medicine, the skyrocketing levels of rentals paid in the urban dwelling clusters and the lack of avenues which could provide for multiple financial services through a safe manner, all have been serving as a severe pull down on the path of productivity improvements in the growing economy.

The project intends to map out and profile the urban migrant labor in select places of NCR-Delhi. We intend to understand the 'urban conditioning effect' and devise a series of efforts

towards redressing the gaps in policy making and urban planning that have been contributing to this effect. The project looks forward to providing constructive suggestions for detailing or re-adapting government policies towards redressing these gaps.

The project also aims at understanding the correlation between external stressors such as social exclusion, economic liabilities, imbalanced and deficient nutritional intakes and poor environmental conditions (air and water) at place of work and residence. These stressors work out a vicious cycle that further pulls down the migrant labor health and work output, which is counterproductive to the economic and better living aspirations that are the primary reasons for the rural to urban migrations. A biomarker analysis of hematological and biochemical parameters (like iron, calcium) from blood samples would be conducted to gauge the health conditions of the migrant laborers specifically looking at anthropometric indices, macro-mineral deficiencies , pulmonary fitness, metabolic and caloric adequacy and conditions like anemia and Protein calorie malnutrition.

The project intends to give a firsthand exposure to students in carrying out field surveys using structured questionnaires and address public health issues.

CHAPTER II

TRENDS IN INTERSTATE MIGRATION AND THE CONTEMPORARY STATE OF MIGRANT LABOUR

The world economy was witness to a large migration of people in the course of the nineteenth century. The emigration of number of Europeans, in different rounds to United States in the course of the 19th century, amounting to at least 50 million persons, is one of the largest in the world. The emigration which has occurred from our country to regions like Malay, Ceylon, Fiji Islands, and, also internally to certain parts of Assam to work in the plantations, under a regime of indentured labour, also has been an important facet of history. While Chota Nagpur, eastern UP and Madras Presidency continued to be the important labour catchment areas in the nineteenth century, have the trends related to labour migration changed ever since?

Towards making sense of labour migration in contemporary India, it would be useful to start with certain stylized facts. One, the last decade has been witness to a process of jobless growth; even after registering high rates of growth, the economy has been witness to low rates of growth of employment. Two, the era has been characterized by labour-saving technological changes, with low employment elasticity. Three, the period was also witness to a growing process of informalisation of labour, with a high level of vulnerability. Four, there was a rise to ascendancy of different rights based legislations in the country, with an explicit mandate of assuring inclusive growth. Five, the same got translated in the policy sphere in the form of increased expenditure under various heads like employment programmes, mid-day meal schemes, and programmes like the NRLM, NRHM and RSBY and also various schemes which tries to identify beneficiaries under the category of expectant mothers and children.

The chapter is divided into four sections. The first section gives an overview of the data with respect to interstate migration. The second section is based on studies which deals with construction migrant labour in the national capital region, immigrant labour in the industrial clusters of Ludhiana, women and child labour in the textile homestead sector in the NCR region. The third section provides an overview of health concerns that affect the migrant workers and the fourth comprises of some concluding observations.

Trends on inter-state migration

The decennial population census and the quinquennial rounds of the National Sample Surveys serve as sources of macro-level date on migration. As has been revealed in studies by Srivastava and Sasikumar (2005), these surveys capture long-term migration or semi-permanent migration better, but fail to capture seasonal migration. This presumes importance for it is the circular and seasonal migrants who are the most vulnerable of them all.

As per the NSSO estimates, in 2007-08, there are around 326 million people, who constitute the migrants in the population, amounting to around 28.6% of the population. The bulk of the migrants are women, whose main reason for migration is the exogamous marriages, which take them to different other villages, towns or districts. As per the 64th Round of NSS, of the total number of migrants, 258.4 mn (79.3%) were female migrants of whom, 82.8% migrated due to marriage. Therefore, too, migration, as categorized on the on the basis of economic reasons, presumes importance.

As per the Census data, the total number of economic migrants increased from 19.85 million in 1991 to 28.9 million in 2001; i.e., as a proportion of the total population, it has increased from 2.45 to 2.8%. It is also important to note that the rural-urban economic migrants who were 37.7% in 1991 rose up to 41.9% in 2001[1]. Ever since the tendency of migration of the urban areas has been on the increase as has been revealed by the number of the 2007-08 survey undertaken by the NSSO.

Of the migrants, bulk of the migration is that which happens within the district, or within the state, it is only 36.3% (2001) which accounts for inter-state migration. See Table 2.1 below.

There has been a steady increase in the pace of urban migration ever since the early eighties both of men as well as of women, but it has been more pronounced for the men. But even as the urban male migration rate for economic reasons, as per the NSS data increased from 12.73% in 1993 to 13.17% in 1999-00, and further to 14.36% in 2007-08, the rural rates were found to decline, that the overall rate of migration remained more or less the same[2].

[1] This analysis counts on Srivastava(2011). See the same for further details.
[2] That is, the 49th, 55th and 64th Round of NSS.

Table 2.1

MIGRATION FOR ECONOMIC REASONS BY STREAM (% TO TOTAL)						
	1991			2001		
	Male	Female	Person	male	Female	person
INTRADISTRICT	**33.7**	**45.4**	**35.5**	**28.7**	**42.1**	**30.4**
RURAL	16.6	28.8	18.5	13.1	28.5	15.1
URBAN	17.1	16.5	17	15.6	13.6	15.3
INTERDISTRICT	**35.7**	**35.6**	**35.7**	**33.2**	**34.2**	**33.3**
RURAL	9.5	15.3	10.4	7.9	15.6	8.9
URBAN	26.2	20.4	25.3	25.3	18.6	24.4
INTERSTATE	**30.6**	**19**	**28.8**	**38.1**	**23.7**	**36.3**

Source: Census Rounds: Migration Tables (D-2)

The 64th Round of NSS reveals the presence of at least one emigrant in about 27.2% of the total estimated number of 222.5 million households. SCs and STs account for 23.9% of the migrants, OBCs for 43.3 % and others for 32.8% of the migrants. While the lowest quintile accounted for 11.1% of the migrants, the highest quintile for 35% of the total migrants. Since the NSS and Census only enumerates households, if they have been in residence for six months, it tends to underestimate short-term economic migrants. Hence the 55th Round of NSS separately assessed this phenomenon of short-duration migration. Between the 55th and the 64th Round of NSS, there has been a sharp and perceptible increase in the quantum of migration. The socio economic profile of the short– run out migrants is distinctly different from that of the long-term migrants.

With the introduction of the MGNREGA scheme, there has been a perceptible decrease in seasonal outmigration, of the distress kind, more particularly amidst the female out migrants. But the substantial increase in employment opportunities have also resulted in an increase under seasonal migration as the data below would show. Between 1999-00 and 2009-10, there has been an increase of employment in the construction sector from 26 to 44 million. Indeed, the Report on Employment and Unemployment of the various years reveal that the construction sector surged with respect to the number of jobs generated (from 26 mn to 44.4 mn), even when there has been an absolute decline in the total employment in agriculture as well as manufacturing between 2004-05 and 2009-10. See **Table 2.2** below. The sustainability

of the same in the context of the stagnation of the real estate sector could be an important concern.

Table 2.2

Estimate of Total Employment (UPSS): 1999-00/2009-10 (in millions)			
Sectors	**1999-00**	**2004-05**	**2009-10**
Agriculture	240.3	257.7	237.3
Mining and Quarrying	2.3	2.5	3.0
Manufacturing	43.9	56.1	53.2
Utilities	1.0	1.2	1.3
Construction	17.6	26.0	44.4
Trade, Hotel etc	40.9	49.8	52.6
Transport, storage &Communication etc	14.5	18.7	20.7
Financing, Insurance, Real estate & business services	5.0	7.8	10.4
Community, social and personal services	33.0	37.7	39.6
Total	398.4	457.6	462.6
Note: Population adjusted figures, computed from various rounds of NSS reports on employment and unemployment			

It would be important to look into the gender composition of migrants. Though a large component of our migrants are women, as far as economic migrants are concerned they constitute only 14.72% of the total migrants. The data in **Table 2.3** gives a disaggregation of the number of males and females in the different sectors of employment. Whereas, the overall share of females in the migrant workers in 14.72%, it is highest in the agriculture and allied sectors at 27.22%. But, it should be noticed that as far as the short-term migrants are concerned, the construction sector continues to be an important source of their employment. Around 33% of the total short-term migrants in the country work in the field of construction, next only to agriculture, which implies that most of those who enter as short term migrants end up in the construction sector in the urban areas.

As per the 2012 CWDS study on Gender and Migration, of all sectional categories, amidst the STs, the share of the labour migration which happens under the short term or circulatory nature is the highest.

Table 2.3

Estimated Number of Labour Migrants in Sectors/ industries							
All India (2007-08) in thousands							
Industry	**Paid /income earning migrants excl marriage**		**Short term migrants**		**Total labour migrants**		**Female Share**
	Males	**Females**	**Males**	**Females**	**Males**	**Females**	
Agriculture, hunting , forestry, fishing	6430	2399	2449	922	8879	3321	27.22%
	14.53%	31.78%	19.32%	43.47%	15.60%	34.35%	
Construction	4257	402	5289	700	9546	1102	10.35%
	9.62%	5.33%	41.72%	33.00%	16.77%	11.40%	
Mining, manufacturing, Electricity	11258	1575	2412	306	13670	1881	12.10%
	25.44%	20.87%	19.03%	14.43%	24.01%	19.45%	
Trade, hotels, Restaurants l	8027	474	1190	32	9217	506	5.20%
	18.14%	6.28%	9.39%	1.51%	16.19%	5.23%	
All services other than trade, hotels etc	14280	2698	1338	161	15618	2859	15.47%
	32.27%	35.74%	10.55%	7.59%	27.43%	29.57%	
	44252	7548	12678	2121	56930	9669	14.52%

Source: NSS report No 533964/10.2/2)

Amidst the ST group, we have this share as high as 58.71%, compared to any other group. (See **Table 2.4**) Majority of the tribal women migrants (52%) migrate to the rural areas. As against the other categories who figured in construction activities and textile related jobs, the STs were largely in live-in household labour jobs. The Adivasi labour migration with circularity is also characterized by presence of intermediaries in the form of labour contractors.

Table 2.4

Distribution of Women Migrant Workers by type of migration(%)					
Type of Migrant	General	OBC	MBC	SC	ST
Long term migrant	44.51	41.56	21.51	25.98	20.81
Medium term migrant	30.02	22.98	30.11	17.36	10.48
Short term migrant	3.93	11.91	10.75	14.54	25.16

Irregular short term migrant	6.42	1.13	1.08	1.08	1.45
Circulatory migrant of longer duration	2.9	9.93	5.38	19.52	22.1
Circulatory migrant of shorter duration	4.55	6.95	4.3	6.06	10
Daily weekly commuters	4.97	3.69	25.81	14.67	8.71
Migrant for family care	2.69	1.84	1.08	0.81	1.29
All	100	100	100	100	100
Short term and circulatory combined	17.81	29.93	21.51	41.18	58.71

Source: CWDS(2012)

In fact, one of the oldest adivasi migration which occurred was to the tea plantations of Assam. Mazumdar (2014) observes the urban based agencies are now relying and counting heavily on the distress in the plantation sector to be an opportunity of getting labour for live-in domestic household services in different cities of India. Mass seasonal migration of adivasis towards undertaking tasks related to cotton cultivation in the Bt cotton areas of Bharuch from the rural areas of Godhra and Panch Mahal is a regular phenomenon.

A word on regional difference with respect to migration is also in order. It is the states with the high and middle per capita incomes which are witness to high gross in-migration rate. There are certain states like Maharashtra, Haryana, Punjab and Uttarakhand, which are characterized by high in-migration rates. States like UP, Haryana, which have a positive net migration rate, if we include See **Table 2.5** below.

Table 2.5

INTERSTATE MIGRATION RATES 2007-08						
STATE	**GROSS IN-MIG**	**GROSSOUTMIG TO OTHER STATES**	**GROSSOUTMIG ABROAD**	**TOTAL GROSS OUTMIGR**	**NETMIGR RATE**	
AP	1.35	1.64	0.58	2.22	-0.87	-0.29
ASSAM	0.43	0.91	0.01	0.92	-0.49	-0.48
BIHAR	0.73	6.24	0.14	6.37	-5.64	-5.51
CHATTISGARH	4.2	1.39	0.03	1.42	2.78	2.81
GUJARAT	4.2	2.2	0.38	2.57	1.63	2
HARYANA	10.24	6.49	0.23	6.72	3.52	3.75
JK	0.99	2.16	0.07	2.23	-1.24	-1.17

JHARKHAND	1.59	3.3	0.07	3.37	-1.78	-1.71
KARNATAKA	4.11	2.9	0.25	3.15	0.96	1.21
KERALA	3.58	2.71	5.3	8.01	-4.43	0.87
MP	2.18	2.82	0.04	2.86	-0.68	-0.64
MAHARASHTRA	5.97	1.63	0.24	1.87	4.1	4.34
ORISSA	1.46	2.65	0.07	2.72	-1.26	-1.19
PUNJAB	7.79	4.9	1.62	6.52	1.27	2.89
RAJASTHAN	3.03	3.59	0.37	3.96	-0.93	-0.56
TN	1.61	2.23	0.81	3.04	-1.43	-0.62
UTTARKHAN	11.63	7.69	0.12	7.81	3.82	3.94
UP	1.89	4.76	0.22	4.99	-3.1	-2.87
WB	3.02	1.57	0.1	1.67	1.35	1.45
Source: NSS report No 533, Statement 6.10.1						

Punjab and Uttarakhand are characterized by high out-migration rates. Amidst the states characterised by a high negative net migration rate are Bihar, Kerala and Uttar Pradesh. Those with high positive net migration rates include Maharashtra, Uttarakhand, Haryana and Chattisgarh. It should be noted that in the case of state of Kerala, the net migration moves from negative to positive , if we take into consideration only migration into the state and to other states. In, fact the internal remittances back to the households constitute an important mechanism of stabilization of consumption for the receiving families.

Different studies have drawn attention to the role played by remittances in the stabilisation of consumption of families of the migrants back home. While 15% of households in Bihar and 24.6% of households in UP and 8.6% of the household in West Bengal report receipt of domestic remittances, in the NSS 64th Round, of the total domestic remittances, the share accruing to the three states are 12.4%, 19.6% and 7.9% respectively . But, if one takes the overall remittances received, (both domestic and international), the share accruing to Kerala is highest at 16.9%

II

The State of Migrant Labour: What do the studies tell us?

Migration facilitates 'informalisation' of the economy in many ways. By providing cheap labour, it might erode the bargaining power of organised local labour. It introduces labour practices which rely on informal networks. Such networks shape recruitment and settlement by

using ethnicity and kinship for mobilization of labour. The ethnic and caste identities of the workers, supervisors and recruiters play an important role in the work process and labour disciplining (Chakrabarty,1989).

This section would focus on a set of studies in the field of migrant labour in the entire of the country. The findings of the empirical studies based on construction labour in NCR, the nurses in Bombay, Delhi and Kerala, the women and child workers in the garment industry in Noida (NCR Region), the migrant workers in the Ludhiana industrial cluster, the Bihar migrant labour in interior Kerala,

The booming construction sector in the country has been one of the most important sources of employment for labour, and in certain, cases, a refuge for the short-term distress labour. In an empirical investigation undertaken in the NCR region , Srivastava and Sutradhar (2013) come up with the findings that even as the migrant labour are better remunerated than in their place of origin , they are highly dissatisfied with the place of stay in the destination as against the origin. It was found that they were not able to avail many of minimum rights due the sheer ignorance of the rules concerned. Gross violation of the rules relating to the number of hours worked as well as the minimum wages to be paid are some of the are features of the construction sector in the NCR region. Given that it is the most important sector which provides employment to the migrant labour, if the situationnear the NCR region characterised by such sort of injustices, it requires proper attention of the government. The overdependence of the labour on the contractor rather than on any other union is also primarily responsible for this.

The Building and Other Construction Workers Act (BOCWA), 1996 provides for the safety, healthcare and social security of the construction workers registered under this Act. Apart from other assistance for construction workers that include provision of pension for workers above 60 years of age and expenses for treatment of major ailments and education of children, the Act directs the state governments to make employers liable for the provision of basic facilities. However, awareness among the construction workers about such Act and provision is abysmally low. All the construction workers enumerated in the survey conducted by Sutradhar and Srivastava (2012) replied that they either don't know about the presence of such board or have not registered with it, reflecting similar scenario at the state and national level. (Soundararajan, 2013)

To reflect on their living standards, the construction workers are also enumerated for different expenses that they spend in a month. The per capita consumption expenditure arrived at by

dividing the total reported monthly expenditure by the number of family members staying with him her/her gives the figures of Rs. 1292.60 and Rs. 1234.34 for skilled and unskilled workers respectively which, when translated into daily per capita consumption expenditure read as Rs. 43 and Rs. 41 respectively. The fact that Rs. 32 a day as poverty line fixed by Planning commission in 2011 invited sharp criticism leading to constitution of a new committee put in perspective the standard of living maintained by migrant labourers in the construction sector.

The tracer survey conducted in the source area further confirms the results of the worker survey in NCR – that wages paid at the destination does bear little resemblance to the local labour market and often reflects the lack of availability of livelihoods in the source area, as evident in the even lower wages and lesser number of labour days available to non migrant workers. That said, through remittances as well as enhancement of educational opportunities and increase in consumption, the migrant households are able to better their livelihoods compared to the non-migrant households, the study by Srivastava and Sutradhar (2012) observes.

In their work on the migrant labour in a set of diverse industries in Ludhiana, Pais and Ufumi (2014) brings out a picture of the migrant labour in the industrial cluster of Ludhiana. Through a Mincerian decomposition approach with respect to the determination of wages, they decompose and prove that the labour belonging to the SC categories receive lower wages compared to other counterparts. The study also observes that despite the absence through higher years of learning, the some of the workers have picked up skills in the trade that they were even operating on CNC machines. Yet another important finding is that that the presence of well-defined rights on land back home had a negative effect on their wage earnings. Most of the migrants to the region were from UP as well as Bihar. Indeed, the labour market segmentation on the lines of caste continues to be a reality, even when it is to be noted the labour belonging to the other backward communities were not facing such a disadvantage.

In their study on women and child labour in the textile sector in the NCR region, Bhaskaran et al (2010) draws attention to the strategies adopted by the firms under an era characterised by global value chain in international production. Firms who act as suppliers for the international apparel market outsource part of their production, in the form of adding embroidery and undertaking embellishment tasks, which amounts to a minor share of the total value added, to the homestead industries or households, so that a legally conformable sort of child labour could be deployed towards the undertaking of the same. In this instance, there are consenting parents back in Bihar who sent their children, particularly boys, for a exposure which they would get in Delhi. In this sense through large scale maneuvering done by the firms, of the existing labour

laws which prevent child labour at firm sites, through the wages handed over directly to the head of the household, the whole process is made legally conformable. Given the marginal nature of the change in wages which is brought about by this process, the authors suggest that conditional cash transfer mechanism should be resorted as a policy strategy towards containing this phenomenon of child labor.

In a logistic regression analysis undertaken by Srivastava (2011) on short duration outmigration, on the basis of unit level data of the NSS 64th Round Migration Survey, it is estimated that the odds ratio of a person belonging to the lowest quintile of monthly per capita expenditure is 2.05 times as much as that of person who is of the fifth quintile, the odds ratio of a person being a ST is 1.57 times against OBC, and the odds of the person belonging the low income state is 1.47 times as against that of a middle class.

Naik and Unni (2013) through an index of vulnerability of workers in the informal sector, in their study tries to compare and contrast the state of vulnerability of labour (both formal and informal) in the cities of Ranchi and Delhi. The study concludes that labour in the informal sector is far vulnerable compared to the one in Ranchi, whereas, the worker in the formal sector in Ranchi is far less vulnerable compared to their counterpart in Delhi. But it should be noted that, in the era of the flexibilisation of production through the global value chain, the extent of informalisation is on the increase, and, many of the rights which accrue to those working in the informal sector stands restricted due to the logic of exclusion written into these legislation. Pais (2015) takes a critical look on this issue.

The process of urbanization and the increase in the number of families with double income have resulted in a large increase in the demand for domestic housemaid servants. The abuse of the workers in this area has been an important matter of concern. Labour advocacy groups have been working towards improving the lot of the labour in this sector. As per the NSSO estimates in 2004-05, the number of workers employed in private households, largely domestic workers, are 4.75 million. Of these, 3.05 million are women workers in urban areas, making the sector the most prominent in female employment in urban areas. The substantial increase in the number of housemaid servants has resulted in the share of the female sin the domestic workers category increasing from 63.4% in 1999-2000 to 71.6% in 2004-05.See Table 1.6 below. Interstate migration accounts for a substantial share of the domestic labour.

A study by Neetha (2009) draws attention to the entry of different worker agencies backed by some legal/ social structure like trade union (SEWA), a co-operative society (Nirmala Niketan

in Delhi) or a church (Yuvati Seva Sadan) or voluntary organisation (Tribal Development Society), which gives the maid labour with some amount of training. In micro-level studies done by Mazumdar and Neetha , women in the fields of domestic labour have expressed their preference of staying out of the places of work.

Table 2.6

Domestic household workers across sub-categories				
Categories of workers	No of workers ('00)		Female share	
	1999-00	2004-05	1999-00	2004-05
Household maid/ servant	4382	23811	80.4	87.4
Cook	64	966	72.6	73.9
Governess/babysitter	26	696	76.4	74.2
Total domestic workers	4471	25474	63.4	71.6

Source: Unit level NSS Employment and Unemployment. Neetha (2009)

Even in this sector, there are a number of organisations which have nothing to do with the church also which used symbols and names associated with the same, engaging in the placement of domestic helps. Even when some sort of professionalization and public advocacy is seen developing in this regard by efforts led by Kamala Sankaran and others towards the betterment of the lot of the domestic household labour, it would take a long time before the control of the *munshi-daffadar-meth* system of labour recruitment in India is limited in its importance.

Prasad Aleyamma, (2009) suggests that *journeys*, rather than settlement, characterize the life of many of the workers, especially those who are engaged in construction work since large construction companies keep shifting their worksites as projects move. The workers who had come to Kerala from Saharsa district in Bihar to build a road had worked in Delhi, Belgaum (Karnataka), Ludhiana (Punjab) and Guwahati (Assam) before coming to Kerala.

III

Health issues in Migrant workers:

With an increasing world population, globalisation of the world's economy, climate change and other socio-political and economic factors, more people migrate today than at any other time. This movement has implications for the health of both the individual who migrate as well as the community they migrate to. It has been documented in the *2009 United Nations Human Development Report* that migration benefits people in terms of increased educational and economic opportunities. However, people who move can also face challenges when accessing local health and social services. A treatise issued by the WHO states that the relationship between migration and health of the migrant is a progressive, interactive process influenced by temporal and local variables. Population movements generally render migrants more vulnerable to health risks and expose migrants to potential hazards and greater stress arising from displacement and insertion into new foreign environment.

Some diseases or illnesses are sustained by differences that are purely geographic or environmental in origin. Examples of environmentally-limited diseases include vector-borne conditions, for which environmental factors determine the distribution of disease transmission, as observed in the epidemiology of malaria, tuberculosis, gastrointestinal infections and respiratory infections. In other situations, the factors that determine or influence health result from more complex interactions (Huynen MM, Martens P, Hilderink HB, 2005). Apart from the burden of infectious disease encountered due to environmental factors such as sanitation and hygiene, migrant labor are also susceptible to non-communicable diseases. Such non-communicable disease include micronutrient deficiencies, malnutrition syndromes (El-Ghannam AR, 2003) and geographically-defined exposure risks, such as health outcomes related to extreme weather or altitude (Marconi C, 2004). Malnutrition, defined as ill health caused by deficiencies of calories, protein, vitamins, and minerals interacting with infections and other poor health and social conditions, saps the strength and well-being of the migrant class. Women are more likely to suffer from nutritional deficiencies than men are, for reasons such as women's reproductive biology, low social status, poverty, and lack of education. Sociocultural traditions and disparities in household work patterns can also increase women's chances of being malnourished. (Elizabeth I. Ransom and Leslie K. Elder, 2003)

Social and economic influences can also be significant factors in health and disease outcomes in migrant populations. Poverty, education, housing and nutrition are directly related to disease prevalence and illness outcomes (BD Gushulak, J Weekers and DW MacPherson, 2010). Recent migrants often have to deal with low incomes, marginalization and limited access to social benefits and health services, especially during the early stages of insertion into a new environment. Low-skilled and seasonal migrant workers are also often concentrated in sectors and occupations with high levels of occupational health risks (BD Gushulak, J Weekers and DW MacPherson, 2010)

In summary, health consequences in migrant labor result from occupational hazards, poverty, substandard living conditions and poor access to health care. Specific problems include infectious diseases, chemical- and pesticide-related illnesses, dermatitis, heat stress, respiratory conditions, musculoskeletal disorders, traumatic injuries, reproductive health problems, dental diseases, cancer, poor child health, inadequate preventive care, and social and mental health problems (Hansen E. and Donahue M., 2003).

In India, the construction sector is the largest economic activity after agriculture and since it is a labor-intensive industry it consists 44% of all urban unorganized workers (Shah K R et al,2010; Tiwary G et al ,2011) This work force comprises 55% of unskilled labor, 27% skilled labor and rest the technical and support staff. As per the report of National Commission for Enterprises in Unorganized Sector (NCEUS), there are about 26–30 million workers in the construction industry. According to NSSO 1999-2000 about 1.76 crore workers in India are employed in the construction activities . Thus construction sector has been and continues to be one of the largest employers in India and being generally unskilled, it attracts migrant agricultural labor during off-season (Annual report. New Delhi: Ministry of Labor, Government of India; 2002)

The construction workers are exposed to multiple physical, chemical and biological agents, which make them vulnerable to various health problems that include -injuries, respiratory problems, dermatitis, musculo-skeletal disorders and gastro-intestinal diseases (Shah K R et al,2010). Construction site workers are exposed to a variety of inhalable particulate matter which lodge and cause inflammatory reaction in the mucus membranes of the respiratory tract and lead to poor performance on pulmonary function tests (Lakshmi Sumana P V, 2016). A number of studies in India have shown that respiratory function among the construction workers is decreased when compared with the existing normograms with no significant association with duration of work, use of face mask and smoking (Naveen R et al, 2014;

Banerjee et al,2015). More precise studies with population control matched for age using spirometry pulmonary function tests are needed to assess the findings of the study. Studies show that workers also suffered from contact dermatitis, dry and fissured skin, frictional callosity, ulcer, and other skin disorders, as the workers are in constant contact with various irritants such as cement; hydrofluoric acids; rock wool; fiber glass preservatives; chalk; fly ash; oil in brick-making; and also different sensitizers such as epoxy resin, phenol-formaldehyde, chromate, cobalt, adhesives, wood preservatives, and polyurethane resins (Banerjee et al 2015). Another reason for having infectious skin disease as well as poor pulmonary health is that migrant workers' settlements are usually crowded, dusty, unhygienic, and ill-ventilated thus providing favorable environment for infections. Compared to other industries, labor engaged in the construction sector also has higher rates of work-related illnesses and injuries. Areas that pose a threat to worker health and safety include operating of hazardous machinery, exposure to hazardous substances, environments prone to slips, trips, and falls, and tasks requiring high repetition, awkward postures, and inadequate rest. Apart from this, in most of construction sites the workers employed are unorganized in nature and are often not guided by the legislations made for the health and welfare of the workers and hence are not eligible for free or subsidized care and preventive initiatives(Kumar .N.A,2011).

Most importantly, there are statistics from the National Family Health Survey which gives us a sense of the very poor performance on health parameters of the country at large. Through the investigation in this study, we are trying to understand the linkages between the epidemiological problems of labour with their conditions of work, giving due focus to aspects of pulmonary fitness of construction labour.

IV

Some concluding observations

Even as empirical studies reveal that with the growing process of informalisation, the vulnerability of labour is on the increase, the period was also witness to a number of macrosocial legislations which had an intent of enhancing the lot of the labour. Nevertheless, the clauses of exclusion built into the same has been restricting the domain of the applicability of these legislations to a very few of them. The presence of rights based legislation and minimum wages act notwithstanding, the same is not implemented in reality due to the absence of institutions like the trade unions on the ground level. Lack of awareness amidst even the

long term migrants with respect to many of the labour legislations with respect to migration, which deprives them of many concessions routed through the agency of the state is a case for instance.

Though the scale and outreach of the MGNREGA might be far below that which is desirable, the ability of the same in enhancing awareness with respect to floor minimum wages, through the intervention of organisations like MKSS in rural Rajasthan would go a long way in assuring a fair deal for the labour. Given the low level of unionization prevalent amidst different urban unskilled labour, the conditions of migrant labour in the urban areas have a chance to improve only if efforts with respect to the notion of minimum wages are developed right from the rural areas where they hail from.

In certain segments like the rights of domestic household labour, the efforts from the part of non-governmental organizations are admirable. The labour protests translating in the form of the betterment of labour conditions have occurred only in those states, where the regimes are friendly to labour, like in the case of the strike of the estate workers in the state of Kerala. The case of the nursing strike would not have gained attention, but for the fact that the there was the pay commission award, which widened the differences of pay between those working in the public and private sector, and also because of the buoyant demand for labour, there was large expenditure incurred from the part of those in the profession towards educational expenses. The entry of men into the profession, in the light of fair wages in the international level also could be held responsible for the strike meeting its objectives. As far as urban unskilled labour is concerned, the extent of social mobility has been near to nil, at best, there has been a transition from their status, from being mere labour to that of being a supervisor or labour contractor.

Even as a number of new intermediaries have entered into the field of labour recruitment, there is a long way ahead for the largely unorganised and footloose nature of labour to get rid of the *munshi-daffadar-meht* system of labour contractors. This is inextricably linked to the hierarchies, both class and caste , extant in the rural countryside. Possibly, this is why the class consolidations in the urban areas, even as they make gains, face severe setbacks; for these affiliations of labour also stand in the way of collective decision making. The scholars in the field of informal labour as well as urban migrant have to revisit the contending perspectives of Rajnarayan Chandavarkar and Dipesh Chakraborti in this regard. Given the hierarchical nature of the labour recruitment system extant in the migrant labour markets, is there any method by which the meths and daffadars could be made to be purveyors of the freebees of the

government, towards looking at the same, it would be apt to undertake studies which would make the jobber himself the centre-point of analysis and investigation.

CHAPTER III

MIGRANT LABOUR IN THE CONSTRUCTION SECTOR IN THE NCR: A SOCIO ECONOMIC ANALYSIS

I. Introduction

Migration of labour is a phenomenon akin to the movement of any factor of production in search of higher returns and better operating environment. It occupies an important place in development literature since migration is considered to be an option and a strategy employed by the people to alleviate their living conditions. Migration within and between countries and regions is driven by economic, social and even political factors. Moreover, movement of people has a profound impact on the individual as well as on both the home and host economies. The individual who migrates is able to earn higher income and achieve a better quality of life, though this causation cannot always be established. Leaving one's home for better opportunities does come at a huge social and psychological cost. It means uprooting from one's society and 'comfort zone' and moving into a totally unknown area. Hence, we observe that social networks play a very important role in encouraging migration. People tend to migrate to regions and countries where they know people or where people from their areas have already migrated and settled. Yet, migration is not always comfortable and while taking the decision of whether to migrate or not, the individuals have to consider the entire benefit and costs of such a move. There have been studies about the push and the pull factors of migration and we do see these factors operating simultaneously to affect migration decisions.

It is important to underline the fact that the end objective of migration is not only income generation, but capability enhancement. Ushering in a new era in development economics, Amartya Sen aptly argues that the end of development is capability enhancement and capacity building. Money and income, at best have an instrumental role in improving human lives. Money translates itself into actual development, when it leads to better health outcomes and education, thus empowering the individual in the true sense of the word. So, the impact of such a move for the individual migrant has to be seen from the income he earns and also the conditions in which he lives and works in the destination regions. Migration, hence, as an issue of development has many dimensions, microeconomic- focussing on what this movement

means for the individual and his household and macroeconomic as to what it means for the economies of both the host economies and the countries of origin of the migrants.

Migration, even if it is temporary and seasonal, has significant macroeconomic ramifications. The host economy witnesses an influx of labour possessing various skills that might be in short supply in these economies. At the same time, the migrant labour, since he is coming from a relatively poorer and undeveloped economy, might be willing to settle for a much lower wage and hence out- compete domestic labour with similar skill set. This can and indeed does, lead to volatile situations where the domestic labour feels threatened by the migrants and employ various ways of marginalising them. Producers and firms, on the other hand, should benefit from such movement in as much as they can work with lower costs and higher margins. We also find, following the implications of the Harris- Todaro model, that migration leads to and feeds an already existing informal sector in the host economy. The informal sector is characterised by exploitative conditions- no security of tenure, much lower wages and no permanent work related benefits such as provident fund, insurance etc. for the employees. The migrants, especially those at the lowest rung of the skill and income hierarchy, have an extremely low opportunity cost and this fact is exploited by their prospective employers. As Harris and Todaro point out, efforts of the migrants that aim to alleviate their conditions of work and living prove futile, if not counterproductive. They land up with much lower monetary compensation and also face very adverse conditions at work. The fact that they still continue to remain in their new homes simply shows that the alternative is even worse. They might not literally have anything to fall back upon- no employment, no assets and no money. They hope for a better future if not for themselves, for their children and family. Migration also puts a lot of pressure on an already strained urban infrastructure. Most of the migrants, especially the unskilled ones, live in slums, often illegal, and are often deprived of their basic living amenities. They face and are also alleged to create law and order problems for the local residents- again a bone of contention between the locals and the natives of the area and the migrants.

For many of the reasons discussed above as well as others, migration is a highly politically sensitive issue. We are living in times, when the issue of immigrants is fuelling right wing extremism and is deciding the leaders of the day. With recession prevailing globally, and more so in the developed countries, migrants are construed as villains of the piece, eating away whatever little opportunities are available in the economies. Hence, elections are being fought and won on this plank of intolerance towards immigrants. Unbalanced economic growth both between regions and between countries is fuelling one of the largest human migrations that the

world has witnessed in known history. In 2015, as estimated by the UNFPA, about 244 million people live outside the country of their origin, accounting for about 3.5% of the world population. Moreover, rising construction activities, informalisation and contractualisation of labour are becoming important avenues for employment of migrants especially the unskilled ones.

Migration of people is supposed to have beneficial impact on the countries of their origin as well. Better emoluments that these people receive in their new employment is supposed to lead to higher remittances, strengthening the economic position of their households and also affording a better future for their children by making it possible to provide them better education and health facilities. In addition to flow of money, migration leads to the flow of technological, social and human capital back to their countries of origin, stimulating economic development and aiding in poverty alleviation there.

II. Present Study. Methodology and Hypotheses

Our study is essentially a microeconomic study of a sample of unskilled labour migrants coming into the National Capital Region (NCR) of Delhi to work in the construction sector. We had a sample of around forty migrant construction labourers based in different parts of Delhi, with equal number of relatively settled migrants and seasonal migrants. The areas that we went to and interacted with the migrants were Rangpuri Pahadi (Vasant Kunj), Bhavar Singh Camp (Vasant Vihar), construction sites at Sri Venkateswara College and Kidwai Nagar. Through a semi structured questionnaire, we try to understand both the macroeconomic and microeconomic reasons and implications of such migration. We extensively interview the respondents on their socio- economic conditions prior to migration and following migration. We seek to understand the reasons for their move- locating both the social and economic factors. We then focus on their quality of life in their residential areas- specifically looking at the extent of hygiene, cleanliness, availability of basic amenities, extent of pressure on his household and income. We also try to understand their expenditure pattern by asking them to recall their detailed expenditure in the past one month on food (including the various sub types), hygiene products, education, medical expenses etc. Though we tried to extract the maximum information from them about their expenditure, we could not succeed very much and obtained scattered data only. In addition to the socio economic analysis, we conduct a health analysis on the respondents as well. We gauge the health parameters of the respondents by a Pulmonary

Function Test (using spyrometers), anthropometric analysis and blood analysis (discussed in the following chapter).

Since our respondents work in the construction sector, they are subject to lot of pollutants on a daily basis that must be having an impact on their health and especially on their pulmonary functioning. Through anthropometric measurements and pulmonary function tests (PFTs) as well as blood analysis, we have developed various health related indices (to be discussed at length in the following chapter) to gauge their general level of wellbeing. The conditions in which they work as well as live are not suitable for a very healthy living, a fact that our study would clearly show. The health outcomes that our analyses show would be a combination of various factors- occupation, location of their homes, dietary habits, consumption of alcohol and tobacco (also drugs). But since we do not have any control groups, it is not possible to isolate these impacts. So, we have different health indices- metabolism index, anthropometric index, micronutrient index and oxygenation index that highlight the pulmonary fitness, nutrition aspect and general level of wellbeing of the respondents.

We also use the Principal Component Analysis to develop an Urban Conditioning Effect (UCE) that reflects their conditions of living in the present location. We have combined parameters such as the size of the house, type of the house, ventilation in the house, shown by the number of windows and the number of persons living in the house to generate the index of conditions of living. Responses related to these parameters are given numbers in such a way that a higher score indicates poorer conditions of living. Given below are all the variables that we considered in constructing the Urban Conditioning Effect using PCA.

type of house- 0 for pucca (that is bricks and cement); 1 for kuccha (bricks and mud); 2 for temporary sheds
Size of the house (with 0 being the biggest house in the sample, going down to number 4)
no. of windows in the house (with 0 being for the house with maximum number of windows)
No. of persons living in the house (considering the actual numbers to be the score)

After obtaining the principal components, we take the weighted average of all principal components with the weights being given by the proportion of the total variance explained by each principal component. This is the Latent Variable approach (Nagar and Basu, 2002). We

undertake a socio- economic analysis of our respondents wherein we try to understand their income and expenditure patterns, relate their skill levels to the income they earn and also their income to their self- perceived hunger indices. Having obtained their health indices from biochemical tests and pulmonary investigations, we try to correlate their hunger indices and their metabolism and anthropometric indicators. Furthermore, we try to correlate their pulmonary fitness with their conditions of living as captured by the urban conditioning effect.

Considering health as a form of human capital, we seek to establish that migration for these unskilled labourers provides them with higher income which should lead to better health outcomes, and hence to higher incomes. Studies that have shown high correlation between income and health, have interpreted this correlation to be causation, but the latter has been questioned by many others who say that the relationship could be the other way round as well, that is better health conditions lead to better and higher incomes. There is equal justification of both these causal links and we have indeed tried to establish both these relations statistically. Income of the migrants, taken as the proxy for their productivity, varies on the basis of their skills, their days of attendance at work and also the benevolence of their contractors. We also had a few cases where the respondents were working simultaneously in two to three jobs and earning more than others who were involved only in one activity. It is obvious that those who are involved in more than one task are healthier and more capable than others. So, one should expect a positive impact of health on income and hence productivity of our respondents. At the same time, there should be a positive impact of income on health of the respondents. But, if this is not supported by our empirical results, then it could be possibly due to the adverse impact of their poor working and living conditions. The latter is termed as the urban conditioning effect referring to the circumstances that these labourers face when they migrate to locations such as the NCR. If we are able to establish a negative impact of the urban conditioning effect on the income (and productivity) of the migrants, then it would point out the fact that the lure of higher incomes in the host economies is at best a chimera for the migrants. They come in search of employment and higher wages, but the poor conditions in which they survive in their destinations, takes away the benefits of the higher incomes they earn and in real terms and capabilities, they might be facing deterioration.

We also hypothesise that when these people migrate, they face adverse living conditions in their host regions- cluttered and unhealthy surroundings, lack of safe and clean drinking water, improper sanitation facilities, availability yet inaccessibility to public utilities such as hospitals, schools, and feel threatened and unsafe in their new surroundings. Hence, we expect a negative

relation between the health indices and the urban conditioning that the migrants face in their new locations. The health indices, especially related to their pulmonary functioning would also reflect the hazard that the respondents face in their work sites, since all of them are construction workers and are constantly impacted by high levels of air pollution.

III. Observations

We have surveyed two kinds of migrants in our study: relatively settled migrants (from Rangpuri Pahadi and Bhavar Singh Camp) and temporary and seasonal migrants (working at Sri Venkateswara College and at the Kidwai Nagar construction site). As expected these migrants were coming essentially from much poorer and industrially backward states such as Rajasthan, Madhya Pradesh, West Bengal, Uttar Pradesh and Bihar. Most of them, if not all, have migrated due to necessity rather than choice. They have an agricultural background, but most of them have either none or very small land holdings, just sufficient to meet their subsistence requirements. They have been pulled out to cities such as Delhi through some exposure about the possibilities that exist here, provided to them by their friends and relatives who migrated before them. For many of the respondents, Delhi was not the first destination. They began moving out of their homes at a relatively young age either after dropping out of school or after coming of age around the age of 14- 15 years, when their move to big towns was facilitated by someone known to them. Thus, there is indeed a strong impact of social networks in migration patterns. The social networks continue to remain strong after they have migrated also, since we observed that people from the same states, and even from the same villages, continue to reside together in the slums they inhabit in Delhi. They generally migrate alone and then after initial settling down, are joined by their families. Migration is primarily driven by economic opportunities in the host regions and in a few cases by social ostracism or some adverse circumstances at home. On balance, however, the push factors seem to play a much more important role than pull factors, in bringing about migration of these labourers. Though economic opportunities are important, the culture, culinary patterns of the destination areas are also important in keeping the migrants comfortable in their new locations.

The temporary migrants are mainly men, but in case of married couples, the wives also join their husbands, leaving their children and parents behind in their homes. It was generally observed that the men are semi-skilled or skilled, functioning as masons, electricians and plumbers; while their wives are unskilled, performing mainly odd jobs, termed ‘Beldaari’. The

relatively settled migrants have spent a long time, a decade or more in Delhi. Their children are studying here and most of their links are in Delhi. They are infrequent visitors to their villages and generally go there for family functions and in times of emergency. They hardly have any regular financial commitments to their kith and kin back home. They are simply trying to make their ends meet and give good education to their children. They do contribute to their extended families in times of emergency if they have surplus funds, and take some money and gifts for people back home. Other than these occasional remittances, most of them did not seem to be doing anything for their families back home. A few were sending money for ailing parents though.

It is interesting to observe that despite having migrated a long time back, they maintain their own social customs and even dietary patterns. So people from Bihar and West Bengal continue to be rice eaters, while those from Uttar Pradesh, Rajasthan and Madhya Pradesh are primarily consumers of wheat and wheat products. The temporary migrants, are by their very nature, rooted in their villages and are here in Delhi for the job at hand. They are here to earn enough money to remit and take back home with them, for consumption, education and health related expenditures. Social functions such as births, deaths, marriages also absorb a significant portion of their income and they have to move out much more frequently and for longer time periods. They are pulled into various jobs and locations by various contractors who hire them for construction activities.

The migrants are generally from very small cities and villages who prefer to come all the way up to Delhi and the adjoining regions rather than move to much closer and culturally familiar and similar places such as the capital cities of their respective states. They recognise the fact that avenues for jobs are much higher in Delhi and in the adjoining regions. So, if they are not able to get anything to do in Delhi, they can simply move to places like NOIDA, Gurgaon and are sure to find a suitable job especially since there are many construction activities happening in these areas.

The living conditions of these migrants, as expected are quite abysmal. The relatively settled migrants occupy various slums and ‘camps’ where they live in extremely crammed conditions, deprived of basic amenities such as clean and safe drinking water, toilet and bathroom facilities. They pay high rents and live in rather unclean surroundings that point to clear apathy by the municipal authorities. The local MLAs treat them as lucrative vote banks and their constituency and do dole out certain favours to them such as promise of regularisation, providing them free drinking water etc. The temporary migrants have an even worse living environment. They are

very much at the mercy of the contractor who is committed to pay them their daily wages and nothing more than that. They come with very meagre belongings and eke out their day to day existence with the help of their earnings. They are daily wage earners, hence they do not have any paid holidays. A day lost due to poor health or any other emergency results in no payment. The contractors do provide them temporary shelters, a make shift toilet and bathing area, but needless to add, these are very small, dirty and unhygienic spaces. So, we expect that these labourers would have much poorer health conditions as a result of their poor surroundings, poor and limited diets and compulsion of working every day. Hence, they face a double jeopardy. Not only are their health conditions poor because of stresses of work and poor surroundings; their income also suffers because of their absence from work due to poor health conditions.

The relatively settled migrants also do not live in very good and clean areas, but their lifestyle and food habits are, on an average, much better than those of the temporary migrants. They generally live in families, which means having someone to cook for them while they are away at work. They have children, which also means that they bring home some nutritious food like milk, fruits, variety of vegetables etc. They are quite clear about one fact that their migration is primarily for food and basic survival. This being the case, they argue that if they continue to remain hungry in the present scenario as well, then the entire strategy is futile. So, even if not able to afford a very nutritious diet, they keep themselves well fed and away from hunger. During the course of our study, we have recorded their responses on various aspects of hunger and constructed a Hunger Index, using the methodology as developed by the FAO (). It was interesting to see a stark difference in the responses of the relatively settled and temporary migrants, with the former reporting hardly any signs of hunger, while the latter frankly admitting that they have gone without food on a few days, had limited meals and lacked nutritious diet in the past month. Their perception of health might not always be reflected in their actual parameters of health, as our health and anthropometric analysis shows.

The poor migrants do not seem to be benefiting from public services and utilities. The relatively settled migrants do have Adhaar cards as well as ration cards and are able to benefit significantly from subsidised rations. Their children do go to government schools, but they are benefiting a great deal from the EWS category admissions in private schools such as Delhi Public School. There are municipality schools in and around their localities, but they are much happier sending their children to public schools. As regards health services, they do have the option to go to government hospitals like Safdarjung Hospital and All India Institute of Medical

Sciences (AIIMS), but they, rightly so, find it very tough to gain entry to these hospitals, since queuing up there would mean loss of many man hours and therefore loss of income. Moreover, they do not get much personal attention and find the visit rather futile. Hence, they like to visit local doctors and practitioners in their localities and nearby market places, especially for minor ailments. The situation is very miserable for temporary migrants, since they neither have ration cards nor have accessibility to government hospitals.

One of the theories on benefits of migration is that it leads to skill enhancement and generation for the migrants. In our sample, however, we found very few respondents attending any formal training programme. Furthermore, there weren't any opportunities for skill generation at their workplace. The contractor and the employer did not invest in human capital formation for these people resulting in fairly stagnant work profile and competencies.

The migrants, settled as well as seasonal, were quite satisfied with the safety at their workplaces and living areas. But, they did convey their anguish about the problems of alcoholism, drug abuse in their areas, especially among the youth. These social problems lead to law and order problems and the police visit these areas often. Their children especially boys, are getting into bad company and their future is at stake.

The settled migrants hardly have any financial commitments to their kith and kin back home. They are simply trying to make their ends meet and give good education to their children. They do contribute to their extended families in times of emergency if they have surplus funds, and take some money and gifts for people back home. Other than these occasional remittances, most of them did not seem to be doing anything for their families back home. A few were sending money for ailing parents though. The seasonal migrants were primarily earning for the purpose of being able to send money back home for their children's education or to repay loans that they might have taken, or just to make ends meet. They remit money or a regular basis, or earn for a few months in places like Delhi and carry back their savings with them when they return to their villages.

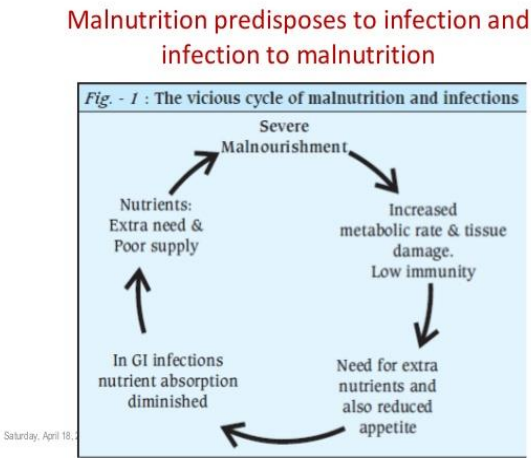
We have exhaustive case studies compiled and presented in Annexure I.

CHAPTER IV

MIGRANT LABOUR IN THE CONSTRUCTION SECTOR: HEALTH ANALYSIS

Introduction

Poor labor laws and deplorable working conditions have a deleterious effect on the health of migrant laborers. Their meagre incomes are insufficient and they are unable to afford the higher cost of living in urban areas. Lack of nutritious food and unhygienic living conditions cause a poor health status and low immunity which in turn makes them susceptible to infections. This further decreases their food intake and assimilation and increases their metabolic load leading to nutritional deficiencies and additional health problems. This poor health status further decreases their output and pulls down the productivity of migrant laborers. This sets up a vicious cycle of low food intake, nutritional deficiencies, low immunity and susceptibility to infection. Living in substandard sanitary conditions where toilet facilities are deplorable and the hygiene of the water source questionable make these laborers more susceptible to infections.



Furthermore, contractors fail to provide suitable on-site medical facilities and health insurance to their employees, letting them fend for themselves to meet theirs and their families' fundamental requirements. In addition to this, there is a hypothetical "urban conditioning" that affects their working efficiency.

One of the many effects of urban conditioning is a skewed perception of hunger and nutrition amongst these laborers. Due to the vast socio-economic disparity, their perception of healthy food and the feeling of hunger is vastly different from the "standard". Moreover, lack of nutritious food manifests in the form of deficiencies such as kwashiorkor, anemia, etc. particularly evident amongst the women and the children. The women often skip meals to ensure there's enough food on the table for their husbands and children. This has a negative impact on their health resulting in anemia and early menopause. Nutritional deficiencies are also reflected by low BMI or body fat percentage in both men and women.

The construction sector continues to be the most important source of employment in the country other than agriculture Construction workers in general are exposed to cement dust, silica dust and to exhaust from construction machinery and passing traffic. Exposure to these occupational pollutants can affect respiratory function. Apart from this for those working in Delhi NCR regions exposure to the poor air quality further increases the risk of susceptibility to poor respiratory health and lung function. The intensity of this response depend not only the sensitivity of the person but also on the acuteness or chronicity of the challenges. Even when the intensity of the pollutants is low, the chronicity of the exposure to such low levels of the pollution makes it hazardous to health. Workers at constructions site tend to put up at or near their workplace. This exposes them to dangerously high levels of silica, mica and other minerals with no respite and leading to a chronic exposure to pollutants. These workers are at high risk of pulmonary diseases such as silicosis, asbestosis, COPD, occupational asthma, etc. Moreover, these workers are vulnerable to respiratory distress caused by deposition of particulate matter in the upper airways (nose and throat), the large conducting airways and/or the small peripheral airways and air sacs or alveoli. This leads to inflammation of the linings of the lungs, causing respiratory distress.

Houses set up by laborers tend to lack proper ventilation. Overcrowding is fairly common in their single room houses where windows are seldom found and the doors are either lacking or are made of flimsy material like tarpaulin. This puts them at even more risk for even while they are away from work their lungs have no respite with almost no exposure to fresh air.

II. Methodology

After interacting with the migrant labourers in their homes/work place and filling in a detailed questionnaire to understand their economic and social status we also conducted the health

survey of the respondents. The health survey was conducted under two separate categories namely the *in situ* analysis and biochemical laboratory testing of the blood samples collected after obtaining consent from the respondents. The following tables summarize the tests conducted.

In situ analysis (Field Work)

ANTHROPOMETRIC ANALYSIS	PULMONARY FUNCTION TEST	CARDIOVASCULAR TEST	COLLECTION OF BLOOD
• Body Mass Index (Height and Weight) • Calculation of body fat (Skin fold analysis) • Anthropometric ratios	• Spirometry • Pulse Rate • Breathing Rate	• Blood Pressure • Pulse Rate • Harvard Step Test	• Tube 1: EDTA containing to obtain plasma • Tube 2: Normal • Tube 3: Sodium Fluoride containing for glucose analysis

ANTHROPOMETRIC ANALYSIS	PULMONARY FUNCTION TEST	CARDIOVASCULAR TEST	COLLECTION OF BLOOD
• Body Mass Index (Height and Weight) • Calculation of body fat (Skin fold analysis) • Anthropometric ratios	• Spirometry • Pulse Rate • Breathing Rate	• Blood Pressure • Pulse Rate • Harvard Step Test	• Tube 1: EDTA containing to obtain plasma • Tube 2: Normal • Tube 3: Sodium Fluoride containing for glucose analysis

In-field Analysis:

1. **Anthropometric Analysis:**

- The height and weight of each labourer was measured. This data was then used to calculate the BMI (Body Mass Index) of the individual.

$$BMI = \frac{Weight\ (in\ kg)}{Height\ (in\ m\ square)}$$

Underweight	<18 kg/m^2
Normal	18-25 kg/m^2
Overweight	Above 25 kg/m^2
Obese	Above 30 kg/m^2

- Hip and waist circumference was measured using a standard measuring tape.

  Mid Arm position was determined as half the length from shoulder joint to elbow; The mid arm circumference was measured by a standard tape.

- The mid arm skin fold was measured using a calliper.

- The mid arm circumference and tricep skin fold measurements were used to calculate the % body fat , MAMC (mid arm muscle circumference), MAA (Mid Arm Area) and MAFA (Mid Arm Fat Area) using the Heymsfield equation.
- Calculation of muscle mass: The mid-arm circumference (cm) and triceps skinfold measurements (mm) were used to calculate muscle arm muscle area (MAMA).
- The calculation of MAMA = $(MAC - (\pi \times TSF/10))^2 / 4\pi$ where, TSF is the triceps skinfold, MAC is the mid arm circumference (cm) and the term 10 refers to the correction for bone area
- $MAA = (MAC)^2 / 4\pi$
- MAFA = MAA – MAMA
- % Fat = 100 x MAFA/ MAA

2. Pulmonary Function Test (PFT) :

Lung function tests were performed using a Spiro Win computerised spirometer to assess the following parameters:

1. Forced Vital Capacity (FVC)

2. Maximum Voluntary Ventilation (MVV)

3. Slow Vital Capacity (SVC).

The subjects were made to sit quietly and readings were taken in sitting posture. The test was conducted and repeated 3 times with rest in between. The parameters measured were FEV1, FEV1/FVC%, forced expiratory flow (FEF 25%-75%).

A sample Spirometer readout is attached in the annexure.

3. Collection of blood sample:

Blood samples were collected after obtaining consent from the respondents in the following 3 vacutainers

- Grey vacutainer containing Sodium fluoride
- EDTA coated Purple capped vacutainers

- Uncoated Red capped vacutainers

Biochemical Analysis: (Medical Laboratory Technology by Kanai Lal Mukherjee)

1. **<u>Blood Processing:</u>**

   - **Red vacutainers:**

   Blood collected in these tubes are allowed to clot and then centrifuged at 5000 rpm for 10 minutes.

   The clear supernatant obtained is the serum(devoid of clotting factors).

   - **Purple vacutainers:**

   These tubes are coated with an anti-coagulant (EDTA) which prevents blood from clotting.

   1 ml of blood was taken into a 1.5ml micro-centrifuge tube (MCT) and was centrifuged at 5000 rpm for 10 minutes. The pellet obtained gives the **Packed Cell Volume** (PCV)

   0.5 ml of the blood was separated out into another MCT for **RBC/WBC count**.

   The rest of the blood in the vacutainer was subjected to 5000 rpm for 10 minutes in the centrifuge. The pellet obtained is the hemolysate and the clear supernatant (plasma with clotting factors).

   - **Grey Vacutainers:**

   The grey vacutainers are coated with Sodium Fluoride and are specifically meant for processing of blood used for glucose estimation.

   The tubes were subjected to 5000 rpm for 10 minutes and the supernatant obtained was then used for assessing the random blood glucose levels of the individual.

2. **<u>Hematology</u>**

   A. **RBC Count:**

   - In an MCT 5 ul of blood is mixed with 995 ul of RBC diluting fluid (1:200) and mixed well.
   - This sample is the loaded onto a haemocytometer and the RBCs are counted.
   - RBC Count = $\frac{No\ of\ cells\ counted \times Dilution\ factor}{No\ of\ squares\ counted \times Volume\ of\ square}$

B. **WBC Count:**

- In an MCT 10 ul of blood is mixed with 490 ul of WBC diluting fluid (1:50) and mixed well.
- This sample is the loaded onto a haemocytometer and the WBCs are counted.
- WBC Count = $\frac{No\ of\ cells\ counted \times Dilution\ factor}{No\ of\ squares\ counted \times Volume\ of\ square}$

C. **Haemoglobin Estimation (Drabkins' method):**

- Haemoglobin and all its derivatives present in whole blood convert to Methaemoglobin under an alkaline pH which reacts with potassium ferricynide to give a red coloured compound (Cyanmethaemoglobin) which can be spectrophotometrically read at 540 nm.
- The normal range for males is 13.5-18.0 g% and females is 11.5-16.4 g%

D. Calculation of haematological indices;

- Mean Corpuscular Volume (MCV) =Hematocrit (%) x 10/ RBC count
  (femtoliters)

- Mean corpuscular Haemoglobin (MCH) = Hb (g/L) x 10 / RBC count
  (picograms)

- Mean Cell Hb concentration (MCHC) = Hb (g/L) x 100 / Hematocrit(%)
  (g/dl)

3. **Glucose Estimation (GOD-POD method; Trinders et al):**

- Glucose is converted to Gluconic acid in the presence of Glucose oxidase which then forms Hydrogen Peroxide in presence of the enzyme Peroxidase coupled with Phenol and 4-Aminoantipyrine to form a coloured Quinoneimine dye. Absorbance of the dye is measure at 505 nm and is directly proportional to the glucose concentration present in the serum sample.
- The normal range for glucose in serum is 80-120 mg/dl.

4. **Calcium Estimation (OCPC method):**

- Calcium (in the serum) in an alkaline medium reacts with ortho-cresolphthalein complexone to give a purple coloured compound which can be spectrophotometrically read at an absorption maxima of 570 nm. The intensity of the colour product is directly proportional to the concentration of calcium.
- The normal range for calcium in serum is 8.7-11.0 mg/dl.

5. **Lipid Profile:**

A. **Cholesterol Estimation (CHOP-PAP Method):**

- Cholesterol esters release free Cholesterol via the action of the enzyme cholesterol esterase. The free Cholesterol is oxidized to form H_2O_2 by cholesterol oxidase . H_2O_2 further reacts with phenol and 4-Aminoantipyrine in the presence of peroxidase pe to give a coloured Quinoneimine dye which can be measured at 505nm. The intensity of dye is directly proportional to the cholesterol present in the serum samples.
- The normal cholesterol levels should ideally be below <220 mg/dl.

B. **Triglygeride (TAG) Estimation:**

- TAG gets hydrolysed by enzyme lipase to give glycerol and free fatty acid. Glycerol forms glycerol-3-phosphate by the action of Glycerokinase in the presence of ATP. Glycerol-3-phosphate is then oxidized to give Dihydroxyacetone Phosphate and H_2O_2 by the action of the enzyme Glycerol-3-phosphate oxidase. H_2O_2 in presence of the enzyme Peroxidase coupled with Phenol and 4-Aminoantipyrine forms a coloured Quinoneimine dye. Absorbance of the dye is measure at 505 nm and is directly proportional to the TAG concentration present in the serum/plasma sample.
- The reference ranges for TAG are:

Normal	<150 mg/dl

Borderline high	150-199 mg/dl
High	200-499 mg/dl
Very High	>500 mg/dl

C. **HDL Estimation:**

- LDL, VLDL and Chylomicrons are precipitated by addition of Polyethylene Glycol 6000. Centrifugation of the serum fraction along with PEG as the precipitating reagent leaves the HDL in the supernatant which is quantified by the CHOP-PAP method.

D. **LDL Estimation:**

- LDL was calculated using the Friedelwald equation:

$$LDL = Cholesterol - HDL - \frac{TAG}{5}$$

- The referencel range for LDL:

Optimal	<100 mg/dl
Near optimal	100-129 mg/dl
Borderline high	130-150 mg/dl
High	160-189 mg/dl
Very high	>190 mg/dl

6. **Iron and TIBC:**

1. Iron Estimation (Ferrozine method)

- In serum, Iron bound by Transferrin is released in an acidic medium where the ferric ions get reduced to ferrous ions. The ferrous ions then react with Ferrozine to form a violet coloured complex which can be read at 570 nm.
- Normal reference values in Serum

Males	60-160 ug/dl
Females	35-145 ug/dl
Neonates	150-220 ug/dl

2. **TIBC Estimation**

- The serum is treated with an excess of ferrous ions to saturate the iron binding sites present on Transferrin. The excess Ferrous ions precipitate out and the iron content in the supernatant gives to measure the Total Iron Binding Capacity (TIBC)
- The normal range for TIBC in treated serum is 250-400 ug/dl.

7. Statistical analysis and calculation of indices:

All results were expressed as mean plus /minus SE. Various indices were calculated based on the following criteria:

- Every result was calculated as score using the following formula

  (Upper value of normal range – observation)/ difference between upper and lower limit)

  e.g Calculation of BMI score having a normal range of 25-18 =

  (25 – observation) / (25-18)
- Total Index is a summation of all scores for one respondents/ no of scores

  e.g Calculation of Anthropometric index = BMI score + % fat score + hip/waist score.

CHAPTER V

RESULTS AND DISCUSSION

In this section, we provide broad contours of our sample respondents and try to generate some statistical results from the responses collected. We begin with discussion on their income and expenditure patterns and also their hunger parameters. Then, we move to a discussion of the anthropometric and biochemical parameters of the respondents that indicate their level of nutrition and health. In the concluding section, we try to relate socio- economic parameters to the health status of the respondents and also their conditions of living to their respiratory health.

Before proceeding with our results and discussion, we put forward a caveat. Though we have data for 42 respondents from all the four sites, the data is not complete because of refusal to answer some questions (especially related to income and expenditure) by a few respondents, inability to answer, lack of knowledge etc. Moreover, we needed to collect blood samples from the respondents to analyse their health status, but a few of our respondents did not cooperate on this count. Also, there were a few persons who could not perform the pulmonary fitness test satisfactorily, so we could not use their data for judging their respiratory health. Due to these issues on ground, we have not been able to generate very robust results, but there are some indications that prove to be quite informative.

I. Profile: General and Economic

1. **Average income**: Rs. 10,137/- per month (range is from Rs 1,500 to Rs 30,000/-)
2. **Average age**: 35.5 years
3. **Area wise count of respondents**

Area/ location	**No. of respondents**
Rangpuri Pahadi	16
Bhavar Singh Camp	8
SVC construction site	8
Kidwai Nagar construction site	10
Total	42

4. **Skill wise distribution of respondents**

Skill set	**No. of respondents**
Unskilled	15
Semi- skilled	5
Skilled	22

Formal Training	**No. of respondents**
Yes	14
No	28

5. **Expenditure pattern on food**

Food item	**Average monthly expenditure as % of income**
Cereals and Pulses	3.8
Fruits, vegetables and nuts	3.8
Milk	1.5
Other food items	6.3

The above statistical profile of the respondents indicates that we primarily interacted with relatively young labourers working in the construction sector. Though around 52% of them were skilled workers (conventionally defined as 'skilled'), only one-third of them had received any formal training. Rest of them either learnt on the job from their elders, relatives and friends. All of them belonged to the informal sector and had been living in these slums for relatively long periods of time. Their health status would as much be the result of their level of nutrition as it would be of their living conditions as well as their conditions at work.

As regards their expenditure profile, we could sense the inability of the respondents to recall their detailed monthly expenditure properly, but they had a fair idea of their total expenditure on food. The latter averaged to around 46% of their monthly income, while the disaggregated expenditure (food item wise) gave a very much smaller figure.

Regression Results

1. We tried to relate the monthly food expenditure of the respondents to their income, by regressing the former on the latter. The results are shown below:

```
. regress mce_food income
```

Source	SS	df	MS	Number of obs	=	15
Model	22169.1996	1	22169.1996	F(1, 13)	=	0.04
Residual	6657935.2	13	512148.862	Prob > F	=	0.8384
				R-squared	=	0.0033
				Adj R-squared	=	-0.0733
Total	6680104.4	14	477150.314	Root MSE	=	715.65

mce_food	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
income	-.0139132	.0668731	-0.21	0.838	-.1583838	.1305573
_cons	1459.304	746.6154	1.95	0.072	-153.6604	3072.269

The coefficient is negative, but the result is insignificant. We cannot read too much into this result since there were only 15 observations (out of 42) for which there were data on food expenditure as well as income. Other respondents gave answers to either one of these categories, hence we could not use them for this exercise.

Similarly, income is seen to have a positive (though again insignificant) impact on expenditure on fruits, vegetables and nuts; and a positive and slightly significant impact on expenditure on milk.

2. Regression of monthly consumption expenditure on cereals and pulses, on monthly income

```
. regress mce_cerealandpulses income
```

Source	SS	df	MS	Number of obs	=	20
Model	80583.5375	1	80583.5375	F(1, 18)	=	0.40
Residual	3655832.03	18	203101.78	Prob > F	=	0.5367
				R-squared	=	0.0216
				Adj R-squared	=	-0.0328
Total	3736415.57	19	196653.451	Root MSE	=	450.67

mce_cerea~es	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
income	-.0110712	.0175763	-0.63	0.537	-.0479976	.0258553
_cons	659.1995	221.5479	2.98	0.008	193.7447	1124.654

3. Regression of monthly expenditure on fruits, vegetables and nuts on monthly income

```
. regress mce_fvnuts income
```

Source	SS	df	MS	Number of obs =	25
				F(1, 23) =	0.22
Model	27500.1752	1	27500.1752	Prob > F =	0.6460
Residual	2919707.77	23	126943.816	R-squared =	0.0093
				Adj R-squared =	-0.0337
Total	2947207.95	24	122800.331	Root MSE =	356.29

mce_fvnuts	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
income	.0086496	.0185838	0.47	0.646	-.0297939	.0470931
_cons	379.4659	192.3921	1.97	0.061	-18.52747	777.4593

4. Regression of monthly expenditure on milk, on monthly income

```
. regress mce_milk income
```

Source	SS	df	MS	Number of obs =	27
				F(1, 25) =	1.52
Model	44110.0679	1	44110.0679	Prob > F =	0.2293
Residual	726063.058	25	29042.5223	R-squared =	0.0573
				Adj R-squared =	0.0196
Total	770173.126	26	29622.0433	Root MSE =	170.42

mce_milk	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
income	.0075487	.0061252	1.23	0.229	-.0050664	.0201639
_cons	114.2886	69.3702	1.65	0.112	-28.58196	257.1592

5. We have also related the monthly income of the respondents to their skill set. The regression results are given below:

```
. regress income skill
```

Source	SS	df	MS	Number of obs =	35
				F(1, 33) =	2.72
Model	70269627.1	1	70269627.1	Prob > F =	0.1088
Residual	853746870	33	25871117.3	R-squared =	0.0760
				Adj R-squared =	0.0480
Total	924016497	34	27176955.8	Root MSE =	5086.4

income	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
skill	1609	976.2922	1.65	0.109	-377.2814	3595.281
_cons	8283	1521.441	5.44	0.000	5187.604	11378.4

The above regression result supports the view that the skill level of the workers has a positive and significant impact (at 10% level of significance) on their income levels.

6. Finally, we relate the Hunger Index (individual's own perception of hunger) to the monthly income of the respondents.

```
. regress hungerindex income
```

Source	SS	df	MS	Number of obs =	35
				F(1, 33) =	1.50
Model	10.8296935	1	10.8296935	Prob > F =	0.2294
Residual	238.313164	33	7.22161102	R-squared =	0.0435
				Adj R-squared =	0.0145
Total	249.142857	34	7.32773109	Root MSE =	2.6873

hungerindex	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
income	-.000109	.000089	-1.22	0.229	-.00029	.0000721
_cons	4.388954	1.008941	4.35	0.000	2.336249	6.44166

The above result is in the desired direction. It shows a negative, though not a significant, impact of income on the self-perceived hunger index of the respondents. This implies that higher is the income level of the respondents, lower is their hunger index.

II. Anthropometric, Metabolic and Biochemical Results of the Sample Respondents

Table 5.1: The following table shows the mean values of the anthropometric parameters of the respondents surveyed. N= 28

Parameter/ Respondent	BMI	% fat	MAMA
Units	NA		cm^2
Normal range	18-25	8-19%	52.6cm
Sample Mean ± S.E	21.41± 0.727	16.34± 2.075	51.64± 3.295

Based on the anthropometric parameters recorded like Body Mass Index (BMI), % fat calculated based on Tricep skin fold (TSF) measurements and Mid arm Muscle Area (MAMA) all respondents in this study are neither overweight nor underweight. However the average BMI is closer to the lower limit of the normal accepted BMI range indicating a tendency towards lower body weights in the population surveyed (Table 5.1)

Table 5.2: The following table shows the mean values of the metabolic parameters of the respondents surveyed. N= 28

Parameter	**Random Blood glucose**	**Serum TAG**	**Total Cholesterol**	**HDL cholesterol**
Units	mg/dl			
Normal range	80-140	150-200		40-60
Sample Mean ± S.E	90.34± 4.37	94.11± 9.92	149.83± 8.69	41.74±0.11
Total samples(n)	28			

The biochemical parameters that were tested to ascertain the capacity to with stand starve and feed episodes indicative of caloric regulation were the Random Blood Glucose (RBG), Serum Triacylglyceride (TAG) , Total cholesterol and HDL cholesterol. These parameters were selected as the maintenance of the short term blood glucose levels would be reflected in RBG levels; and the capacity to withstand long term starvation based on mobilization of stored fat would be reflected in the serum TAG levels and Total Cholesterol levels. The HDL cholesterol would reflect the available extra hepatic cholesterol available for metabolic use. Low total cholesterol along with low HDL cholesterol would be expected in case of poor cholesterol load in the body. As shown in Table 5.2, the mean RBG in the respondents tested is within normal

range but as is seen with the Anthropometric indices, the mean is closer to the lower limit indicative of lower carbohydrate load i.e a lower caloric intake.

However the extremely low mean Serum TAG levels in the population surveyed much below the normal healthy limit as well as the moderately low total cholesterol and HDL cholesterol, clearly reflect lower metabolic and caloric stores in these respondents. This would make these individuals less capable of withstanding and regulating even short term episodes of starvation. In the event of such short term starvation episodes the body would respond and adapt by utilizing muscle mass for its metabolic needs. However, the results showing adequate subcutaneous fat and Mid Arm Muscle Area suggests that all respondents have regular food intakes and do not experience any starvation conditions. This would indicate that they have food at regular intervals but the quantity and quality of the food w.r.t caloric status is poor.

Table 5.3: The following table shows the mean values of the haematology parameters and serum calcium levels of the respondents surveyed. N= 28

PARAMETER	**Blood Hb (g/dL)**	**Total RBC count (10^6 cell/cm3)**	**HCT/PCV(%)**	**MCV (fL)**	**MCH (pg)**	**SERUM CALCIUM (mg/dl)**
NORMAL RANGE	Males: 13 - 17g/dl Females: 11.5 - 15.5 g/dl	Males: (4.4 - 5.8)10^6 cells/cm3 Females: (3.8 - 5.2)10^6 cells/cm3	Males: 37 - 51% Females: 35 - 46%	82-98 fL	27-33 pg	8.7-11 mg/dl
MEAN +/- S.E.	**11.89 +/- 0.789**	**5.75 +/- 0.546**	**44.607 +/- 2.001**	**91.434 +/- 8.908**	**22.872 +/- 1.701**	**10.63 +/- 0.557**

The table (Table 5.3) above shows the haematology parameters like Haemoglobin concentration and the indices like Mean corpuscular volume (MCV) and Mean corpuscular haemoglobin (MCH). The low mean haemoglobin concentration and the low MCH index indicates a high incidence of hypochromic normochromic anaemia. Such a condition is normally reflective of marginal iron deficiency but no apparent folic acid deficiency.

All respondents in the study showed acceptable levels of serum calcium (Table 4.3). The average age of the respondents was 35 yrs and as all of them were employed in the construction sector they had high exposure to sunlight ensuring adequate Vitamin D levels that indirectly ensure good assimilation of dietary calcium.

Table 5.4: The following table shows the mean values of the parameters tested to access pulmonary fitness of the respondents surveyed. N= 28

PARAMETER	FVC(L)	FEV1(L)	SVC(%)	MVV(%)	PEF(L/S)	PIF(L/S)
N	30	30	32	32	30	28
NORMAL RANGE	2.66 - 3.80L	2.05 - 3.20 L			3.90 - 7.23 L/S	2.54 - 4.12 L/S
MEAN +/- S.E.	2.15 +/- 0.145	1.77 +/- 0.132	66.43 +/- 7.00	62.76 +/- 5.735	4.627 +/- 0.298	3.02 +/- 0.335

Table 5.4 shows the mean values of the pulmonary fitness parameters tested on the respondents using a portable siprometer. The average Forced vital capacity was about 60% of the required value indicating poor PFT under stress. Most respondents showed a better response in Slow Vital capacity. The poor response w.r.t PFT in spite of the respondents being heavy workers could be because of either low lung function or poor hematology status. About 60% of respondents showed moderate pulmonary obstruction and 20% showed severe obstruction. Since most of the respondents were employed in the construction sector, it would appears that exposure to specific construction related air pollutants like bitumen fumes, tar fumes, silica crystals and vehicular exhausts has severely compromised the pulmonary fitness of construction workers.

To better analyse the large data set tested in this study and to correlate it with socioeconomic parameters like food intake, income and sanitation and hygiene, we have attempted to organize the biochemical parameters into a few health indices. These are

1. The Anthropomeric Index – AI
2. The Metabolic Index – MI
3. The Pulmonary Fitness Index - PFI
4. The Oxygenation Index – OI

All the indices are calculated as a summation of relevant parameter scores that show independent collinearity divided by the number of parameters summed. The parameter scores for every individual tested for the parameter is calculated using the following formula;

$$\text{Parameter score} = \frac{\text{upper limit or normal range} - \text{observed value}}{\text{Difference between upper and lower limit of normal range}}$$

Any individual having all normal scores will have an index close to 0.5. The range of all indices will be 0.5 +/- 1. An index score of 1 and above indicates low parameter scores and an index

score between 0 and – 0.5 indicates higher parameter scores. Following is the formula applied to calculate the 4 health indices.

Calculation of AI = BMI score + % fat Score + MAMA score/ 3
Calculation of MI = RBG score + TAG score + TC score – HDL score / 4
Calculation of PFI = FVC score + FEV score + PEF score + PIF score / 4
Calculation of OI = FVC score + MCV score + MCH score /3

Table 5.5: The following table shows the mean values of the Health indices calculated for the respondents surveyed. N= 28

INDEX	Anthropometric index	Metabolic index	Pulmonary Function Index	Oxygenation Index
Mean +/- S.E	0.588 +/- 0.122	0.79 +/- 0.15	1.075 +/- 0.255	1.25+/- 0.275

Table 5.5 shows the mean value of the AI, MI, PFI and OI calculated from the data estimated from this study. As reflected in the individual parameters, the most significant index affected is the PFI and the OI, both being very high indicating a lower pulmonary fitness and oxygen carrying capacity in the respondents tested. The marginally higher Metabolic index in the population tested reflects the low Random blood glucose levels indicating short episodes of fasting and or starvation and the low cholesterol as well as TAG levels indicating caloric deficient diets.

III. Interrelations between health status and socio- economic parameters

In this section, we try to establish some correlations between the hunger index of the respondents and their metabolic and anthropometric indices. The hunger index, as we have discussed earlier, is evolved with the help of answers that the respondents give to a set of questions that relate to their food intake and their perception of hunger. The table below gives these correlations.

Parameters	Correlation coefficient	No. of observations
Overall Metabolism Index and Hunger Index	0.255	23
Overall MI (HDL) and Hunger Index	0.029	23
Anthropometric Index and Hunger Index	-0.271	26
Micronutrient Index and Income	-0.452	20

Positive correlation between metabolism index and hunger index is quite unexpected, since one would expect a person with lower hunger index to have a better (higher) metabolism index. So, the expected relation between these two parameters is negative. One way to understand the result that we have obtained (a positive correlation) is that the respondents do not have a 'true' perception of their hunger. They do not realise that their daily food intake is not sufficient to give them the required nutrition. This fact is buttressed by another correlation that we obtained between the micronutrient index as shown by the respondents' blood samples and their monthly income. Again, we expected a positive correlation, but we get a negative correlation between the two parameters, thus showing that people with higher income do not show better level of nutrition. One way of interpreting this result is that the micronutrients that we considered in our study were only iron and calcium. Since most of our respondents are male and predominantly work outside in the sun, they are not expected to show much mocronutrient deficiency. So, even if they have low income, they are inherently pre- disposed to higher levels of iron and calcium. Another reason for this unexpected correlation could be the adverse impact of their conditions of living (UCE) on their health parameters.

As for the anthropometric indicators and their correlation with the hunger index, the relation is as expected. There is a negative correlation implying thereby that a person with a lower hunger index has a better (higher) anthropometric index.

We have also tried to correlate the oxygenation index (var 42) of the respondents to the conditions of their living as reflected in the urban conditioning effect (shown by principal component of conditions of living- pcoi). We get a negative correlation between these two parameters with the coefficient being -0.3866. This implies that smaller are the houses, poorer is the quality of construction, lesser the number of windows in the house and more is the number of persons who reside in the house, lower is the oxygenation index of the respondents. We also carried out a regression exercise wherein we regressed the oxygenation index on the urban conditioning effect and got a negative and significant impact (at 10% level of significance) of the urban conditioning effect on the oxygenation index.

```
. regress  var42 pcoi
```

Source	SS	df	MS		
Model	51.9712786	1	51.9712786	Number of obs =	18
Residual	295.790869	16	18.4869293	F(1, 16) =	2.81
				Prob > F =	0.1130
Total	347.762148	17	20.4565969	R-squared =	0.1494
				Adj R-squared =	0.0963
				Root MSE =	4.2996

var42	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
pcoi	-2.057299	1.22701	-1.68	0.113	-4.658445	.5438461
_cons	2.84301	1.048761	2.71	0.015	.6197367	5.066284

ANNEXURE I

CASE STUDIES

I. SUNIL PANDIT (Bhavar Singh Camp)

Sunil Pandit appeared to be leading a more or less settled life and had a gravitas about himself. He has a wife and three children- two sons and a daughter. He is 44 years old and appeared to be in good health, other than a nagging back pain. He works as a mason (Raj Mistri) and has learnt this skill from his father and uncles who do the same work back home in Khagariya, Bihar. He has basic literacy, being educated till standard three in his village, Maraiya, district Khagariya. At the age of 18 years, he went to Bilaspur, Madhya Pradesh in search of employment. He worked as a daily wager for Rs 30 per day. Then, he was brought to Delhi by his brother in law in 1993, where he started working on his own and earning Rs 40- 50 per day. He has lived in Bhavar Singh camp since then, having purchased his jhuggi where he still lives, for Rs 5000. Being a raj mistri himself, he has rebuilt his house in various stages. When we met him, his family was living on the terrace of the house since he was constructing the ground floor of the house where they would eventually be living. He says that his house has been built in almost three tries at the total cost of Rs 50,000. When we met him, he showed confidence that his house would be ready in another two weeks time.

His wife is 38 years old and seems to be managing the household fairly well. Their elder son, Rampreet is 22 years old. He has completed school and is enrolled in the School of Open Learning. He is also enrolled for a computer course. The respondent was dismissive about him saying that he has almost quit studying and does not seem to be heading anywhere. His group of friends in that area are not a good influence on him. The second son, Amarjeet has just joined School of Open Learning and appeared to be bright and responsible. The youngest child is a girl, 19 years old, who has completed school and is now pursuing training in nursing under a doctor nearby- Dr. Goyal.

Back home, in his village live his father, brother, sister in law and their three sons. His father is now dependent on his second son, who is 30 years of age, and lives with him in the village. He also works as a mason. He earns around Rs 400 per day and takes care of the family. None are dependent on the respondent, but whenever he and his family go to the village- once or twice a year for 15 days, they give around Rs 1000- 2000 to them.

Sunil earns around Rs 500 per day from his work as mason in Delhi. He does not work for any contractor. He gets work for around 15- 20 days a month. So, he is able to earn around Rs 10,000 per month. The frequency of his payment varies between being paid daily to being paid every 15 days. His working hours are 9 am- 1 pm and 2 pm- 6 pm. There is no formal overtime charge as such, though when he works more, he gets paid more by the employer (he is not working for any contractor).

He has a pucca house, with a ground floor and a terrace. He has a bathroom, but they go out in the open (jungle) for toilet purposes. They get water from a tubewell twice a day which they then store in covered plastic containers. They do not have to pay for the water. The 'vidhayak' (local MLA) puts a lump sum amount of money in the beginning of the month for water for the camp, and then tops it up whenever this amount is over. The quality of water is quite good, according to them.

Their main expenditure items are food, education for their children. He suffers from constant back pain and pain in the knees for which he visits doctors in the camp as well as government hospitals. He eats thrice a day- morning (2- 3 rotis, sabji and dahi); afternoon (rice, dal, sabji); at night (roti and sabji). He doesn't have any vices, but does take pan and drinks sometimes (once in 6 months or so, as his wife told us).

Their house is clean, they have a bed, bedding, gas stove, big cylinder, refrigerator, TV and sewing machine. They have a ration card, voter's id card and bank account (Punjab National bank, balance of around Rs 1000- 2000). He also has an LIC policy of Rs 1,00,000 for which he pays a premium of around Rs 7000 per annum. He got this policy done around 7 years back. All possess Aadhar cards.

He does not foresee any possibility of returning to the village since there is no future there. There is no employment and also no good educational opportunities for his children. He does not possess any land in the village and has no attachment with his roots. Migration was and continues to be the only option for him.

II. MOHAMMAD JANNAT HUSSAIN (Rangpuri Pahadi)

Finding construction workers at Rangpuri Pahadi was equivalent to finding a needle in a haystack. However, after a seemingly fruitless search, we found one. Quite fittingly, his middle name was Jannat.

Mohammad Jannat Hussein is an electrician by profession. He works primarily on a contractual basis at construction sites dotted all over Delhi-NCR. Originally from Gambheerpur village in the Shivan district of Bihar, a dispute with his mother, as well as other detrimental circumstances caused him to migrate. Mohammad has tried his hand in multiple professions- from tailoring at Panipat to salesmanship and electrical works in Delhi. He acquired the skills of an electrician through a vocational course when he was as little as thirteen years of age. Contrasting from the rest, he has studies till eighth standard and knows how to read and write.

Sitting amidst the cacophony of welding machines operating at full power and hammers pounding the house to shape at the construction site we met him at; we couldn't help but marvel at his story. If we ignore his apocryphal claims of age (He says that he was born in 1996 and got married in 2004), Mohammad, with an earnest twinkle in his eye, gave us a quite detailed account of his socio-economic condition.

He arrived in the city after getting married to his wife and does not visit often, as he has little of an incentive to go because both his parents are not alive. The only reason he visits his village now are marriages or other social events at the native place. He came here with his sister and brother-in-law, who also did tailoring as it was their family occupation.

Though he has multiple mouths to feed, with his wife and 5 children at home, Mohammad generally has enough to make ends meet. He supplements his work as an electrician with occasional day jobs as a salesman at the malls of Vasant Kunj. Earnings from construction works range from Rs 300 to 400 per day while salesmanship generates Rs 400 to 500 per day. A typical day has him work at the site from 9 in the morning to 6 in the evening.

Mohammad has three school-going children. Nargis, his eldest and only daughter goes to a nearby government school while his sons Farhan and Armaan go to Delhi Public School. Education expenses take away a major chunk of his income, requiring him to shell twenty to twenty-five thousand per year to buy books, stationery and uniforms. It was surprising to note that all his children attend tuitions for multiple subjects and attend the classes at nearby masjid along with.

He has seven siblings, the eldest being 35 and the youngest, from his step-mother, being younger than seven years of age. The benightedness is to such an extent that he does not remember the name of his youngest sibling.

Mohammad spends approximately Rs 6000 to 7000 per month to satisfy basic consumption expenses for his family. In addition, he shells out Rs 2000 per month as rent. His economic condition is helped by the fact that he sends virtually no remittance back home (except for social events such as weddings) and that he has no debts to pay. He is able to provide for a nutritious diet, with ample servings of roti, sabzi, eggs, pulses and the occasional meat dish available every week.

Mohammad's house consists of just one room with a window, though there is an attached toilet and bathroom. Water is available through an overhead tank while there is uninterrupted energy supply. The residence, as well as the area around it is quite clean, with MCD workers coming frequently to remove garbage. He commutes by bus to his place of work and uses his cycle to pick his children up from school.

Socially, Mohammad has faced no harassment at his place of work or residence. He is not a member of any labour union and does not have any political affiliations. However, he occasionally does help out at the nearby mosque. His main concern as of now is to get his children educated.

It was heartening to see that Mohammad, despite his circumstances was doing reasonably well. His story, his mannerism as well as his cooperation led us to conduct a productive interaction.

III. RAMDEVI (Sri Venkateswara College construction site)

Ramdevi, a 36 year old woman, hails from Garotha, of the Tehroli thana in the Jhansi district of UP. Her life has been constantly nomadic due to the nature in which she and her husband seek construction work in Delhi NCR. During my interaction with her, she reveals that she migrated to Delhi 3 years back to join her husband who works as a construction worker in Delhi. Her reason for leaving Garotha was due to her loss of control over a ration shop that her family owned. This ration shop distributed supplies for rice, sugar, atta, and matti oil. As political parties switched a couple of years back in her constituency, she states that there were attempts to take over her family's ration shop by followers of the new political affiliation. She mentions with distaste that they were from the Yadav community and had ordered abnormally large amounts of food supplies- 10 quintals rice, 20 quintals of atta, 10 quintals of sugar and 20 drums of matti oil, knowing fully well that this amount of food supply would leave a negligible amount for the rest of the village. On refusing to supply them with their order, she says that her family's control over the ration shop was reported to the police. At this point she says that the ration shop is legally hers, but is operated by the people who reported her family to the police. Currently, her family is fighting their case at a court in Allahabad.

Ramdevi has 3 children who stay at Garotha with their grandparents and uncles. Two of them- Raghbend and Ragini, aged 15 and 11 years respectively, attend school while the elder one, Rani stays at home and contributes to the housework.

Ramdevi left for Delhi after her source of income from the ration shop ceased. Upon reaching Delhi, she joined her husband and started working on a construction project for a multi-storey building in Gurgaon. Her worked involved unskilled beldari work involving labour activities with cement mixing and brick-carrying. The construction work took nearly a year for which she and husband earned nearly Rs 2 lakh according to her husband’s estimates. Unfortunately, she fell ill soon after as she was diagnosed with a severe case of dengue. Her husband took her to the Kamla Hospital in Gurgaon paying a hefty amount of around Rs 3-4 lakh. She says that it was a conscious choice to visit the private hospital at that time because her excessively poor and deteriorating physical condition. In order the fund the medical bill, a major portion of their earnings from the Gurgaon construction project were used and a loan of Rs 30,000 was also obtained from acquaintances they knew. She said that the loan amount had been paid off. On interacting with her husband, a few contradictions in what he and she stated emerged. Her

husband states that the loan has not been paid off and that they now owe their lenders Rs 60,000. However, Ram Devi does mention her ignorance with regards to how their finances are handled. Even during my initial interaction with her, she stated that they had earned an amount close to Rs 7 lakh from the Gurgaon project instead of Rs 2 lakh, the earnings her husband mentioned. It is clear that her husband handles their finances. He takes on the duty of fetching their groceries and other consumption goods apart from planning out their finances. This is the reason why she was not able to estimate their monthly consumption food expenditure as she was not familiar with food prices and other costs.

Her daily earnings for working at the college construction site are Rs 230 while her husband earns Rs 350 a day. They generally work for 20 days a month for around 8-9 months in a year. She begins her work at 8 AM, takes a one hour break from 1-2PM after which she resumes her work till around 5 PM. The remaining days are those in between different construction projects or are spent in visiting their family members at Garotha and Papra. Their monthly income is a little above Rs 11,000 and they send remittances to their respective family members in Garotha and Papra for a total amount of Rs 5000 a month whenever possible. Their savings are negligible as their monthly consumption expenditure is nearly Rs 5000 a month. A majority of the expenditure is spent on food consumption- their meals consist of roti, daal, vegetables and meat. The vegetables purchased are usually tomatoes, potatoes, brinjal and other green vegetables. They consume meat and fish about four times a month while milk and rice is rarely consumed. Ram Devi usually eats to her fill and she says that it's a necessity as she wouldn't be able to do her labour work otherwise. To relieve her stress, she has grown dependent on consuming tobacco and spends Rs 50 daily for this habit.

Due to her nomadic migrant lifestyle, her dwellings keep shifting as well. At SVC, she and her husband reside in a one-room kaccha brickhouse (without windows) which they constructed themselves. Their possessions are minimal and the only electricity consumption they use is in the form of an electric bulb. They arrange water supplies according to the work site they reside in. At SVC, they procure water from the college pipes, cooler and a tank (not sure of its location).

When asked about her future plans, it is clear that she wishes to go back to Garotha to reunite with her children and family members. Her life as a ration shop owner was a lot more stress-free and left her generally content. Migrating to Delhi has led her to experience a harsher lifestyle as she was unprepared for the drastic physical change in her daily activities. The heavy

physical work leaves her mentally drained and she feels powerless over controlling decisions that will impact her life. However, as I often saw with many migrants I surveyed; a degree of resignation is involved as a coping mechanism during their hard times. Her poor socioeconomic position does not leave her much choice but to accept her condition and to keep pushing ahead for her sake and that of her family's. There are a lot of frustrations and problems such as the case wherein she lost control over shop, but she has to resolutely move ahead and find new avenues to support herself. Therefore, these families are always living in the present; their socioeconomic status leaves them no choice. They smoothen out their consumption patterns sourced from their present income levels in a completely rational sense. Their present is governed by how much they earn- an insufficient amount would mean an extended time of hardship and stress while a larger amount would mean more remittances back to their family members and a slightly larger amount of savings for the months of hardship.

IV. MOHAMMAD HUSSAIN (Rangpuri Pahadi)

We visited Mohammad Hussain's home in the Israeli camp of Rangpuri Pahari on a hot Tuesday afternoon. We were welcomed into his house by his enthusiastic daughter and shy mother. Hussain , 37 is a painter by profession who shares a two room house with his wife and 5 children. His eldest daughter is 15 and studies in the 10th standard and his youngest son is almost 2 years old. He migrated to Delhi nearly 20 years ago from Jharkhand to earn a livelihood in Delhi. Despite having a certificate course in painting from Dulux Paints, Mohammad has been unemployed for the last 3 months and only recently secured a job polishing wood near DDA flats. When employed, he earns around 10-12,000 rupees per month. He feels that his job is dangerous at times as he need to scale tall walls without any safety belt; however he has no other choice. Off late his family is facing an acute financial crunch on account of his unemployment and has taken a loan of Rs 30,000 from their close friends during Eid. When he works, his average working day stretched to 8 hours with a lunch break in the middle. His family in Jharkhand are farmers and the full family jointly owns around an acre of land. His relatives at home are not primary dependents on him; he sends money whenever there are any savings.

He begins his day with a small cup of tea and rusk. He eats roti and aloo for breakfast, followed by a bowl of dal, sabzi and 3 rotis for lunch. Dinner is the same with rice at times in place of roti. Meat is considered a delicacy and consists of chicken and rarely mutton. Parwal and bottle gourd are generally made, also half a litre of milk is bought for the whole family every day. The family consumes no curd or fruits. Wheat and rice are bought at Rs 2/kg and Rs 3/kg from the ration shop. Vegetable are worth Rs 350 are bought for the whole week from the weekly market.

Despite the fact that Hussain has himself studied only studied till 5th standard and cannot read and write, 4 of his children go to school (except the youngest). One of his sons, Wasim goes to Delhi Public School under the quota for impoverished children. His eldest daughter was a bubbly teenager studying in the 10th standard with an interest in science. She wishes to become a doctor as its' her father's dream from her, and was looking at the medical equipment we had with us with a great interest! The total expenditure is around 12,000 for per year for the education of all the children.

The family owns and lives in a 2 room house, with only 1 window in the kitchen. Despite the obvious space crunch, the house was relatively clean. One of the walls was a highlight wall, clearly a result of Hussain's profession! They had a fridge and a washing machine, though clothes are generally hand washed. Electricity is supplied by meter and costs around Rs 700 a month. Water is procured from the bore well and is untreated. They receive water only once in 2 days and store it in buckets. They pay around Rs 250 per month for water. The house contains a toilet and bathing area, with a defunct geyser.

Overall, despite their hardships, the Ansari family spoke to us warmly, and Hussain answered all our questions with great patience!

V. WASIM SHAH (Bhavar Singh Camp)

Our interaction with Wasim Shah of Bhawarsingh Camp was unique due to varied reasons. For starters, he represented a segment of the labour demographic that we hadn't interviewed yet: a young man in his early twenties, rather than a settled family man. Secondly, he seemed to be estranged from his family and rarely spent any time inside his own house. (infact tensions were so high in his household currently that he agreed to speak with his only outside his home). He claimed to have migrated to this area of Delhi from a village in Gaziabad, along with his family when he was a small child. Currently 14 people lived in his household. This includes his parents, two brothers and their wife and children, his 2 unmarried sisters, his 4 year old daughter from a broken marriage and himself. In fact, he could not even recollect his own sister in-law's name for the purposes of this survey and claims he has nothing to do with them. He works as a freelance manual labourer. Most of his current work is near Ambience mall. He gets to know of upcoming jobs in on account of his network of friends and acquaintances in the area. The call him in his on his phone whenever there is work to be done. He makes Rs 450 per day. He claims to eat all his meals outside and spend the nights at a friend's room, thereby barely staying at home. He has tea, biscuits for breakfast, chole bature/ rajma chawal for lunch, and some non-veg food items for dinner. All of this is bought from a hotel/dhaba. He claims to feel giddy sometimes during work and is addicted to smoking (claims to smoke 25-50 cigarettes a day. He has a daughter from a broken love marriage and claims that he has a responsibility only towards her. He wishes to send her to a hostel when she is slightly older so that he can work without worrying about her well- being. His relations with his wife's and her family are also strained and he claims to have spent 3 months in jail on account of rape charges alleged on him by his sister in law.

VI. SRIKANTH

Srikanth represented the section of migrants who leave their villages to look for work, while their families stay behind. He migrated over two decades ago along with 2 other members from his village, Balliyan. They were lured by an agent who claimed that he could get them a job in South Africa, however they were duped and ended up in the city with no job and no money (the agent fled with over Rs 70,000 of their money). He currently lives in a single room with his brother. Srikanth works as a loader of cargo with JP cement. He earns Rs 435 per day, which amounts to roughly Rs 12,000 a month. He has a wife, 2 sons and 3 brothers back in the village. He claims to send roughly Rs 5000 per month back home. He eats all his meals outside, except dinner which he cooks at night. Breakfast is generally chai and biscuit at the office, followed by kadhi-rice/rajma -rice for lunch. The 2 brothers roughly spend Rs 1200 per month on non-veg food. He spends Rs 200-300 on vegetables per week, Rs 120 on oil. He gets water from the bore well, like the rest of the locality and stores it in buckets. The 2 brothers use the jungle, as there is no toilet in the house. They have a substantial loan of Rs 1.4 lakh, which was taken by the family to help one of the brother's in the village to fight for elections in the Zilla Parishad. However the brother was defeated and the family now has the burden to repay this heavy amount that they raised from various acquaintances. Towards the end, Srikanth expressed regret at having left his education incomplete. He also tried to read the questionnaire we had with us and was able to fluently read out the headline.

VII. JAMES

James was perhaps the most interesting respondent in the survey. He has worked in a variety of different jobs- right from an electrician to shopkeeper to petrol pump attendant. Originally from Howrah, Kolkata, James left for Delhi in 1992, and has not looked back since. Prior to 1992, most of his family members had already migrated to Delhi, and he was one of the few family members living in Kolkata at the time. During our interactions with him, he seemed to come across as a regular youth who was very attached to his gang of friends. This was one of the reasons he stayed back despite the fact that the rest of his family had started to migrate to Delhi. On reaching Delhi, he worked in a variety of jobs. He spent a few years working as a caterer (and was paid Rs 30 per month), and as a newspaper man delivering papers in Vasant Kunj. For a while, he also helped put op many advertisement banners up on hoardings in Lajpat Nagar. Some years later, he started working at an electronics store- he picked up the necessary skills within two months. He then invested in creating a similar electronics shop called Pulse Electronics, in Munirka with a few friends having the same line of work. This did not end well finally, as his friends ran away with their earnings, and he couldn't pay back the loan which was borrowed and used to build the shop. Finally, he had to put down his shop. In addition to these jobs, he also worked as a driver for Air India for a year. From our discussions with him, it was clear that due to a variety of different circumstances, James found it hard to stick to any one job- the bad experiences with Pulse Electronics and the fact that he states that he was sensitive to the rude manner in which his boss would scold him made him want to work on his own terms.

James now lives with his extended family at one of the numerous bastis in Vasant Vihar. Currently, James calls himself a multitechnician, and works freelance as a plumber, electrician and carpenter rolled into one. He carries a CV everywhere he goes, hoping that he can land a permanent job. At present, he earns Rs 300/400 for every odd job he gets from houses around Vasant Vihar. He sources his work through networking with his clients; he has many such people who have been his old clients and he relies on them for work.

James also has a wife and a son. His wife stays at the Baroda House due to her work commitments with their son.

James' house is clean and well built, with all modern amenities such as an AC, fan, cooler, refrigerator and television available. His house was generally much bigger than the average

housing structure in Bhagat Singh Camp. It consists of 2-storey structure with four rooms (out of which he rents out one room), a kitchen and a bathroom. Unlike most slum-dwellers, he sources his water from a private contractor, saying he doesn't trust the local source. His household ends up spending 12000-15000 Rupees per month to cover all expenses. However, he admits that not having a regular job lately has been deleterious to family finances.

James' maintains a thorough record of all his expenses and income as well as identification documents. This helped us get a complete picture of his socio-economic condition, reflected in the exhaustive data available.

VIII. BHARAT YADAV

Bharat Yadav, a 38 year old man divides his time between his native place in Madhubani, Bihar and his residence in Mahipalpur, Delhi. He migrated to Delhi for the first time 10 years back in search for higher earning opportunities. On arriving in Delhi, he started working at an export cloth factory in Gurgaon. He worked for around 10 years but found the pay to be low (Rs 5000-6000 per month) and later went back home. His parents who own bighas are into kheti work and Bharat helped them when he came back. After four years, he left for Uttrakhand to become skilled in painting. After getting trained in painting he worked in Chennai as a painter. The language issue compelled Bharat to converse in strings of English with his fellow workers. He worked here for two years under a contract. Bharat believes in his own work ethic and prefers not to work under any form of contract labour as he wishes to avoid its politics. It's apparent that he trusts his standard of work and would rather find alternative independent forms of work. So he left Chennai to come back to Delhi wherein he settled in Mahipalpur. His wife and children (a 12 year old daughter and and two sons aged 6 and 8 years) stay in Madhubani. His wife maintains the housework and often helps with the kheti work her in-laws are involved with. In Mahipalpur he shares his residence with 3 other co-villagers. They live in a single room with an attached kitchen. Bharat pays a rent of Rs 1000 per month as do the others. Bharat works for around 7 months in a year with the rest of months being spent with his family in Madhubani. He works for 4-5 months continuously before moving back to meet his other family members in Madhubani. He sends remittances worth Rs 5000/6000 depending on his earnings for the month. In his current painting job, he gets a daily wage of Rs 450. He is able to earn a salary of Rs9000- 13000 a month. There are no sickness leaves provided for him; if he doesn't turn up his wage for that day is not provided. His earnings are also dependent on whether the materials provided to him by the supplier reach him on time. If there is a delay and he isn't able to work for a day, wages are not provided as well. His work is generally dependent on the volume of painting done with a little variation here and there. He works for 8 hours- gets up at 5:30 in the morning, has a lemon tea along with roti-sabzi and packs the rest for his lunch at the work site. He tries to find work near Mahipalpur itself and generally keeps his transportation costs minimal by walking to his work sites. He generally feels that he doesn't work overtime or at night shifts; if he does so it is only once a month. After walking back home he has a meal consisting of dal,rice and sabzi before dozing off at 10:30 PM. His landowner provides him with electricity and water and he pays for these facilities (Rs 300-500 a month

for Bisleri water and a similar amount for electricity). His monthly consumption expenditure amounts to around Rs 4000 in this manner. He pays for the tuition of his kids for an amount of Rs 800. Fortunately, he hasn't fallen ill in Delhi but if he does, he says he will visit a hospital in Mahipalpur which will provide consulting services for free. Back home, he owns a buffalo which provides milk to his wife and children. The extra milk is sold off to neighbours and the like. He has taken a loan worth Rs 50,000 some years back to build his house in Madhubani where his wife and children stay. The loan has been paid off around 4 years back. Bharat also talked to us about how he felt that everyone should have money and should also believe in positive thinking to be successful in life. He seems to be happy with how he's able to get his nutrients- he generally felt that he was able to eat enough and that he had variety in his food.

IX. **TASHLIM NASIR HUSSAIN (Rangpuri Pahadi)** Tashlim, a 48 year old widow, migrated from Badhayun, UP with her husband in search of job opportunities fourteen years back. Her sister who had migrated to Delhi previously advised her to migrate to Delhi for higher earning opportunities. She left her parents who are involved in kheti work under the batai system with their landlords. On arriving at Delhi, she settled at Rangpuri Pahari after finding no other accomodation. Tashlim has eight children, two of whom are married and do not stay with her. Among the other six living with her, she has a son, Majir, who is working as a welder while the others attend school and help her in the daily housework. Both Majir and Tashlim are the breadwinners of the family. Tashlim herself works as a maid at four houses in Vasant Kunj and her average monthly salary amounts to around 6000 rupees a month. Her work involves cutting vegetables, washing utensils along with cleaning and mopping. She receives a bonus of Rs 100 and a suit for Diwali. However, in the last 3 months, she had taken a month off work to marry her 20 year old daughter Tarannum and therefore didn't receive any wage during that time. Her family had travelled back to Badhayun for the wedding; this being one of the fewer occasions she visits her native place. Tashlim visits her parents once very 1.5 years for around 2-4 days as she doesn't get too many leave days at work. Majir, her oldest son, earns a monthly salary of Rs 6000 via welding. Barely being able to scrape through each month, Tashlim does not send any remittances back to her parents. The house she lives in is a semi-pukka, one storey building very closely located to a small lake which has been converted into a dump yard of sorts by the residents. The family owns a TV, cooler and a tubelight. Her husband who was a carpenter had made the furniture (primarily a bed and a cot) before he passed away at the age of 63. Their daily meals include tea for breakfast, roti, garlic chutney and daal for lunch and dinner. Tashlim says that her family can afford to eat only few varieties of food- apart from the regular diet, chicken and eggs are consumed only once a month and fruits are considered a luxury. The family's total monthly consumption expenditure (on food, electricity, phone bills, etc) would amount to around Rs 8000. Tashlim had also borrowed around Rs 40,000 to build her house and pays an amount of Rs 2000 (need to recheck) a month (two years). Water is procured from the Masjid lane every three days and it is stored in vessels, buckets and bottles. The water is not treated or boiled before usage. Her living conditions are not hygienic: adjacent to her home is a small pond filled with stagnant water which is used as a toilet facility by its neighbours. This can have long-term health effects on her and her growing children. Her medical facilities are restricted to a doctor in Rangpuri Pahari. When asked about

how healthy she feels, Tashlim says she cannot conceive being otherwise as her children are dependent on her for survival.

X. CHINTU (Rangpuri Pahadi)

This 18-year-old belongs to Khurja, UP, and is one of the local lads of this area. He does not seem to be having a very good reputation, having bad habits (into drinking, drugs), which he also conceded is a part of growing up in this environment and also indulging in petty quarrels. They are Hindus belonging to the Jatav caste (SC). Before shifting to Rangpuri Pahari, he was living with his paternal ancestors in his village. His father was a driver in Delhi, was a drunkard and used to beat up his mother. So, she shifted to Delhi along with her children. It was her brother- in-law (husband's elder brother) who brought her here. She remarried one Murari, from Mathura, who has been born and brought up in Delhi and they have been living in Rangpuri Pahari since eight years. Chintu calls him 'Chacha' and does not seem to be having a very good relationship with him. Murari is a driver with a private courier company and earns around Rs. 10000- 12000 per month.

Chintu's mother has been working in peoples' homes as house maid, earning around Rs 3000-4000 per month. Chintu works primarily for a contractor (Malkhan), cleaning sewers and chambers. He works for around 10- 12 hours a day, cleaning around 10 chambers a day. He is paid Rs 300 a day, though he did say that the payment was not too regular and depended on whether the contractor was paid by the employer or not. He is generally free on Sundays. He works for two contratcors and circulates between the two of them according to the availability of work. He is able to earn around Rs 4000- 5000 per month, but it depends on the availability of work. His father, 'chacha', was rather dismissive about him and said that his money hardly adds to the home budget. He wants him to get a job, preferably a government job.

Chintu has studied till class 5 and can sign, read and write a little bit in Hindi. He was also a conductor way back in his village. In Delhi, he has been doing the job of a sweeper and sewer cleaner on daily wages. He remembers his days in the village rather fondly. He used to eat well, even have milk and did not have any bad habits. Coming to Delhi, he got into bad company and now chews tobacco, spending around Rs 40- 50 per day and also drinks.

His mother, Dilkesh, has been unwell for the past three months and the family has already spent around Rs 1800 on her treatment (this was reported by her husband). She has lost her job as house maid as well. She has two more sons and one daughter. Her younger son has also stopped studying after class 5 and Chintu has got some training arranged for him for motorcycle

repairing. The other son and daughter are studying in classes 3 and 4 respectively. They study in a government school near the locality, in Mahipalpur.

This family has no connection with their village. Chintu's mother faces ostracism from home as nobody wants to maintain contact with her or her children. Chintu also complained that he keeps calling them on phone, but they never respond. Nobody comes to them and they do not go anywhere.

Out of a family income of around Rs 15000- 16000 a month, Rs 3000 goes as rent, Rs 500- 700 for electricity, Food, vegetables, milk, chicken, eggs, toiletries take another Rs 5000 and miscellaneous expenditure ranges between Rs 1000- 2000. They do not send any money home. Murari has nobody in his village- all are dead, he says. The family does not have significant savings. They do not have a savings account. They do not even have an aadhar card, it is only Murari who possesses one. They do not have a gas connection and have a small gas stove with a small cylinder.

They have a one room establishment, around 12 feet by 10 feet. It is pucca house with an asbestos roof. They do not have a toilet and go into the forest for this purpose. They have a small enclosure that serves as their bathroom. For water, there is a boring done by the RWA and they also get regular water supply once a day at a place slightly far off from where they live. Water is opened for half an hour. They fill around 15- 20 litres of water and hire a rickshaw to bring the water cans home. Water is stored properly and kept separately for cooking and drinking and for washing and cleaning.

Food is cooked outside the house- they have a cooking stove and also a chulha, where they use cowdung as fuel. They have one cot, one fan and mattress. They also have one cooler fan with pump. Food is cooked 2- 3 times a day. They are mainly roti eaters, have dal, some green vegetables as well. They do use milk- the lady was preparing sewian when we met her. They also eat eggs and chicken.

Though two of their children go to school, both husband and wife were quite dismissive about the need for education. Education does not get them jobs, they argue and all they need is basic literacy to be able to read, sign and locate bus numbers. Neither are government schools attractive to them, nor are the free government hospitals. The crowd and the running around that has to be done is quite frustrating they say and therefore, they visit a dispensary and a private doctor in Mahipalpur for all illnesses.

When inquired whether the family went out into the city for some kind of outing, Murari did not cite money as being the constraining factor. Rather, he categorically stated that he did not have time to take the children out. The area of Rangpuri Pahari, according to this family is neither clean nor safe. It is almost everyday that police have to be called for some problem or the other in this area.

XI. Rakesh (Kidwai Nagar)

Rakesh was a 22 year old construction worker we surveyed in Kidwai Nagar. He had migrated to Delhi a month back from Bairganiya, Bihar. He does line work at the site and earns 9,000 per month.(Rs 6,000 for 8 hours work plus Rs 3,000 for doing overtime) His parents and 3 smaller siblings continue to live in their village. Though his family is currently not financially dependent on him, he plans to send some money back home once he has some savings. He has studied till inter, and came to Delhi to seek a higher paying job. He secured this job through his uncle who is also a contractor on the site. He is currently living with 3 other co-workers on the site itself. It is a small room with no windows. One person cooks lunch and dinner for all four every day. Their meals mostly comprise of roti, dal, potatoes or parwal. Breakfast is usually a cup of tea and biscuits. He contributes Rs 2,000 per month for the total household's expenses. Groceries are bought from a local kirana store. He has borrowed Rs 3,000 from his workplace to meet his expenses; this amount will be deducted from his salary. Despite water being provided on the site, he spends Rs 30 everyday to procure drinking water from outside as he does not consider the onsite water to be clean. During the few days of his arrival to Delhi he fell sick and had to spend Rs 200 to visit a doctor and buy medicines. Despite his young age, he claimed that he feels physically weak and tires out easily as compared to others on the site. He misses his family and is looking forward to visiting home during Holi.

XII. JAMNA (SVC Construction Site)

Jamna is a 26 years old construction worker currently working at Sri Venkateswara College. He has studied till 5th grade and then had to quit education due to lack of financial support. He is a mesthri by profession and has acquired the skills of a mesthri in Agra. He was born at Phutera village of Dammu district in Madhya Pradesh. He migrated to Agra when he was 4 years old along with his parents who were in search of work opportunities, later they moved to Delhi. Presently he is living with his wife HariBai and his youngest daughter Khusboo who is 2 years old. He has one more daughter and two sons who are living with his parents back at their hometown. He used to have another daughter too, but unfortunately she fell in a water storage tank and passed away. He earns upto Rs350 per day, his wife also works and earns upto Rs250 per day. He sends 3000 rupees to his parents every month in order to support them and his children who are schooling. He has a loan of Rs10,000 due which he borrowed for the medical fee of his parents. His parents have two acres of land in their village but it is left fallow due to no irrigation. He goes back to his village twice a month to see his kids and parents. He lives in a brick house which is set up on the campus and procures drinking water also from a borewell in college. He has made a bathing area using asbestos sheets. He spends 3500 every month to buy groceries. He buys them from a local Kiraana store. His diet mainly consists of Roti, Vegetables and Leafy Vegetables. Recently he was down with fever and had no energy to work. So he went to a doctor in Satya Niketan for some medicine, he feels that he was cheated and has told that the Doctor has charged an exorbitant price. He is unhappy about how local people take advantage and exploit migrants even though they are really poor. Even though he is facing such problems he says that he is happy with his life. He is always looking forward to meet his kids and parents and spend more time with them.

XIII. KAMLESH (Rangpuri Pahadi)

Kamlesh is a 53 years old woman we surveyed at Rangpuri Pahari. She is currently working as a cleaner and Bheldaari at construction sites. She finds these opportunities through a Thekedaar. She migrated to Delhi from Merut 36 years ago. She came with her parents and grandparents. They left Merut mainly because of disputes in the village and also to find better employment opportunities. She goes back to Merut twice a year now only to visit her relatives. Initially her parents settled in Nandnagari, eventually they kept moving from place to place where work was available. Later she got married and settled at Rangpuri. She is now separated from her husband and lives on her own with her son and his wife. Having no education she could only find unskilled jobs. Currently she works for 10 hours a day and earns 250 rupees per day. Her working hours extend to 12 hours also on few days. She is the sole bread earner in the house, her son is illiterate and does not work anywhere and her daughter in law stays at home. She contributes nearly all of her income towards household expenditure, in fact the expenditure exceeds the income often. She does not have a Ration card also. She has no savings and also has an outstanding loan of 60,000 rupees which she borrowed for her daughter's wedding. Her house often runs out of food and they even skip meals regularly due to unavailability of food. There were days on which she even went through without eating anything. Her life is really tough and difficult. One of her main problems was the encroachment of their residential area by private land owners. The people living in Rangpuri Pahari are being forced to vacate their homes due to a plan of building a shopping complex or a mall at that site. The residents were told to vacate and leave but having no where else to go, they refused to leave. Few days later a crane came and destroyed their houses. They are still living in the houses with broken walls and roofs. They have no toilets or bathing facilities and even electricity. She procures drinking water daily from the free water supply near Ryan International School. She is hoping that the Government would help them and make their miserable lives better.

XIV. Moolchand Verma (Bhavar Singh Camp)

Moolchand Verma is a forty six years old male who resides in Bhawar Singh Camp, a massive slum in Vasant Kunj. He is currently working as a mason under a contractor in various parts of Delhi and does not know how to read or write. He is originally from Kunhanta village, located in Hamirpur district, Uttar Pradesh, India. While initially he migrated to Sonepat with his Mother and brother to earn his living, he then migrated to Panipat alone, leaving the other two behind. He worked there as a Rickshaw wala but then came to Delhi in search of better life conditions. He migrated to Delhi in 1990 in the search for work and started working as a free-lancer after acquiring the skills from his friend. Now, the only reasons he visits his hometown back are social events, pregnancy of his wife and emergencies.

He lives with his big family of 9 members which includes his wife, Chanda (43); five daughters and three sons, eldest being 22 and youngest being 3. All of his kids are unmarried, where his eldest daughter is working as a housekeeper along with her mother and five kids are studying different government schools. His mother lives at his native village but is dependent on him for financial help, while his two brothers, also living there are non-dependents. He owns a two storey pakka house with two rooms and enough space. Although the electricity is supplies 24x7, the place faces an issue of fluctuating voltage. The water supply is available only two times a day and is fetched from ground water pump. It is treated before being used for drinking purpose. The house facilitates a bathroom, but there are no washrooms nearby. Hence, the family members defecate at the nearby jungle.

Verma's wage rate is as low as Rs 350 per day. Along with that, he gets paid on daily basis, but only gets work on half of the days in a year. In November, his monthly earnings totaled to Rs 6000 only. His wife's monthly income is Rs 2000, while his daughter's earnings are comparatively higher at Rs 6900 a month. Verma has a nine hours long working shift from 9-6, but can be expected to work till 9 pm on rare busy days. His shift includes a one hour rest break on normal days.

His major consumption expenses include food items like wheat, rice, oil, eggs, chicken, salt, sugar and other spices. Also, he spends Rs 100 on alcohol daily. He recently borrowed Rs 70,000 from his wife's work place for repairing his house and is paying an interest of 10% per month. His neighbourhood and working environment are safe and devoid of discrimination. He

has an aadhar card, voter's ID, ration card and bank account issued in his name. The confectionery is purchased from Kendriya bhandar and Ration shop, while the leftovers are stored in a refrigerator owned by the family.

XV. Mohammad Kawrol (Kidwai Nagar)

Mohammad Kawrol, a 45 years old man from Bihar migrated to Delhi in 2004 alone because of the poor employment opportunities at his native place. He acquired his skills when he was working at DLF and a vocational training that he did from Gurugram, Delhi NCR. From past two months he is doing a job at NBCC which he got through a contractor. He visits his home on festivals every two to three months for duration of 15-20 days.

He has to support his family back home; including his wife, four kids and mother. His wife is unemployed and does not know about any schemes under MNREGA. Two of his younger kids are studying while the other two are not doing anything as of now. Kawrol owns a one room tin house which he shares with his thirty years old brother and twenty five years old nephew, both non-dependents. They also share a kitchen and toilet facilities. The water is fetched once a day from an electrical motor and is not treated by any means. There are no bathing facilities in his house.

His monthly income sums up to around 6000 rupees out of which rupees 1200 are sent to village, which is mostly spent on food and education. The remaining amount is spent on food items like cereals, eggs, meat and fish and intoxicants. He recently borrowed an amount of Rs 20,000 from a baniya in his village for treatment purpose and has to payback an amount of 25000 to him.

Kawrol thinks that his workplace is not safe for migrant workers, although the living place is quite safe. He has a voter's ID and Bank account at his village. His consumes three meals a day where hi breakfast includes tea and biscuit, lunch consists of roti, rice and dal/sabzi and dinner has rice with meat or dal, as available. The confectionery is bought from a local kiraana store and the cooked leftovers are stored for maximum of four days.

XVI. Imran (Kidwai Nagar)

A young man named Imran is a twenty seven years old worker at NBCC construction site, Kidwai Nagar. He is originally from Allahabad, Uttar Pradesh and got schooling till fifth standard from the same. He migrated to Delhi in 2016 itself, but has worked in Chennai and Bangalore before this. He had migrated from his birth place in search for employment and visits there in every 4-5 months for a week to meet his parents. His father, an illiterate man lives in the village itself. He lives here with Ameena, his twenty years old wife and their three daughters. His wife can also read and write as she also studied till fifth standard.

Their one room home was made out of tin. The electricity is supplied 24x7 and the water is also supplied to the home. They use a common bathroom and toilet facility. Imran has a monthly income of Rs 7500 but the payment is received on every Sunday. He works on all the days of the month and gets paid in cash. He sends some amount to his relatives in native village which is spent on mostly food and other requirements. He owns five *bigha* of land in his village. His normal working hours are from 8 in the morning to 8 in the evening where he gets a break for an hour or two. Also, he can take an unpaid leave for which rupees 150 are deducted every time.

His monthly expenditure includes expenses on cereal and pulses, milk products, fruits and vegetables, eggs, fish and meat and intoxicants. He has not undertaken any loans and feels safe at his work place and living place as a migrant worker. Although, He has been threatened or harmed for being a migrant laborer in the area. He owns a ration card and Bank account. What's surprising is that he does not have a voter's ID but still voted in the elections in UP.

He consumes three meals a day, most of which consists of sabzi, roti and rice. The confectionery is bought from a nearby kiraana store, but the cooked leftovers are not stored for future comsumption.

XVII. Sarju (SVC Construction Site)

Sarju is a forty five years old man working at Sri Venkateswara College as a construction worker with his wife. He does *chunayi* here was working here for past ten days only. He is an unskilled laborer from Phutera village, Damo district, Madhya Pradesh. He has completed his education till second standard from Mitera. He first migrated to Delhi 20-25 years ago with his friend in search of work. Now, he visits his village in every month or two to meet his children. He has five kids, eldest being 18 and the youngest being 10. All of them are dependent on him for financial assistance.

They live in a temporary shelter here and have an all-day access to drinkable water and electricity. Toilet and bathroom facilities are also available. He sends rupees 5,000-10,000 to his children every month through his brother's bank account. He also owns three *bigha* of land, back in village.

The working shift is constant from 08:00 to 17:00. No overtime or night shifts are undertaken. The major expenses are incurred on cereals, pulses, vegetables, sugar and medicines. They have bought some crockery and utensils in the past one year. Sarju has taken one loan from his village 2-4 months back for Rs 20,000 which is yet to be paid with an interest at 5%. He has not been threatened or harmed at his work place, yet he believes that the living conditions are not very safe for migrant workers. He has a Ration Card, voter ID and Aadhar card, all issued in his village in Madhya Pradesh.

He intakes three meals on a typical day, mostly consisting of Roti-Sabzi and Daal-Rice. Non vegetarian food is prepared only once in 8-9 days. Most of the time the grocery is shopped from a nearby kirana store and the food storage varies from day to day. He scored comparatively higher in the hunger index with 5 points.

XVIII. ROBIN SINGH (Bhavar Singh Camp)

Robin Singh is a 25 year old man who resides in Kusumpur Pahari in Vasant Vihar, Delhi. At the time of our survey, he was working at Bhavar Singh Camp as a construction worker. Robin was born in Didoli, Muradabad in Uttar Pradesh. At Didoli, while he attended school (till class 8), he also took part in farming activities for his co-villagers (his family didn't own any land). After his elder sisters got married and arrived in Delhi to live with their husbands, he followed suit and migrated to Delhi with his wife, parents and brother around 2 years back. Robin states that they made this move to Delhi because of uncomfortable situations that his sisters possibly had to undergo- during his survey he said that he moved to Delhi in order to protect his sisters. There were other reasons to migrate as well- they were seeking better earning opportunities as jobs were minimal back home. His father, Raju, works as an office clerk at Noida, and his mother, Budhi works as a housekeeper. He has a brother who is working as an office boy at Zee TV. Robin also goes back to Didoli around two-three times a year to visit his uncle and grandmother. He does not regularly share remittances with any family member, but he does give his grandmother nearly Rs 1000 every time his visits her.

His wife, Sandhya takes care of household activities of their two children- Rehan, their four-year old son and Anshika, their 2.5 year old daughter. Sandhya cooks the food. They stay in a semi-pukka, one-room (100 sq.ft) house which does not have toilet facilities- they walk around 200 metres to a nearby jungle as an alternative. Robin has even got a tattoo of an "S", his wife's initials on his upper arm. He works for nearly eight hours a day (from 9:00 AM to 5:30 PM with a lunch break in between). He starts his morning with just a tea and a couple of biscuits; but by lunch time he has a heavier meal including dal, rice, roti, vegetables and meat. He also smokes regularly, and spends around Rs 24 in a day on cigarettes.

During our interaction with him, he also mentions that he used to work for the Delhi metro (for the Vasant Vihar station which was being constructed). He left his job after a year because of he did not enjoy the limited freedom that was available in such contractual work; he states that he wishes to work on his own terms and therefore has decided to rely on his own network connections to fetch him work. During his time at the metro construction site, he worked for 12 hours a day (much longer than his 8-hour schedule currently). He was paid Rs 14000 a month for which his payments came in on the 10th of every month, regularly. Leave facilities were nonexistent, and he would have to make it to work even if he did not feel well. He also mentioned that due to the lack of upholding safety standards at the workplace, a co-worker

faced a brutal death as his body came under a crane during work. There were times wherein he too, did not feel safe as a migrant worker in Delhi.

XIX. SUBHASH KUMAR (Kidwai Nagar)

Subash Kumar is a young migrant of 22 years. He came to Delhi from Saran in Bihar around one and a half years back. He describes his life in Bihar as a carefree one compared to his lifestyle in Delhi. Back at his home in Saran, he attended a college to pursue a bachelor's in psychology and worked alongside as a farmer on the fields his family owns.There seems to be little employment creation in his village. Even for jobs he did find, his wage income was much lower than what he currently earns in Delhi. With little earning opportunities with which he could just about make his ends meet, he decided to migrate to Delhi. His elder brothers had migrated to NCR Delhi much earlier than him- Shambhu and Soham had migrated to Delhi around 15 and 10 years back respectively. Shambu now works as a mechanic and Soham is a tailor. On entering NCR Delhi around one and half years back, he met his brothers who stay at Geeta Colony and landed a job as a construction worker in the same area due to his brothers' contacts. He completed his work at Geeta Colony after 6 months after which he started working at East Kidwai Nagar. He left his brothers at Geeta Colony as he says that he seeks out a life on independence; one wherein he does not have to listen to his elder brothers. Subash earns an approximate monthly wage of Rs 8000 and sends back monthly remittances for nearly Rs 4000 back to his parents. He is only able to earn that 8000 after working an overtime of 3 hours daily. He works on all 30 days except on the days he falls ill. His work hours are generally 12 hours long- he starts work at 8 AM, takes a lunch break for an hour from 1 PM and finally finishes his work by 8-9 PM. His work hours are also flexible to change if the work or contractor demands it. Subhash stays in a kaccha one-room setup with 4-5 coworkers who all belong to Saran as well. There are no windows and his electricity consumption is sourced from a bulb and a fan. Water is collected from a bore nearby during early mornings and evenings on a daily basis. It is not treated and the water is stored in buckets. The lack of care towards their hygiene is due to a paucity of time as a major chunk of the day goes in working and resting. Subash cooks all the food for his roommates He says that he wishes he misses the variety of food he used to get back at home. He recently fell severely ill when he suffered from high fever for ten days- since there are no paid sick leaves, he forced himself to work during the latter days of his recovery. Subash also says that he does not feel safe in Delhi. He recounted an incident of physical assault his coworker faced and says that the incident shook him deeply. Additionally, he worries about his occupational hazards wherein he like most workers work from 10-20 feet above the ground wherein the precautions taken for the construction work are minimal. In

January, he even witnessed two people falling to the ground from high heights. He therefore does not feel safe while working. Due to the drastic change of environment from is carefree life in Saran to a stressful life in Delhi, he says that feels that he's trapped in a jail in Delhi due to his heavy work commitments. He often feels homesick and misses his friends back at Saran. As our survey interview ended, he mentioned the bad air quality in Delhi and stated that "Gaon ki hawa, dilli ki dawa jaise hai."

XX. GAYA PRASAD (SVC Construction Site)

Gaya Prasad, a 40 year old man migrated to Delhi around 30 years back from Papra, lying in the Tehroli district of Jhansi. He currently works as a construction worker at Sri Venkateswara College as a construction worker. He left Tehroli in search of better work and earning opportunities. He first migrated to Delhi around thirty years back. However, he then left for Himachal Pradesh, where get stayed for around 1.5 years to get trained in construction work. After coming back to Delhi, he started working as a construction worker. His wife Ramdevi joined him three years back when the ration shop they used to own was snatched away from their hands and their source of income from it, ceased. So he lives with his wife Ramdevi, who also works as a construction worker alongside him. They both live a nomadic life wherein they keep shifting to areas they work in for shelter and sustenance. At Sri Venkateswara College, he and his wife have a one-room kaccha brickhouse (without windows) which they constructed themselves. They have minimal possessions and the only electricity consumption they use is in the form of an electric bulb. They arrange water supplies according to the work site they reside in. They procure water from the college pipes, cooler and a tank.

Gaya has 3 children who stay at Garotha with their grandparents and uncles. Raghbend and Ragini, aged 15 and 11 years respectively, attend school while their elder sister, Rani stays at home and contributes to the housework. He sends back remittances worth Rs 5000 per month for his children and his mother in Garotha and Papra.

As a construction worker, Gaya earns a daily wage of Rs 350, while his wife earns a daily amount of Rs 230. They generally work for around 20 days in a month, and they do not receive payment or sick leaves.

Together, Gaya's and Ramdevi's monthly income is nearly above Rs 11,000. Since their monthly consumption expenditure is nearly Rs 5000 a month, savings are near negligible. A huge proportion of the expenditure is spent on food consumption- to consume their diet of roti, daal, vegetables and meat. They usually consume vegetables such as tomatoes, potatoes, brinjal and other green vegetables. They consume meat and fish about four times a month while milk and rice is rarely consumed. Gaya and his wife smoke regularly and spend between a range of Rs50-100 on a daily basis on pan and tobacco. Additionally, he also consumes alcohol regularly. Gaya does not worry too much about not getting enough to eat, however he does think that he gets to eat few kinds of food. He also feels that his diet is not healthy and completely nutritious.

XXI. MAJID (Kidwai Nagar)

Majid is an 18 year old construction worker who was working at Kidwai Nagar at the time of our survey. He belongs from Saroorpoor, from the Zillapur district of Uttar Pradesh. At Saroorpoor, his father, Khalid, farms sugarcane and wheat on the 50 bighas of irrigated land they own. During the time he lived in Saroorpoor, Majid worked as a motorcycle mechanic. Majid has six siblings, some of whom are residing in Delhi- Hamid, his 26-year old brother works in a newspaper company in Noida, and Sajid, his 23-year old brother works at a cell tower. Majid left his village with five other co-villagers after a falling out with his brother. On reaching Delhi, they first arrived in Ghaziabad. Majid was then trained by his cousin, who is a contractor, and who provided him with on-the-job training. He has had this job for three years now. His monthly wage amounts to Rs 9000. Most of his recent savings have been consumed due to marriage expenses for one of his sister. Things are not entirely dull for him; he also mentions that he recently received a watch from his girlfriend as a gift.

He and his coworkers share food within a common kitchen/mess. diet includes rice, roti, bred, vegetables, dal, meat and fruits like apple. His daily expenditure on pan/tobacco is nearly Rs 50 a day. Majid also thinks that he does get to eat a variety of food, and that his diet may not be healthy and nutritious. Additionally, there have been occasions when he has skipped meals, or has gone without eating for the whole day, Unfortunately, Majid also recently suffered from chikungunya. During our survey team's visit to Kidwai Nagar, the worksite was prevalent with many mosquitoes. Workers like him are not able to take adequate protection and precaution to prevent such serious diseases from affecting them.

Majid now also visits his hometown once in every 1-2 months to meet his family members.

XXII. ASHOK KUMAR (SVC Construction Site)

Ashok Kumar is a 25-year old construction worker, our survey team found at Sri Venkateswara College. At the age of 15, he left his Durgapur, his hometown within the Ajaigarh district of Madhya Pradesh, with a known mistri, to find employment in Delhi. Back home, there were few opportunities to work in farming at that time. His father lives in Durgapur, while his mother lives and works with him in Delhi. He visits family back home once every two months for nearly a week.

He earns a daily wage of Rs 230. Since his work is contractual, when he does find work, he works for many consecutive days- for instance, he worked each day last month (since the time of his survey round). He doesn't receive any holidays, or leave facilities such as sick leaves. His normal working day starts at 8 AM in the morning and ends at 5:30 PM in the evening. There is generally little variation in these timings. He buys his food from a ration shop. On many occasions, he is worried that he does not get to eat enough food as he finds his diet insufficient to feed his full appetite. He lives with seven other people (three of which are family members and the other four are co-villagers). He sends around Rs 1000-2000 as remittances back to his family members in Durgapur.

Even though Ashok has personally not received any threats, he does not feel safe at his workplace or at his home. This is possibly exacerbated due to his nomadic lifestyle wherein his work dictates where he gets to live.

XXIII. SHAMEENA (Rangpuri Pahadi)

Shameena is a 27 year old woman living within the Israeli Camp at Rangpuri Pahari. She owns a shop in front of her house and sells eatables and other commodities to the people at Rangpuri Pahari. Shameena was born in Muradabad in UP. She migrated to Delhi around 15-16 years back with her husband, and they first migrated to Seelampur in Delhi. From Seelampur, they later shifted to Sangam Vihar where Shameena's brother Mohammad Hashtan Khan, a carpenter, resides.

Shameena has two sons- Mohammad Shadab and Mohammad Shoaib, aged 10 and 7 years respectively. They stay in a one-storey pakka housing setup one room and one window. Her sister-Bebe also resides in Rangpuri as well. Both sisters share their electricity and water supply facilities. In addition to these facilities, both sisters own a combined toilet facility. Shameena's husband passed away and since then both the sisters have made convenient arrangments to make life easier for both their households. Shameena's parents have also passed away and her family members at UP do not visit her often. She does not send remittances back home.

Her shopkeeping earns her around Rs 250 to as high as Rs 500 a day. She earns Rs 6000 generally on a monthly basis. Her shop opens at 7 AM and shuts down by 9 PM. Shameena has not had any substantial education and she has not been trained to even write her own name. Additionally, she does not possess a ration card, and a voter's ID card. She is yet to receive her Aadhar card.

Even though she does not worry about getting enough food to eat, Shameena is concerned about the few kinds of meals that she and her children consume. She feels that their consumption of food does not fully include all varieties of food so as to have a healthy and nutritious diet. There have also been occasions when she has eaten lesser than she should and when she has skipped meals.

XXIV. LAL (Kidwai Nagar)

Lal, a 25-year old man had started working as a construction worker at Kidwai Nagar for the past one month. He recently migrated last year from the Gangarampur district from West Bengal. He left with a known mistri/contractor from his village.

He visits his home back at Gangarampur once in a year and generally stays back for two months. His 20-year old wife, Joba lives in West Bengal and helps in the farming activities back home, in addition to household responsibilities. He has two children Rani and Mintu are 8years and 10 years respectively.

Lal stays with 4 other workers (who were also his co-villagers) at Kidwai Nagarin a two-room temporary tin house. Water supplies are procured on a daily basis in the morning and are stored in drums. They generally do not treat their water before consumption. His housing setup also has toilet and bathing facilities. Lal sends back remittances worth Rs 5000-6000 on a monthly basis.

Additionally, his family back home owns 1 bigha of farming land. At Kidwai Nagar, Lal earns a weekly wage of Rs 500-600

He starts working by around 8 AM in the morning; takes a one hour lunch break from 1-2PM and generally finishes his work by 8 PM in the evening. Lal generally feels safe and comfortable at his workplace and has generally not been threatened or harmed because he is a migrant worker.

His diet generally includes rice, dal, vegetables, tea, and meat on a weekly basis. He procures his food from the local kiraana dukaan. His diet includes rice, roti, dal, vegetables and fruits like bananas. In general, he doesn't have to worry about a shortage of food (he does mention that he ate less than he thought he should on a few occasions, but this could be due to his busy work schedule) and his household has never run out of food. He also feels that he gets to eat different varieties of food and that he is able to include healthy and nutritious food within his diet.

XXV. Om Prakash (Rangpuri Pahadi)

Om Prakash is a middle aged man who works as a marble fitter on contract basis. He does not have any formal school education or vocational training. He has learnt his job through experience and it is his family occupation as well, since generations. He hails from Karauli (Rajasthan), Hindaun city. He migrated to Delhi in early seventies. Before coming to Delhi, he worked at numerous places like Hyderabad, Kanpur, Jaipur, Kolkata Mumbai and Chennai. He frequently visits Gurgaon for construction work. According to him, during last 6 months, he has not been able to get work due to his poor eyesight and other health problems. Moreover, he is suffering from other medical complications. He regularly visits his home every year. His two brothers reside with his parents and take care of them. He does not send any remittance back to his home. He is very optimistic about his son's future and wants him to be an able man who could support his family.

XXVI. Abdul Hay (Rangpuri Pahadi)

We met Abdul Hay (47) on our way to Rangpuri Pahari. He was coming back from the village Giridih, Jharkhand, with his daughter Rahima (7). She is 7 years old and stepped foot in Delhi for the first time. Coming away from her mother did not seem daunting to her. Later, we have learnt that education for the motive for such a move.

He generously invited us into his house, as we explained about our survey. There were 3 residents in the 1 room, 1 kitchen house. It included Abdul, Rahima and his younger brother Ibrahim. The room did not seem congested. It was their own residence: bought and renovated with a cost of over ₹100000. After working in Delhi as a "migrant" for over 20 years, this buy seems strangely satisfying.

Abdul works as a construction painter in Noida, Gurgaon and several parts of Delhi. Taken together with the earnings of his brother (who is a construction painter, too), their household earnings add up to ₹30000. The figure seems lucrative. However, the alarming number of dependents in Giridih informed us of the true picture. With income from *khetiwadi* barely enough for sustenance, the brothers send up to ₹18000 every month. There are 12 members in the household of Abdul, residing in Giridih. He visits his family 3 times a year and each time, for a month long.

Analysing the expenditure pattern, Abdul lives a comfortable life in the relatively stable surroundings. He, often, has comfortable working hours. However, depending on the circumstances, he occasionally works overnight. His food consumption is satisfactory by quantity but (as he, eventually, mentioned) there is little diversity in consumption. His daily diet involves significant amounts of Potato and Dal. He consumes meat once a week. He was honest in informing us of his addiction to *Guthka*, and assured that he plans to stop it.

His story gives a satisfying picture of the life in Rangpuri. However, when I visited his washroom premises, the deplorable quality of life seemed apparent. Two long decades of work and there is no great escape from the realities of a migrant life.

RANGPURI PAHADI- WHERE THE PETTY FRUIT VENDORS LIVE

The angst against the displacement from plots where they lived for years, the angst against the authorities for the lack of sympathy on these issues, the absence of any specific programmes targeting these displaced groups forms part of the general concerns of the urban slums, irrespective of whether it is Kolkata, Bombay or Delhi. We were finding people narrating to us the stories of their lives, which were striking a similar chord with that of recent studies by the Kolkata Research Group on Mumbai in this regard. The skyrocketing rents in slums, the literal absence of a sense of private space and the continual extraction of *haftas* from the police and the local politicians seem to be a common narrative of urban India.

'In those days, the whole region was a big jungle. There was no building anywhere. The closest somebody ever lived in communities was at Mehrauli, and far off at Munirka. Large tracts of forest were cleared for the residential colonies developed by DDA in Vasant Kunj. We had our places of stay at Mehrauli, it was from there that we came to Vasant Kunj, in this corner of Rangpuri Pahadi.

The places where we stayed were stamped as reserve forest areas and the little hamlets in which we lived were bulldozed many a time, to no avail of our objection. She was drawing attention to the redefinition of property rights in Delhi with the onset of progress. How can the residential colonies of Vasant Kunj be any less of reserve forests than the places where we lived in?

Later we were forced to move to places on rent, now rent is taking a toll on our lives. A very good part of what we earn is shelled out on rent. The places we used to stay and we took for granted are no more ours. The skyrocketing rents in the city is nothing compared to the rent which we pay for the small tenements where we put up. It is even more than 50 to 60% of what we earn', laments the wife of a petty fruit trader, who has seen Vasant Kunj evolve over the decades

The place has a group of people making their living out of the petty trade in fruits and vegetables. 'Sudden abrupt changes in weather and no proper place for storage pose severe risks to our earnings. We take loans from the local Jats, who create no problem, if we keep paying, procure the fruits from Azadpur and sell in residential colonies around extending from Munirka, R K Puram, Vasant Kunj up to Mehrauli'. It seems they are reconciled to the high rates of interest being charged. Indeed a detailed ethnographic study on the survival of minorities in such slums in petty trades needs to be carried forward.

OBSERVATIONS FROM INTERACTION WITH MIGRANT LABOUR WORKING ON CONSTRUCTION SITE AT SRI VENKATESWARA COLLEGE

On Sunday, October 2, 2016, students of the Department of Economics conducted a survey of all the migrant labour in the college campus, working on a new construction. These people arrived here just 10 days back, after earlier labour shifted out, for reasons not known to us (in fact, the present workers wanted to know what went wrong with the earlier labour force, so as to make some judgments about their present employer- the contractor). There are four families on campus, with all the members of the family working in different capacities on the site. There were three families where the husband and wife were employed by the contractor. One family had four members- father, mother and two sons, all working on the site. The mother and father in this case were quite old and fragile. They had been literally dragged to Delhi since they were not working and earning anything back in their villages. The families hailed from different districts of Madhya Pradesh and UP- Panna, Dammu and Jhansi (UP).

October 2 being a national holiday was a leave for them (the first in 10 days) and they were enjoying every moment of it by lazing out in the sun and playing cards. They were quite possessive about their free time, and did not want to speak to us in the beginning; so we began speaking to their wives and then slowly they relented and spent substantial time with us. They were happy to share their stories with us and had no false assurances or hope that they would gain from the process. They sounded like a confident lot, not diffident, neither apologetic, nor seeking favours or sympathy and quite eager to share their story.

These workers are true migrants, in the sense they are always on the move and are ready to move wherever there are opportunities. They either have none or very small land holdings back in their villages and have no other source of employment there. These districts have witnessed very poor rainfall and years of drought, making agriculture a very unviable proposition for them. One of them even commented that if they overstay at home, they land up in huge debts, so the rational thing for them to do is to move out for employment. Though there are certain opportunities available for them in the state of Madhya Pradesh itself for example in Bhopal and Indore, but coming as far as Delhi is more sensible since not only are there many more construction projects here, but there are many, if not more opportunities in the areas that can be easily accessed from Delhi- NCR area, Haryana and UP (NOIDA). Hence, if they do not get a job in one place, they can always move to some alternative location. The families, that is parents, their children, are back home where they are studying and basically waiting for some

remittances coming their way. All the able bodied persons left with no choice are moving out, and the ones that are left behind are either too old or too young to be used as working hands.

There was a hierarchy of jobs that these people were performing. The women were doing 'beldari', primarily the menial jobs or the so called unskilled jobs, whereas two of the men were employed as 'mistris'- had learnt the skill in Agra and by working on some other site, and were better paid. The unskilled labour was being paid Rs 250 per day while the skilled 'mistris' were being paid Rs 350 per day. The contractor had promised an amount of Rs 400 per day to the skilled mistris, but on arrival at the site, he reduced it to Rs 350. Similar work, if available back home in their village would not fetch them more that Rs 200; and if they work on fields the amount is even lesser. Migrant couples had their children studying in government as well as private schools back in their villages. An interesting case was one where the couple had one daughter and two sons. While the former was studying in a government school, which the farmer himself acceded was of very poor quality; his two sons were studying in private schools paying a fee of Rs 90 per quarter and also paying a combined amount of around Rs 1500 for uniforms and books. He justified this differential treatment through the argument that education of the daughter would anyway go waste since she would get married and go away. Basic literacy would be enough for her, he argued. As regards the sons, he hopes that if they study well they might be able to pull themselves out of their dismal situation and even land themselves a good lucrative government job. They were quite clear that they are providing what they possibly can to their children. What the children make of it, whether they improve their economic and social status or whether they continue to do what their fathers and forefathers did- it is a question of luck and choice that they make.

Commenting on their economic status and their hopes and despair, they appear to be reconciled to their fate. They have been migrants not only as adults, but have been on the move since their childhood. The only solution they can think of, to pull them out of this existence, is of landing themselves any kind of government job. They commented that the major reason they voted for the current chief minister and his party was because he offered new vacancies and recruitments in the government in 2015. But, this deadline has been postponed twice and now stands at 2017. They were very categorical in saying that the present government would not be able to secure another term in office because of this breach of trust.

They appeared satisfied with their current location of work and conditions. The jhuggis that they are inhabiting now were actually built by the earlier labour and they are planning to improve them since they see their assignment as a long one- spanning around a year or a year

and a half. Though they are needy and in a very unenviable situation, they were neither found complaining nor appeared to be people who would be ready to be walked all over. They were clear that if they are not treated well by the contractor, or see him wavering from his commitment then they would instantly leave and join somebody else. So, got a sense of a seller's market here.

The way and methods by which these labourers and contacted and given a job are primarily of two types. Either they get some information from their kith and kin about the availability of work in Delhi, or the contractor contacts them through agents. They arrive by train (take a bus from their village and then train from the nearest district railway station) and wait at Sarai kale Khan railway station. The contractor and his agents pick them up from here. They are paid some subsistence money or arrival and then after 10- 15 days, after which they get monthly payments. They do not get any weekly off, the day they do not work, they don't get paid.

Their living conditions are not hygienic. Their one-room hutments are very small and can barely seat two people. These are simply brick structures, with asbestos roofs and an open space making up the door and two spaces on the opposite wall that make up their windows. They are using asbestos sheets as their doors. All the four families have made brick chulhas for themselves outside their rooms where they use pieces of wood and twigs for cooking. They have limited utensils that they have carried from home. They sleep outside on a platform or on the sports ground and have to deal with mosquitoes and insects throughout the night. They have one enclosed space (enclosed with asbestos sheets) that functions as their bathing area and also have a toilet (Indian style) with a tap connection, but it is dark and quite dirty. They get drinking water from the college (RO) and there is a tap from which they are able to procure water for other needs. They have plastic and steel jars to store little ration- rice, flour, pulses and masalas. They make their purchases once in eight days or so; vegetables either daily or once in two days; milk consumption is hardly there- two families were seen to be sharing half a litre of milk on a daily basis. They eat thrice in a day- mainly chapatis and vegetables- primarily potatoes, green vegetables and other seasonal vegetables. They also eat rice sometimes and have non vegetarian meals once in a week.

Their physical appearance did not give us much hope regarding their health and nourishment. They realise the fact that their body is their only resource, but they just not earn enough to feed themselves with nutritious meals. Variety in their food is also lacking, again due to the high cost of vegetables, fruits and their very limited earnings. Their earnings are primarily to feed themselves and to send it home for their parents and children. They also use these earnings to

get rid of their debts that they might have incurred for some medical issue, family functions, or simply to make their ends meet in their villages. They have significant social commitments back home like sending money and gifts to their married daughters and sisters, organising ceremonies etc.

They approach the village moneylender/ trader for loans in their villages who charges high cumulative rates of interest. They have bank accounts and have also opened up new ones to take benefit of Pradhan Mantri Jan Dhan Yojana. They had to give Rs 100 to open up their accounts, and are awaiting transactions in that account. None of them had heard about MGNREGA, so their village doesn't seem to be benefiting from this scheme. Gas connections and cylinders are being provided to them under the government scheme, but rather than getting these free of cost, they had to pay Rs 800 for these cylinders (obviously a transaction cost for them)

Their frustration with the government is palpable and obvious. Their villages are absolutely without any jobs- neither in the agriculture sector nor in the factory sector. They have no hope that there would be any factory coming up in the area. Their entire hope is on government jobs that also seem to be a distant reality. They are the real victims of corruption in the system and face exclusion wherever they go- be it schools, hospitals or police stations. Such exclusion deprives them from any possible capability enhancement and they are suffering economically, physically, emotionally and psychologically.

FIELD OBSERVATIONS BASED ON INTERACTIONS WITH TRADE UNIONS IN DELHI ON BOCWA

The construction sector serves as the most important sector of employment next only to agriculture in our country. There are around 3.24 crore labour working in the construction sector in our country. The sector has been an important avenue to which labour migrate to work in the urban areas. The steady increase in the price of residential property coupled with the big boost in infrastructure spending in the last decade has contributed in no insignificant way towards the growth of employment in the sector. The slowdown in the sector following the price decline in the residential property sector has had a negative effect on the demand for labour. However, the infrastructure spending from the part of the governments, both at the centre and the state, continues to provide employment to many in the sector.

Apart from the migrants who work on a permanent migrant basis, there are many who work in the sector as purely temporary short- term migrants. Given the large workforce in the sector and the compulsion which force them to migrate from one city to another, and the risks associated with accident at workplace, the government has brought forward the BOCWA Act, which tries to assure some minimum welfare measures for labour at workplace, and to his/ her dependents. As per the Building and Other Construction Workers Act 2002(BOCWA), a 1% cess on the construction activity is levied towards facilitating welfare measures for construction labour. A labourer registered as per the Act would be able to avail the benefits even if he/she is on a work in another state. Number of studies, including that of Srivastava and Sutradhar (2012) as well as Soundararajan (2013) have drawn attention to the low level of awareness with respect to the BOCWA Act, despite the presence of the scheme.

Soundararajan (2013) draws attention to the low level of registration under BOCWA in many states in the country, except for states like Kerala, Tamil Nadu and West Bengal, where there is a strong presence of trade unions and a large conscientisation of worker rights. In fact, certain studies have drawn attention to the low proportion of labour who have been enlisted as part of the BOCWA, despite being construction labour. As per the 2013 study, in Delhi, of the 1,84,000 labour, only 41,770 have registered with the BOCWA Board, this was just 2.3% as against the national average of 17%. As against the funds collected of Rs.656.29 crores, only Rs. 28.36 crores have been spent. How is it that in Delhi the amount spent is just 4.32% as against the national average of 17.07%? It is in this particular context that we thought we should

explore the reasons for the same in the course of our field work. In our interaction with the trade union leaders in the field we have posed these queries.

We were trying to explore the reasons behind the low level of registration of the construction workers with BOCWA Fund and also the low level of expenditure as compared to the corpus. These findings as reported in Vidya Soundararajan (2013) article in EPW does not seem to be holding now at least with respect to registration. In her intervention in 2013, she drew attention to the low level of registration in the BOCWA funds despite the benefits associated with the same.

The workers in the construction sector are categorized under various heads: beldar, raj mistri, plumber, electrician, welder, carpenter, polish man, PoP, shisha, crane operator, driver (for plying construction material). There isa lrge process of learning in the trade involved. The initiation into the field is int e from of a helper. There are number of organizations in NCR working towards organizing labour. Amidst the trade unions in the construction sector, they are affiliated to larger trade unions like INTUC CITU, BMS, IFTU, HMS. All of them have pockets of influence in the city. But most importantly, though the organizations are driven by ideological considerations and political affiliations, the workers are driven to loyalty o organizations mostly on the basis of the ability of the local person to fight for their benefits. In fact, contrary to the earlier periods, the people volunteering to work in the trade union sector are very less. Though a new political formation, even the AAP has a trade union in the form of Shramik Vikas Sangathan.

In the contingency of death at workplace, an amount of Rs. 250000 is paid from BOCWA. For natural death, a compensation of Rs.100000 is paid to the dependents of the labour for the marriage of two children an amount of Rs. 30000 is paid in case of girls and Rs. 25000, in case of boys. Scholarships for students in the schools range from Rs 100 to 200 per month in class I to VIII, 500 per month for those in XI and XII and 16000 annually for those students pursuing classes beyond the same subject to clearance of tests. Given the benefits accruing to the BOCWA card holder, there is market which has evolved around this issue. Even workers who have nothing to do with the construction sector are now being enrolled in the BOCWA, even as some of the genuine perso do not manage to get entry. This defeats the very purpose of the legislation. Given that it is the labour union which has to vouch for the verification of the labour, and the vague clauses with respect to registration as labour, the bogus entry into the rolls of the BOCWA is swelling its numbers.

Despite the presence of clauses in this regard, the protective devices at workplace like goggles for the welders, shoes and gloves for the workers, electric welding machines , and the belt kit are all even now out of the reach of the workers, for the bills related to the same would be reimbursed only subject to the purchase of the same.

Ever since 2011, the registration of labour in the BOCWA has increased, but there has emerged a group of brokers or intermediaries who are getting labour who are otherwise not of the construction sector to get entry into BOCWA. This has become a new problem. Unfortunately, through a set of brokers, number of ghost workers are being registered in a world dominated by the politics of competitive populism by different organizations, Worst is, even as workers who are not in the construction sector stands to benefit from the welfare measures of the corpus, there are high risks of the genuine workers being excluded. From Hari Nagar to Sarita Vihar, there are these brokers who are now upstaging the BOCWA, towards free riding on the labour welfare measures, which defeats the whole purpose of the legislation. Can't proper verification measures be put in place?

The registration of genuine labour should increase, and the labour entitlements in the form of safety equipment should be made available in such a manner that they would be able to reimburse the expenses fast. Or, better, the tools be made available at worksites through the BOCWA. The hazardous conditions under which the construction labour work have to be addressed. Our study also highlights the importance of the same in the context of the high prevalence of pulmonary related disorders amidst the construction workers vis-a-vis their counterparts in other sectors.

The minimum wage in the city for a task of eight hours is fixed at 9560 per month, but it is barely enforced. The costs of litigation is high, the sense of worker solidarity is lacking. Even as the labour are covered under the ESI rules, at times, it takes a lot of time to get their bills cleared, that given the number of workdays lost in the process, they have to forego their recoveries on various grounds. The unions spoke to us about the severe prevalence of tuberculosis amidst the workers. And also issues related to heart ailments and eye sight problems. The hospitals in the regions adjacent to industrial clusters have to be upgraded with proper provision of medicine and other facilities. Judicious spending on public infrastructure spending on health is warranted to bring desirable outcomes.The Deen Dayal Upadhyaya hospital is a source of refuge for the workers at Mayapuri, but the facilities do not match up to the growing health demands

The trade unions also expressed disillusionment with the process of labour administration of justice. The inspections on the complaints lodged on violation of labour laws are undertaken by the Labour Inspector, Investigating Officer, Asst Labour commissioner and Dist Commissioner. Litigation relating to labour issues are routed through various labour courts in the city. The trade unions also attribute good work to have been done in the city sometimes due to the benevolence of the bureaucrats. But to count on the same is not always possible. There are seven district labour courts: Jail Road, Karampura, Nimri North, Nimri West, Okhla, Jhilmil and Shahdara, of these Jhilmil is far off from the industrial sites

Even as benevolent social legislation towards redressing the problems of the labour is warranted, the efforts of upstaging the same through the process of registering bogus workers would defeat the very purpose and spirit of the legislation. Rather than doing away with such legislations in the name of "government failure", better effective methods of inclusion of genuine labour and punitive measures against wrongful inclusion should be initiated so as to make the legislation work to yield results.

(This is based on the interactions with Mr Rajesh Kumar of Delhi State Nirman Evam Building Kamgar Union affiliated to IFTU, based at Mayapuri and Mr. Chotelal of Engineering Workers Lal Jhanda Union affiliated to CITU. We are grateful for their time and co-operation, but all the responsibility of any argument is purely that of the author.)

NOTES FROM MAYAPURI (INDUSTRIAL WORKERS)

Mayapuri has been one of the old industrial areas in South Delhi. Hosting factories in various sectors like light engineering, manufacture of motors, welding, apparel exports , it has a diverse set of industries, producing commodities which makes use of labour of unskilled and semi-skilled nature. Migrant labour from different parts of the country like Bihar, UP and Bengal apart, there have been others travelling to the city from the neighbouring towns of Haryana through train getting down at Delhi Cant. station towards the industrial areas of Mayapuri , Naraina and Loha Mandi.

As we enter the region, we find some of the workers sharing a fast meal in some of those make shift dhabas which were serving roti and dal. As we venture through the side of the bylanes besides some of the firms, we find an array of bicycles. Unable to find any labour out of the factory, given the time, we met a vibrant trade union activist, Rajesh from IFTU, readily extending to us an invitation to the region.

In fact, we were surprised to know about the presence of a strong trade union movement in the region, contrary to the other places where we visited. He took us to the office of IFTU, which he claimed had a membership of 5000 in the region alone. He aired concerns relating to the gross violation of minimum wages in the region. The safety measures are extended at construction sites only by a set of builders, leaving the labour to bear all the risks at wroksite. The hazardous work conditions in the various factories in the region has resulted in the high incidence of tuberculosis in the region. Even the doctor employed in the DOTS centre has contracted the same. The poor and inefficient delivery of services at the primary health centres in the region as well as the DDU hospital has resulted in the labour being forced to avail the services at private clinics. The claims of the labour with respect to ESI benefits takes a lot of time to be cleared, costing them at times, a day's wage.

Violation of minimum wages, differences between the workers in the organised and unorganised working in the same factory, the different levels of minimum wages of the unskilled, semi-skilled and skilled labour according the Delhi norms—all formed part of our discussion. Rajesh expressed his opinion that without a vibrant trade unionism, it would be impossible to reach out the benefits in the form of provident fund, bonus and pension to the labour.

Well- armed with the court verdicts, he was critical as to why the payment bonus should be extended only to factories which were in existence for five years. He suggests in this world of

mobile and footloose capital, it is only logical for capital to flee after making quick profits. Counting on a Supreme Court verdict, he opined that bonus is not a gift or concession of the firm, but a righteous claim of the sweat of the labour. He also felt that companies, even when they make the payments of ESI on time, were quite reluctant to make payments on account of bonus as well as PF on time. Why do they not pay the PF payments on time, it is because of the absence of a vigilant trade unionism.

When any issue relating to the industrial labour is brought to the attention of the government, it is shuttled from the Labour to the Health department and from there to the Industries department. The labour has to fight a long way to justice, his path to the labour courts turns out to the difficult without the support of concerned lawyers and trade unions. He also expressed concern at the growing instances of job loss due to mechanisation as well about the increasing instances of industrial accidents, due to the lack of safety conditions. Factory inspection committees should cease to be bureaucratic in nature, and should have more engagement with those in the civil society.

When we queried as to why the trade unions were not successful in enlisting as many workers in BOCWA, which was intended to address the benefits of the mobile construction labour across states, he quipped that this fund was also witness to large scale transfer of funds for other purposes. So, even when macrosocial legislation is brought forward by governments, its follow up requires labour mobilization as well as conscientisation.

With growing informalisation of labour and the increasing presence of footloose capital, even crafting workable macrosocial legislations have become a big challenge.

ANNEXURE II: QUESTIONNAIRE

ANNEXURE III: CONSENT FORM FOR RESPONDENTS

श्री वेंकटेश्वरा कॉलेज

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एक शोध अध्ययन के लिए सहमति पत्र पर फ़ार्म

शीर्षक:
राष्ट्रीय राजधानी क्षेत्र में शहरी अकुशल प्रवासी श्रमिकों का मानचित्रणः परियोजना के के लिए सामाजिक आर्थिक स्थिति और स्वास्थ्य की स्थिति में एक अन्वेषण

मैं _____ इस परियोजना "राष्ट्रीय राजधानी क्षेत्र में शहरी अकुशल प्रवासी श्रमिकों का मानचित्रण" में भाग लेने वाले अन्वेषक द्वारा उपलब्ध कराई गई जानकारी से सहमत हूँऔर काम के लिए प्रस्तावित कार्य मेरी संतुष्टि के लिए समझाया गया है। मैं इसके द्वारा अध्ययन में भागीदारी के परिणाम के रूप में प्रायोजकों, नियामक अधिकारियों, सरकारी एजेंसियों और नैतिकता समिति को अन्वेषक द्वारा मेरे से प्राप्त जानकारी जारी करने की अनुमति देता/देती हूँ।

अगर मेरे डेटा सार्वजनिक रूप से प्रस्तुत करा जाता हैं तो मेरी पहचान गोपनीय रखी जाएगी ।
मैं स्वेच्छा से इस अध्ययन में भाग ले रहा/रही हूँ।
हस्ताक्षर

तारीख

ANNEXURE IV: SAMPLE SPIROMETER READ OUT

ANNEXURE V: FEW PICTURES

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    Provisional agenda item 4.8: Health of migrants. Report by the Secretariat

Work Progress Report
(July,2017- March,2018)

Title Of the Project

To develop novel FRET based tools to detect in vivo localization and phosphorylation of *M. tuberculosis* signaling protein.

Name of the students:

1-Vaishali Lakra
2-Naintara Jain
3-Astha Purwar
4-Sucharita Sen

5-Samruddhi Pradhan Vandana Malhotra
6-Vaishali Goyal
7-Harsh Bhakhri

(B.Sc (Hons) Biochemistry)

Submitted To

Dr. Vandana Malhotra Dept. of Biochemistry Sri Venkateswara College University of Delhi New Delhi

SRI VENKATESWARA COLLEGE
UNIVERSITY OF DELHI
NEW DELHI -21

Project Title: Understanding the developmental stages of *Dictyostelium discoides* and its the effect of nutritionand external signals on growth.

Students benefitted: Total 07 students from Biochemistry, Biological Sciences, and Life Sciences

Status: Completed

Mentor: Dr Nimisha Sinha

Students:

1. Vaibhav Mahajan B.Sc (Hons) Biological Sciences
2. Pranjal Yadav B.Sc (Hons) Biochemistry
3. Rhutu B.Sc (P) Life Sciences
4. Dilsher B.Sc (Hons) Biological Sciences
5. Mayank Saini B.Sc (Hons) Biochemistry
6. Shagufa Nisrat Noorie B.Sc (Hons) Biochemistry
7. Nikita Bansal B.Sc (Hons) Biochemistry

1. INTRODUCTION

1.1 About the Organism: *Dictyostelium discoideum*

Dictyostelium amoebae grow as separate, independent cells but interact to form multicellular structures when challenged by adverse conditions such as starvation. Up to 100,000 cells signal each other by releasing the chemoattractant cAMP and aggregate together by chemotaxis to form a mould that is surrounded by an extracellular matrix. This mechanism for generating a multicellular organism differs radically from the early steps of metazoan embryogenesis. The lifecycle of *D. Discoideum* is relatively short, which allows for timely viewing of all stages. The cells involved in the lifecycle undergo movement, chemical signalling, and development, which are applicable to human cancer research. Most *Dictyostelium* strains used in the laboratory can be grown either with bacteria or in axenic medium. When grown in the presence of bacteria, cells double approximately every 4 h, whereas axenically grown cells double more slowly, every 8–12

h. The cells can be grown in a standard microbiology incubator or on the laboratory bench, provided the room temperature is consistently 22°C.

1.2 Importance as a model organism

i. It can be observed at organismic, cellular, and molecular levels primarily because of their restricted number of cell types and behaviors, and their rapid growth

ii. It is used to study cell differentiation, chemotaxis, and programmed cell death, which are all normal cellular processes. It is also used to study other aspects of development, including cell sorting, pattern formation, phagocytosis, motility, and signal transduction.

iii. Many of its genes are homologous to human genes, yet its lifecycle is simple, *D. discoideum* is commonly used as a model organism.

iv. Another remarkable feature of the organism is that it has sets of DNA repair enzymes found in human cells, which are lacking from many other popular metazoan model systems. Defects in DNA repair lead to devastating human cancers, so the ability to study human repair proteins in a simple tractable model will prove invaluable.

1.3 Life Cycle Stages

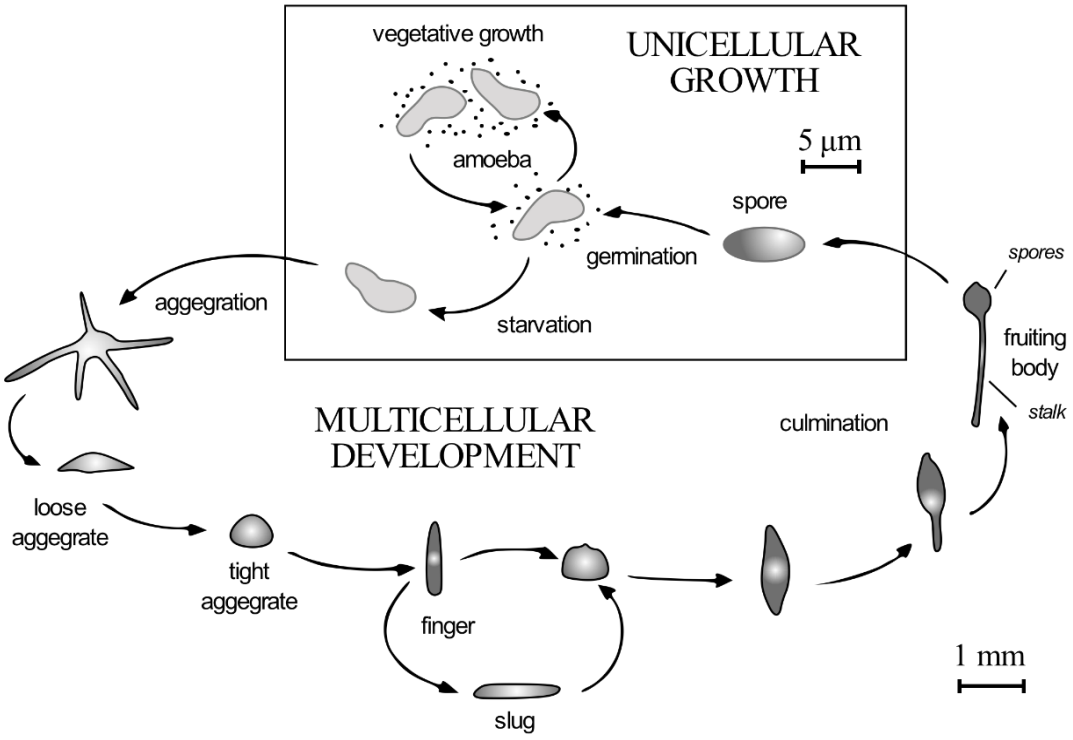

Fig.2 Life cycle of *Dictyostelium discoides*

2. OBJECTIVES

1. To study the life cycle of the organism and visualize the different stages of life cycle.
2. To study the growth curve of the organism.
3. To study the effect of i) starvation ii) external facors like, light on the growth and life cycle stages of the organism.

3. RESULT AND DISCUSSION

3.1 The spores were visualized under the compound microscope for doing the cell count using a hemocytometer. The spores appeared as small rounded, smooth, transparent structures under the microscope as shown in Fig 3. The spores were counted in the five squares as mentioned in the Materials and Methods.

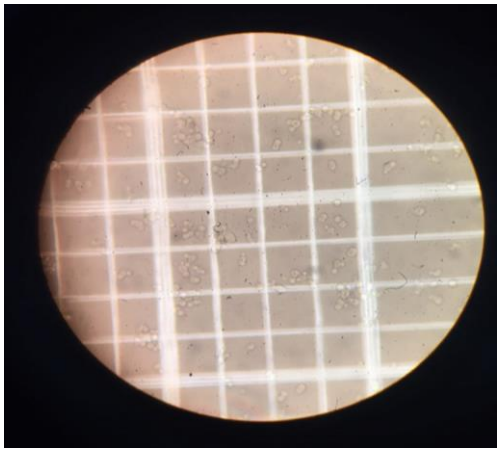

Fig 2: Spores of *Dictyostelium discoides* as observed under a compound microscope at a 400x magnification using a haemocytometer.

Calculations:

The results obtained were as follows:

Square 1 = 10

Square 2 = 08

Square 3 = 12

Square 4 = 10

Square 5 = 10

Total number of spores in 5 squares = 50

Total number of spores per ml = 50 x 50,000 = 2.5 x 10^6/ml

At this cell density the spores were subcultured in 50 ml HL5 media at a cell density of 2 x 10^4/ml and again kept for growth at 22^{o}C for 2-3 days. The cell density was again calculated as mentioned above and the cultures were maintained.

Certificate

On the basis of declaration made by the student **Deeksha Sharma,** I/we hereby certify that the project report entitled **"COMPUTATIONAL STUDIES OF POLLEN ALLERGEN PAR H 1 FROM *PARTHENIUM HYSTEROPHORUS* TO INVESTIGATE ITS STRUCTURAL AND BINDING FEATURES"** submitted by **Deeksha Sharma** to the Department of Computer Science, Jamia Millia Islamia, New Delhi, for the partial fulfillment of the requirements of the degree of **M.Sc.(Bioinformatics),** is carried out by him/her under my/our guidance and supervision. The report has reached the requisite standards for submission.

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PROJECT REPORT

2019

AREA OF RESEARCH: Molecular Biology of *Mycobacterium tuberculosis*

MENTOR: DR. VANDANA MALHOTRA

SUBMITTED BY:-

ATAL VATS

BSC.(H) BIOCHEMISTRY Vandana Malhotra

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Project done in the field of:

Molecular Biology of *Mycobacterium tuberculosis*

Project Report

Submitted By: Gantavya Arora

Submitted to: Dr. Vandana Malhotra

PROJECT REPORT- August 2019

SRI VENKATESWARA INTERNSHIP PROGRAM FOR RESEARCH IN ACADEMICS (VIPRA)

Sri Venkateswara College,
University Of Delhi , Benito Juarez Road ,
Dhaula Kuan , New Delhi

STANDARDIZATION OF ANTIOXIDANT, ANTI-INFLAMMATORY AND ANTI-BACTERIAL ASSAYS TO ASSESS POLYHERBAL FORMULATION AS A MODE OF TREATMENT FOR ALLERGIC RHINITIS

Chhavi Dua , Manjulika Bharti , Ayushi Kumari , Kumari Akanksha

Mentor : Dr. Nandita Narayanasamy

INTRODUCTION

ALLERGIC RHINITIS

Allergic Rhinitis (AR), also known as hay fever, is an inflammatory condition of the nasal mucosa in the upper airways which is elicited by an interaction between environmental allergens and IgE, in sensitized individuals. It affects about 10-15% of the general population. AR is characterized by nasal symptoms such as congestion, stuffy nose, runny nose, itching, sneezing, rhinorrhea and ocular effects such as eye itching, redness and tearing and thus deteriorates the productivity and quality of life of a person (Varshney, 2015).

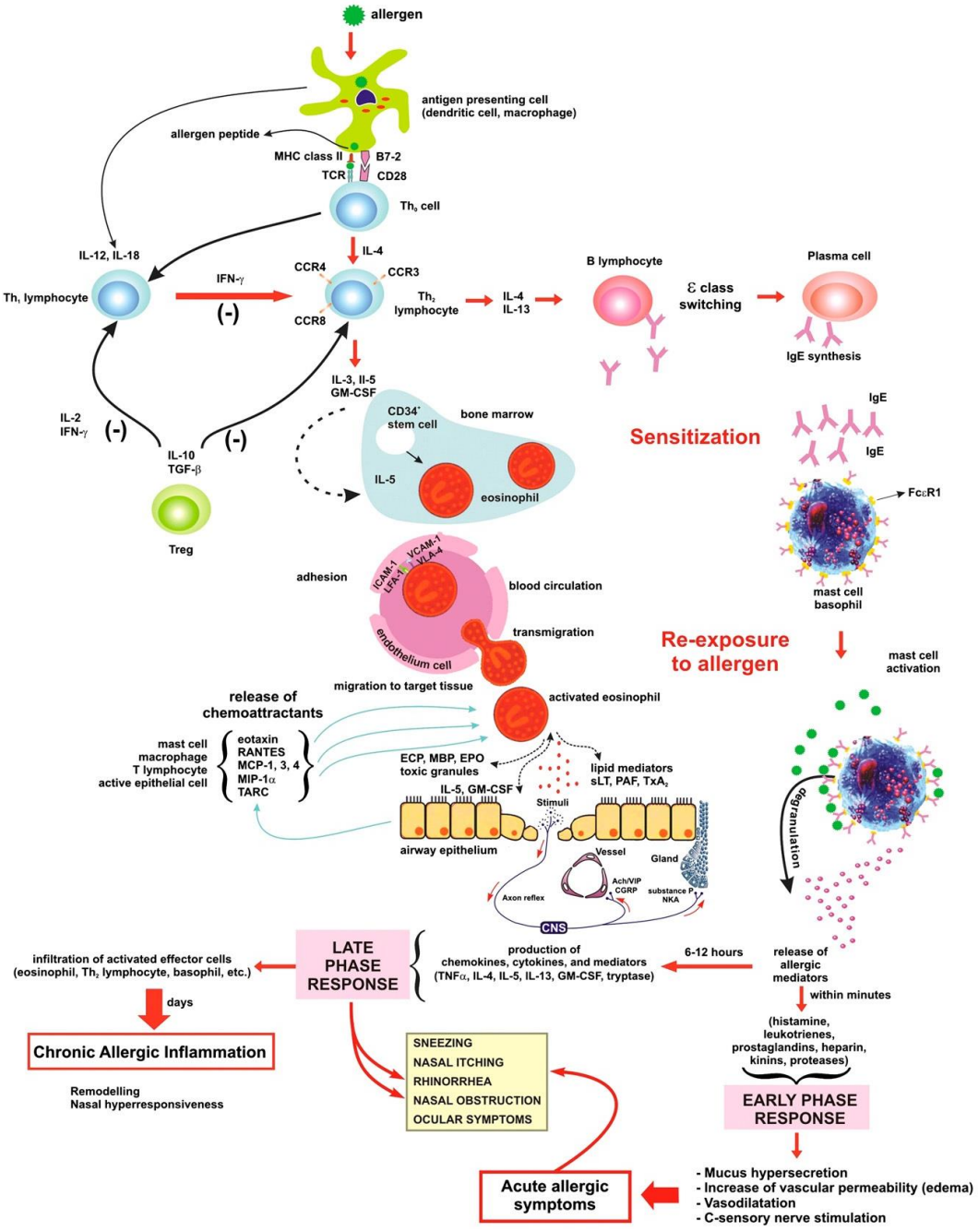
A distinctive feature of allergic rhinitis is a Type 1 hypersensitivity reaction (reactions that involve IgE mediated release of histamine and other mediators from mast cells and basophils) in response to an inciting inhaled allergen which maybe in the form of pollen, animal dander, dust mite fecal particles etc. A cascade of immunological and biochemical events lead to the clinical expression of the disease.

After inhalation of allergens, they are eluted into the nasal mucus and subsequently diffuse into the nasal tissues. Initiation of the sensitization process is done by antigen presenting cells (APCs), which are primarily dendritic cells. They break the allergens into antigenic peptides and present them to the naïve helper T lymphocytes (Th0) in the lymph nodes. The dendritic cells can polarize the naïve T cells into either Th1 or Th2 cells according to their own phenotype and with signals received from processed antigens and from the tissue microenvironment during antigen presentation. For example, those matured by IL-3 and CD40 ligand engagement promote Th2 phenotype while those that mature through viral contact promote a Th1 phenotype.In such cases, the Th2 lymphocytes release cytokines IL-4 and IL-13 that interact with the B lymphocytes to induce the synthesis of allergen-specific IgE which then binds to its specific receptor on the surface of mast cells **(**Togias *et al***).** Figure 1 shows a schematic description of the events that trigger an allergic immune response.

Early phase response: It occurs in sensitized individuals within minutes of exposure to the allergen and lasts for about 2-3 hours. One of the cardinal components of the early phase response is the degranulation of mast cells upon interaction with IgE that releases a variety of pre-formed and newly formed mediators. Histamine, which is the major mediator of allergic rhinitis, stimulates the sensory nerve endings of the 5th nerve (trigeminal) and induces sneezing. Histamine also stimulates the mucous glands causing the secretion of mucous (rhinorrhea) and histamine, leukotrienes and prostaglandins together act on the blood vessels causing nasal congestion.

Late phase response: It occurs 4-6 hours after antigen stimulation and is characterized by a prolongation of symptoms – sneezing, rhinorrhea but most predominantly a sustained nasal congestion which lasts for about 18-24 h. The late phase response is predominantly inflammatory in nature and is characterized by an inflammatory cellular influx comprising of predominantly T lymphocytes, basophils and eosinophils. A variety of mediators are released by these cells including leukotrienes, kinins, histamine which result in the continuation of the symptoms and the development of the late phase (Ruby Pawankar, 2011).

Figure 1: Schematic description of the events that trigger a nasal allergic immune response.



INFLAMMATION

Inflammation can be defined as a complex, vascular lymphatic and local tissue reaction elicited in animals by the presence of viable and non-viable irritants as a protective and normal response to any kind of harmful stimulus. It is a complex process, which is frequently associated with pain and involves occurrences such as: the increase of vascular permeability, increase of protein denaturation and membrane alteration.

FACTORS AFFECTING INFLAMMATION:

Lysosomal Enzymes: It is postulated that lysosomal components such as hydrolytic enzymes or cationic proteins play important roles in the initiation of inflammation, tissue injury and connective tissue breakdown. Higher levels of catalytic enzymes were found in inflamed tissue or serum of arthritic rats as compared to normal animals. The presence of elevated lysosomal contents namely neutral proteases, acid hydrolases, chemotactic factors, kinin generating factors, vascular permeability factors, pyrogens in the synovial fluid of arthritic patients has been clearly documented.It is indicated that there may be some kind of regulation by autonomic neurohormones, glucocorticoids, prostaglandins and cyclic nucleotides in immunologically-provoked secretion of lysosomal mediators of inflammation by human neutrophils.

Prostaglandins: Prostaglandins of E series are involved in cellular injury and inflammation. Most of the non-steroidal anti-inflammatory agents are active inhibitors of its production from its precursor, arachidonic acid. These prostaglandins E_1, E_2 often induce the increase of vascular permeability in animals and flare response in human. PGE type has been identified in the inflammatory exudate of carrageenan induced inflammation in the rat. Prostaglandins occur relatively late in inflammatory process and are often associated with migration of leukocytes into inflamed site. In rabbits it has been shown that during phagocytosis, prostaglandins are released from leukocyte lysosome and also during endocytosis.

Complement System*:* Some complements together form approximately 10% (w/v) of human serum globulins. These, often called as reactive proteins, are continually available to all body tissues and play a vital role in the protective mechanisms of the organism against exogenous or endogenous injury agents. These complement constituents when set into action against injurious agents often cause damage to the host.The complement activation further stimulates many other reactions by which many more pathogenic and inflammatory factors are formed for example anaphylatoxin which causes smooth muscle contractions, increases capillary permeability, accumulation of migrated leukocytes, releasing histamine from tissues, formation of high molecular kinins, lysis of platelets and thereby releasing vasoactive amines and other catalytic enzymes enzymes.

Protein Breakdown **Process**: Local protein breakdown process may bring about perpetuation or the reduction of inflammation. If anti-proteolytic drugs can prevent the process like histolysis, kinin, kallikerin formation, fibrin deposition, then it will be a real therapeutic use to treat inflammation. However, it has also been shown that exogenous proteases may act as anti-inflammatory agents and increased synthesis of glycoproteins in the liver during inflammatory process. Hence, it is very difficult to say whether the proteolysis may aggravate or inhibit the

existing inflammatory process. Extracellular proteases from plasma transudate infiltrating leukocytes, chondrocytes and synovial cells may degrade albumin which perhaps enhance the protein synthesis and wound repair by delivering amino acids and peptides from mobile amino acid pool. The local regulation of proteolytic activity has some advantages and also disadvantages.

Calcium*:* Organic substances which provoke lysosomal enzyme secretion from neutrophils do so by first promoting calcium entry into the cells. Increased intracellular calcium could bring about the accumulation of intracellular cyclic GMP, which in turn could signal the secretion of lysosome granule constituents into the extracellular environment. (SR NAIK, 1976)

IDEAL CHARACTERISTICS OF A DRUG FOR ALLERGIC RHINITIS:

An ideal drug for Allergic Rhinitis must possess the following properties:

- Effect on prime causative factors
- Inhibitory effect on initial reaction
- Inhibit established inflammation
- Effect on end results of established inflammation

Thus to arrive at a promising medication for Allergic Rhinitis the following properties need to be considered

- **Anti-inflammatory property**: AR is characterized by inflammation of the upper respiratory tract, therefore, drugs that serve to reduce inflammation can be used for treatment. These drugs could function by inhibiting protein denaturation(protein denaturation is a well-documented cause of inflammation), or by inhibiting synthesis of leukotrienes and prostaglandins from arachidonic acid via the 5-LOX and COX pathways respectively.
- **Antioxidant property:** The free radicals are important mediators that provoke or sustain inflammatory processes and consequently, their neutralization by antioxidants and radical scavengers can attenuate inflammation. During the course of inflammatory response, large amount of NO formed by nitric oxide synthase (iNOS) in activated macrophages surpasses the physiological amount of NO, which is usually made by neuronal form of NOS (nNOS) or constitutive form of NOS (eNOS), this NO nitrosylates macromolecules. It also causes increased vascular permeability, vasodilation, tissue and endothelial damage leading to inflammation. Various *in-vivo* studies show that the oedema induced by substance-P is mediated through the release of NO. The pro inflammatory role of NO in chronic inflammation has been inferred, based on the observation of elevated levels of nitrite in rheumatoid synovial fluid. Hence drugs having antioxidant properties are often accompanied by anti-inflammatory effects. Antioxidants are also known to prevent secondary viral infections.
- **Antibacterial property**: Antibacterial property of a drug protects the person against any secondary bacterial infection which can further aggravate inflammation. (M.V Anoop, 2015)

POLYHERBAL FORMULATION AS A MODE OF TREATMENT

Treatment of allergic rhinitis is guided typically by the need to reduce symptoms. There are a number of pharmacotherapies available for it that are composed of oral and intranasal H1 antihistamines, decongestants, intranasal corticosteroids, anticholinergics, however they are known to provide relief to about 60% of the subjects which indicates the need for additional treatment to improve its efficacy. Moreover, antihistamines which are commonly used for the treatment of AR, are known to have several side effects such as excessive drowsiness and performance impairment which can lead to accidents and personal injury.

Considering high prevalence of AR and low efficacy of modern allopathic medicines, it is now essential to understand the utility of herbal formulations. Combination of different herbs may provide symptomatic relief and prevent recurrence of disease. The reason for using polyherbal formulation is its increased efficacy and decreased toxicity and many international journals are a testament to its high efficiency.

Polyherbal formulation is based on the principle that the therapeutic effects of herbal medicines are exerted due to the presence of different phytoconstituents. Most of these formulations are effective even at a low dose and offers no risk at a high dose thereby giving a superior risk to benefit ratio. Lastly, as they are a bounty of nature, they are cheaper, eco friendly, readily available and hence have better affordability and accessibility.

Reactive oxygen species contribute to the pathogenesis of allergic disorders. The presence of chronic inflammation in the epithelium of the upper airways in AR can lead to development of persistent oxidative stress. Therefore, treatment with herbs having antioxidant and anti-inflammatory properties can help in alleviating nasal symptoms and provide relief from ocular symptoms. Herbs with antibacterial properties can be used in combination to prevent the risk of acquiring secondary bacterial infections.

So the first step towards devising out a polyherbal formulation for allergic rhinitis would be to standardise antioxidant, anti-inflammatory and antibacterial assays for various potential herbs and then determine the ratio in which they need to be combined to achieve the desired result.

METHODS AND MATERIALS

ANTIOXIDANT ASSAY:

Evidences suggest that allergic disorders like Allergic Rhinitis are mediated by Oxidative Stress. Excessive exposure to Reactive Oxygen Species and Nitrogen Species characterise Oxidative Stress which ultimately leads to damage of Proteins, Lipids, and DNA. The overproduction of inflammatory mediators such as Neutrophil derived free radicals, Reactive Oxygen species, Nitric oxides etc. lead to tissue injury by damaging macromolecules and play role in pathogenesis of inflammatory diseases.

Antioxidants are compounds that inhibit oxidation and they along with radical scavengers help in neutralising effects of free radicals. Antioxidants also help in preventing microbial infection.

Therapeutic interventions that decrease exposure to environmental ROS or increase endogenous antioxidant defences could be beneficial as supplementary therapy for allergic respiratory disorders.

1. Polyphenol Estimation :

Polyphenols are micronutrient known to act as Antioxidant and are obtained from certain plant based foods. They act as scavenger of oxygen and Nitrogen free radicals thereby protecting the macromolecules of the cells and they also have the ability to up-regulate certain metal chelation reaction. The phenolic groups in polyphenols can accept an electron to form relatively stable phenoxyl radical thereby disrupting chain Oxidation Reaction in cellular components. Therefore Polyphenol as Antioxidant may protect constituents of the cell against Oxidative damage and minimise risk of diseases associated with Oxidative Stress.

Polyphenol Estimation by Folin Ciocalteu Method:

*PRINCIPLE***:**

The Polyohenols react with specific redox Reagent like Folin Ciocalteu reagent(mixture of Phosphomolybdate and Phosphotungstate) in a basic Oxidation Reduction reaction. The Pheonlic compounds dissociate into Phenolate Anion under basic condition and reduces the Folin Ciocalteu reagent to form a blue colored complex. The complex shows maximum absorbance at 750nm and the intensity of color produced by the chromogen depends on the amount of phenolics compound present in the reaction mixture. The phenolic compounds are oxidised while the metal ion of the reagent gets reduced in the process. Gallic Acid is usually as the reference standard for Polyphenol estimation and the amount of Polyphenols present in the sample is expressed as milligram per gram equivalent of Gallic Acid.

METHOD:

Gallic acid stock solution of 1mg/ml was prepared and using this solution another stock solution II of 100µg/ml was prepared . From this stock solution II 0.1ml, 0.2ml, 0.4ml, 0.6ml, 0.8ml and 1ml were pipetted out in separate test tubes and total volume was made up to 1ml

using distilled water to get 10, 20, 40, 60, 80 and 100µg/ml solutions. Also extracts were prepared in quadruplicates using 0.25ml extract and 0.75ml distilled water. To all the above solutions 1:1 diluted 0.5 ml Folin Ciocalteau Reagent was added and 0.4ml 20% Sodium Carbonate Solution was added after 5 minutes. The solutions were mixed and incubated at room temperature for 20 minutes. After incubation 5ml distilled water was added in each tube and then the absorbance of the solutions was measured at 750nm using VISIBLE Spectrophotometer. The absorbance values were plotted against concentration and standard graph was obtained.

2.Ferric Reducing Antioxidant Power Assay (FRAP):

PRINCIPLE:

Reducing capacity of a compound may serve as significant indicator of its potential antioxidant activity. In the following method the compound with antioxidant capacity reacts with Potassium Ferricyanide to form Potassium Ferrocyanide, the Iron in +3 state gets reduced to +2 state. The Potassium Ferricyanide reacts with Ferric Trichloride to yield Ferrocyanide; a blue coloured complex which shows maximum absorbance at 700nm. The increase in absorbance implies increase in the reducing power i.e. increased Antioxidant Activity at increased concentrations.

METHOD:

Gallic acid stock solution of 100µg/ml was prepared using a 1mg/ml solution of Gallic acid. From the prepared stock solution 0.04ml, 0.1ml, 0.2ml, 0.3ml, and 0.4ml were pipetted out in separate test tubes and total volume was made up to 0.4ml using distilled water to get 10, 25, 50, 75 and 100µg/ml solutions. The Extract solution were made in quadruplicates by adding 0.2ml extract and 0.2ml distilled water. Then 0.8ml Phosphate Buffer (pH -6.6) and 0.8ml Potassium Ferricyanide (1%) was added in each tube. The solutions were incubated at 50ºC for 20 minutes. After incubation 0.8ml Tri Chloro-Acetic Acid (10%) was added in all the tubes and then the solutions were centrifuged at 3000rpm for 10 minutes. After centrifugation for each solution 0.75ml supernatant were taken and 0.75ml Distilled water and 0.16ml Ferric Chloride (0.1%) was added. The absorbance of these solutions was then taken at 700nm using a Spectrophotometer.

ANTI-INFLAMMATORY ASSAY:

1. Inhibition Of Protein Denaturation:

PRINCIPLE:

Protein denaturation is related to the inflammatory process as it may lead to the production of auto antigens in case of certain diseases. The denaturation process involves alteration in the electrostatic, hydrophobic, hydrogen and disulphide bonding in the protein molecules which

may lead to the production of auto antigens. Thus by controlling the production of auto antigens and inhibiting the denaturation of proteins , the extract shows anti-inflammatory activity.

METHOD:

In this method, the reaction mixture consists of BSA and plant extract along with 1 N HCl. It is incubated for 20 min at room temperature and then for 5 mins at 57 degrees. It is then cooled and phosphate buffer solution is added. The turbidity in the solution is measured at 600 nm.The control test consists of distilled water instead of extract and product control test lacks BSA.

The assay can also be performed by measuring absorbance at 280 nm to assess the inhibition of protein denaturation due to unfolding of tertiary structure of proteins at higher temperatures.

The extent of inhibition is then calculated by the formula for different concentrations of reaction mixture.

2.Nitric Oxide Scavenging Assay

Reactive Oxygen Species

Although, reactive oxygen species (ROS) and reactive nitrogen species play an important roles in many biological processes and are involved in host defense, overproduction of these species such as hydroxyl radical (.OH), hydrogen peroxide (H2O2), superoxide anions (O^{2-}), and nitric oxide (NO.), as well as peroxyl nitrite contributes to the immunopathology of a vast variety of conditions including inflammatory diseases, cancer, atherosclerosis, diabetes mellitus, hypertension, AIDS, and aging (Darley-Usmar et al., 1995; Lee et al., 2000) and also contribute to food deterioration.

An antioxidant is a molecule stable enough to donate an electron to a rampaging free radical and neutralize it, thus reducing its capacity to damage. These antioxidants delay orinhibit cellular damage mainly through their free radical scavenging property.

Polyphenols show anti-oxidant activity as they posses various redox properties like acting as reductant, H donor, singlet O quencher, metal chelating agent, absorption and neutralization of free radicals etc.

PRINCIPLE:

Sodium Nitroprusside in aqueous solution at physiological ph generates NO which interacts with oxygen to produce nitrites. Griess reagent is used to detect the presence of nitrites in the solution. Then sulphanilamide is added which leads to diazotization of nitrites.On subsequent addition of azo dye agent, N- naphthylethylene diamine hydrochloride, a pink coloured azo compound is formed.

The polyphenols present in the plant extracts compete with oxygen for interaction with NO. Thus, leads to decreased production of nitrites. Hence, their NO scavenging activity can be calculated by the formula -

$$\% \text{ NO scavenging} = \frac{\text{Absorbance of control - Absorbance of test}}{\text{Absorbance of control}} \times 100$$

METHOD:

Gallic Acid stock solution l- 1mg/ml and stock solution ll- 100µg/ml was prepared. From the stock solution l : 0.1ml, 0.125ml, 0.15ml, 0.175ml and 0.2ml were pipetted out in separate tubes and total volume was made upto 1ml using distilled water to get 100, 125, 150, 175 and 200µg/ml solutions. Similarly 0.25ml, 0.5ml and 0.75ml gallic acid solution was pipetted out from stock solution ll and total volume was made up to 1ml using distilled water to get 25, 50 and 75µg/ml solutions. Extract solutions were prepared in quadruplicates by pipetting 0.25ml extract and 0.75ml distilled water. A control without the test compound, but an equivalent amount of water and 0.5ml Sodium Nitroprusside was taken. 0.5ml Sodium Nitroprusside(20mM) prepared in Phosphate Buffered Saline (pH7.4) was added in all the tubes and incubated at 25ºC for 3hours. After incubation 1.5ml of Griess Reagent was added and incubated for 30 minutes for color development. Absorbance of all the solutions was measured at 546nm using VISIBLE Spectrophotometer.

ANTIBACTERIAL ASSAY:

Disk Diffusion Method:

PRINCIPLE:

It is a test of the antibiotic sensitivity of bacteria. In this method, a wafer (a filter paper disk) containing antibiotic is placed on an agar plate which already has a bacterial culture spread over and the plates are incubated. The compound present in the filter paper disk diffuses from the filter paper into the agar.

If an antibiotic stops the bacteria from growing or kills them, then a zone of inhibition will be formed. This is an area around the wafer where the bacteria have not grown enough to be visible. The size of the zone depends on how effective the antibiotic is at stopping the growth of the bacterium. Another factor which also influence the size of a zone is the diffusion of the antibiotic within the agar medium and varies based on the molecular configuration of the antibiotic.

METHOD:

Culture Plates were prepared by pouring LB-Agar media in sterile petri plates. The plates were left to solidify. Now the secondary bacterial culture was spread on the culture plates using a sterile glass swab. To obtain a uniform growth the plate was streaked with swab in one direction, the plate was rotated 90º and the plate was again streaked in that direction. The rotation was repeated 3 times. The plates were then allowed to dry for approximately 5 minutes. Using a flame sterilized forceps 4 filter paper disks were gently placed each at an angle of 90º with respect to each other on the petri plates. 20µl of extracts were then added on the filter

papers, one extract on each paper. For the control Ampicillin on one wafer and autoclaved distilled water on anther wafer was also poured on each plate. Each extract was added in quadruplicates. The plates were incubated overnight at 37ºC in an Incubator. The plates were then examined the next day for appearance of Zones of Clearance around the extracts.

LIST OF REAGENTS:

1. **Gallic Acid** Stock (1mg/ml):10 mg Gallic acid weighed and dissolved in 10ml distilled water.
2. **Folin Ciocalteu Reagent (**1:1diluted): 5ml pure FCR mixed with 5ml distilled water.
3. **Sodium Carbonate** (20%):2g Sodium Carbonate was weighed and dissolved in distilled water. The volume was made up to 10ml.
4. **Ascorbic Acid stock (**1mg/ml):10mg Ascorbic Acid weighed and dissolved in 10ml distilled water.
5. **Phosphate Buffer-** pH 6.6, 20ml -7.73ml of DiSodium Hydrogen Phosphate mixed with 12.27ml of Mono Sodium Dihydrogen Phosphate.
6. **Ferric Chloride** (0.1%, 10ml):0.01g of Ferric Chloride was weighed and dissolved in 10ml distilled water.
7. **Trichloroacetic Acid** (10%, 20ml):2g Trichloroacetic Acid was weighed and dissolved in 20ml distilled water.
8. **Potassium Ferricyanide**(1%,20ml):0.2g Potassium Ferricyanide was weighed and dissolved in 20ml distilled water.
9. **Bovine Serum albumin** (5%):1g BSA was weighed and dissolved in distilled water. The volume was made up to 20ml.
10. **Phosphate Buffer**- 0.1M, pH: 7.4, 100ml: 38.76ml of MonoSodiumDihydrogen Phosphate mixed with 61.24ml of DiSodium Hydrogen Phosphate.
11. **Sodium Nitroprusside: 5mM:** 0.02998g NPS dissolved in 20ml Phosphate Buffer Saline (0.2M)**; 20mM:** 0.11918g NPS dissolved in 20ml PBS(0.2M); **100mM:** 0.5959g NPS dissolved in 20ml PBS (0.2M)
12. **Griess Reagent:(**Mix equal volumes of 1% Sulphanilamide and 0.1% NEDA.)
    - **1% Sulphanilamide:**1g Sulphanilamide weighed and dissolved in 100ml Distilled water.
    - **2% Phosphoric Acid:** 2.35ml of Phosphoric Acid Stock dissolved in 97.65ml of distilled water.
    - **0.1% NEDA:** 100mg N-Naphthyl ethylene diaminedihydrochloride was weighed and dissolved in 100 ml of 2% Phosphoric Acid.
13. **LB Agar Broth:** 2g LB powder and 1.8g Agar were weighed and dissolved in distilled water. The volume was made up to 100ml.
14. **LB Liquid solution:**2g LB powder was weighed and dissolved in distilled water. The volume was made up to 100ml.

RESULTS AND DISCUSSION

Polyphenol Estimation

Table 1: Gallic Acid Standard for Polyphenol Estimation

SL No.	Concentration of Gallic Acid (µg/ml)	Absorbance at 750nm
1.	0	0
2.	10	0.003
3.	20	0.107
4.	40	0.559
5.	60	1.016
6.	80	1.421
7.	100	1.785

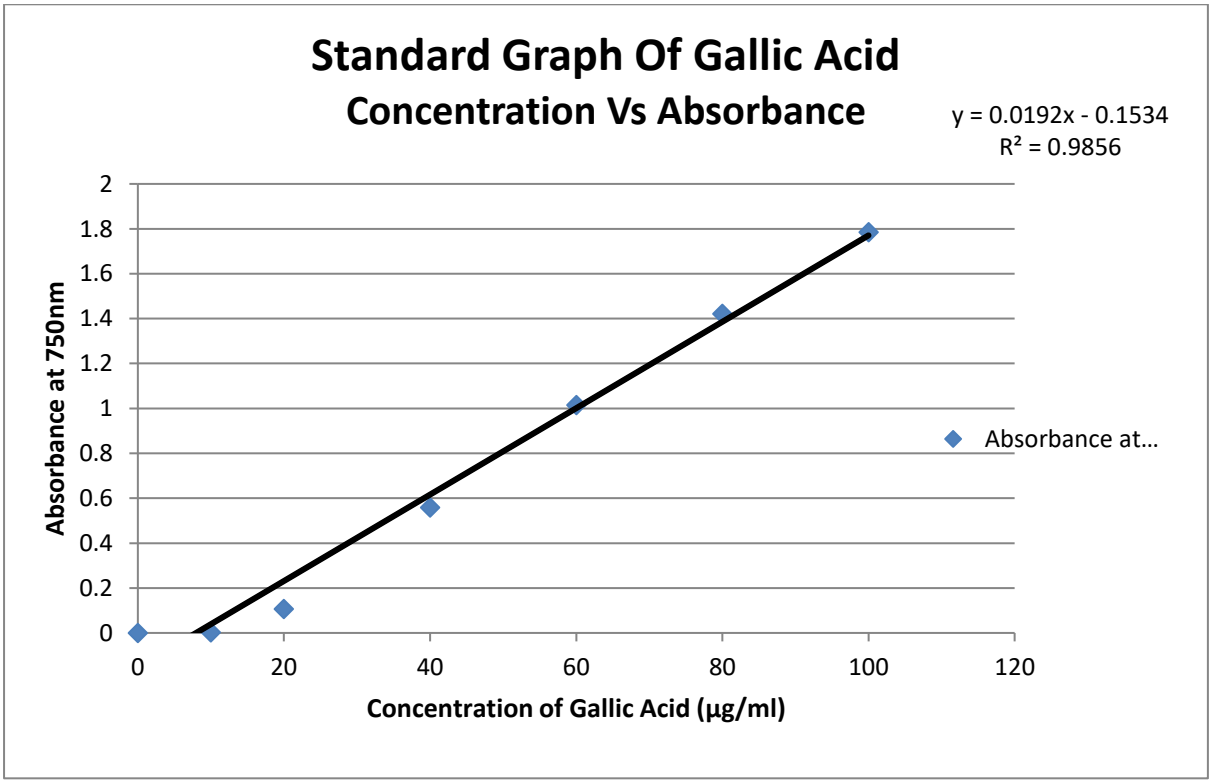


Figure 2: Standard Graph of Gallic Acid

The polyphenol content of different extracts was estimated upon reaction with Folin Ciocalteau reagent using gallic acid as the standard.All the extracts seemed to show a considerable amount of polyphenols with the highest concentration being shown by **dry tulsi leaves in milk media**.

Eugenol in Tulsi is an important phenolic compound which is known to have antioxidant and anti-inflammatory properties.**Haritaki**, an important constituent of the **churn** used is supposed to have antioxidant property. Tulsi and churn when taken with milk showed the best results which is in accordance with some research papers suggesting that tulsi taken with milk supposedly heightens its antioxidant property.(Table 2 and figure 3)

Table 2: Total Phenolics content of different extracts

Sl No.	EXTRACTS	Absorbance at 700nm	Phenolic Content from graph (µg/ml)	Dilution Factor	Total Phenolic Content (µg/ml)
1.	Dry Tulsi Leaves in Water	0.914 ± 0.150	56.16	4	224.63
2.	Dry Tulsi Leaves in Lemon Water	0.941 ± 0.166	57.58	4	230.32
3.	Dry Tulsi Leaves in Milk	0.907 ± 0.093	55.80	6.8	379.46
4.	Fresh Tulsi Leaves in Water	1.139 ± 0.065	68.00	4	272.00
5.	Fresh Tulsi Leaves in Lemon Water	1.587 ± 0.115	91.58	4	366.32
6.	Fresh Tulsi Leaves in Milk	1.634 ± 0.045	94.05	4	376.21
7.	Fresh Tulsi Meristem Leaves in Lemon Water	0.758 ± 0.112	47.95	4	191.79
8.	Fresh Tulsi Meristem Leaves in Milk	1.338 ± 0.091	78.47	4	313.89
9.	Churn in Water	0.986 ± 0.117	59.96	4	239.86
10.	Churn in Lemon Water	0.748 ± 0.074	47.70	6.8	322.34
11.	Churn in Milk	1.475 ± 0.134	85.67	4	342.67

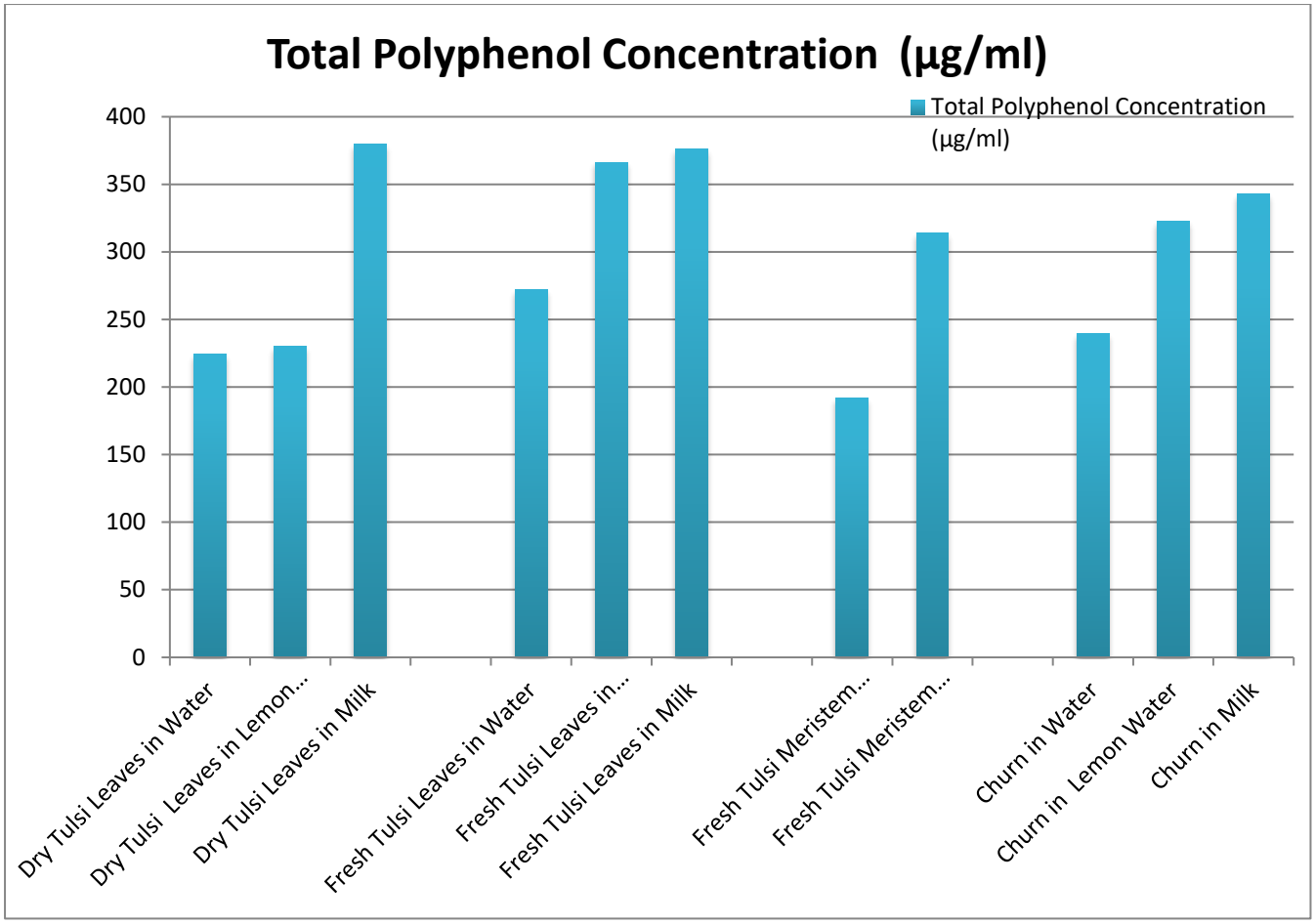


Figure 3: Polyphenolic Content of the Extracts

Ferric Reducing Antioxidant Power Assay (FRAP):

Table 3: Gallic and Ascorbic Acid Standard for FRAP Assay

Sl. No.	Concentration of Gallic/Ascorbic Acid (µg/ml)	Absorbance at 700 nm by Gallic Acid	Absorbance at 700nm by Ascorbic Acid
1.	0	0	0
2.	10	0.247	0.059
3.	25	0.594	0.175
4.	50	1.123	0.371
5.	75	1.568	0.553
6.	100	1.842	0.743

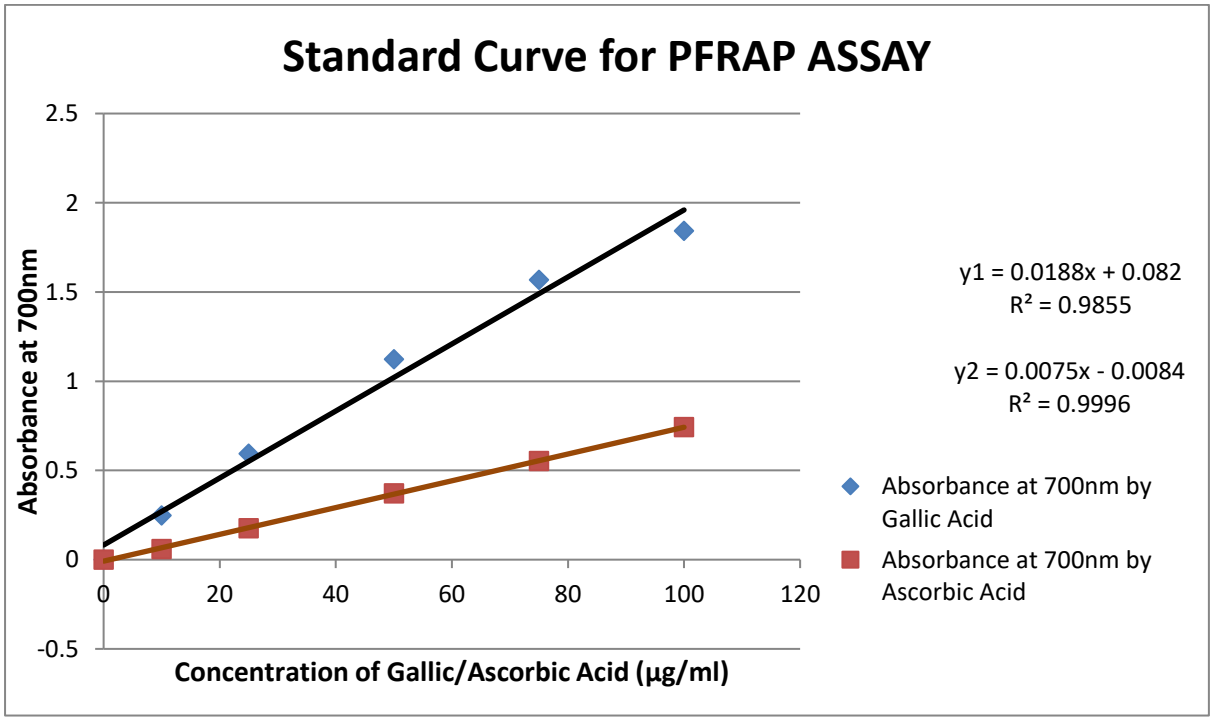


Figure 4: Standard Curve for PFRAP ASSAY (Concentration Vs Absorbance)

Table 4: Total Gallic Acid Equivalents of Different Extracts

SL No.	EXTRACTS	Absorbance at 700nm	Gallic Acid equivalent of Extracts (µg/ml)	Total Gallic Acid Equivalent {Gallic Acid equivalent *Dilution Factor(6)} in µg/ml
1.	Dry Tulsi Leaves in Water	1.506 ± 0.032	75.74	454.44
2.	Dry Tulsi Leaves in Lemon Water	1.400 ± 0.058	70.11	420.66
3.	Dry Tulsi Leaves in Milk	1.388 ± 0.026	69.47	416.82
4.	Fresh Tulsi Leaves in Water	0.541 ± 0.039	24.41	146.46
5.	Fresh Tulsi Leaves in Lemon Water	1.076 ± 0.068	52.87	317.22
6.	Fresh Tulsi Leaves in Milk	0.664 ± 0.073	30.96	185.76
7.	Fresh Tulsi Meristem Leaves in Lemon Water	0.338 ± 0.077	13.62	81.72
8.	Fresh Tulsi Meristem Leaves in Milk	0.633 ± 0.236	29.31	175.86
9.	Churn in Water	1.449 ± 0.062	72.71	436.26
10.	Churn in Lemon Water	1.420 ± 0.04	71.17	427.02
11.	Churn in Milk	1.423 ± 0.161	71.33	427.98

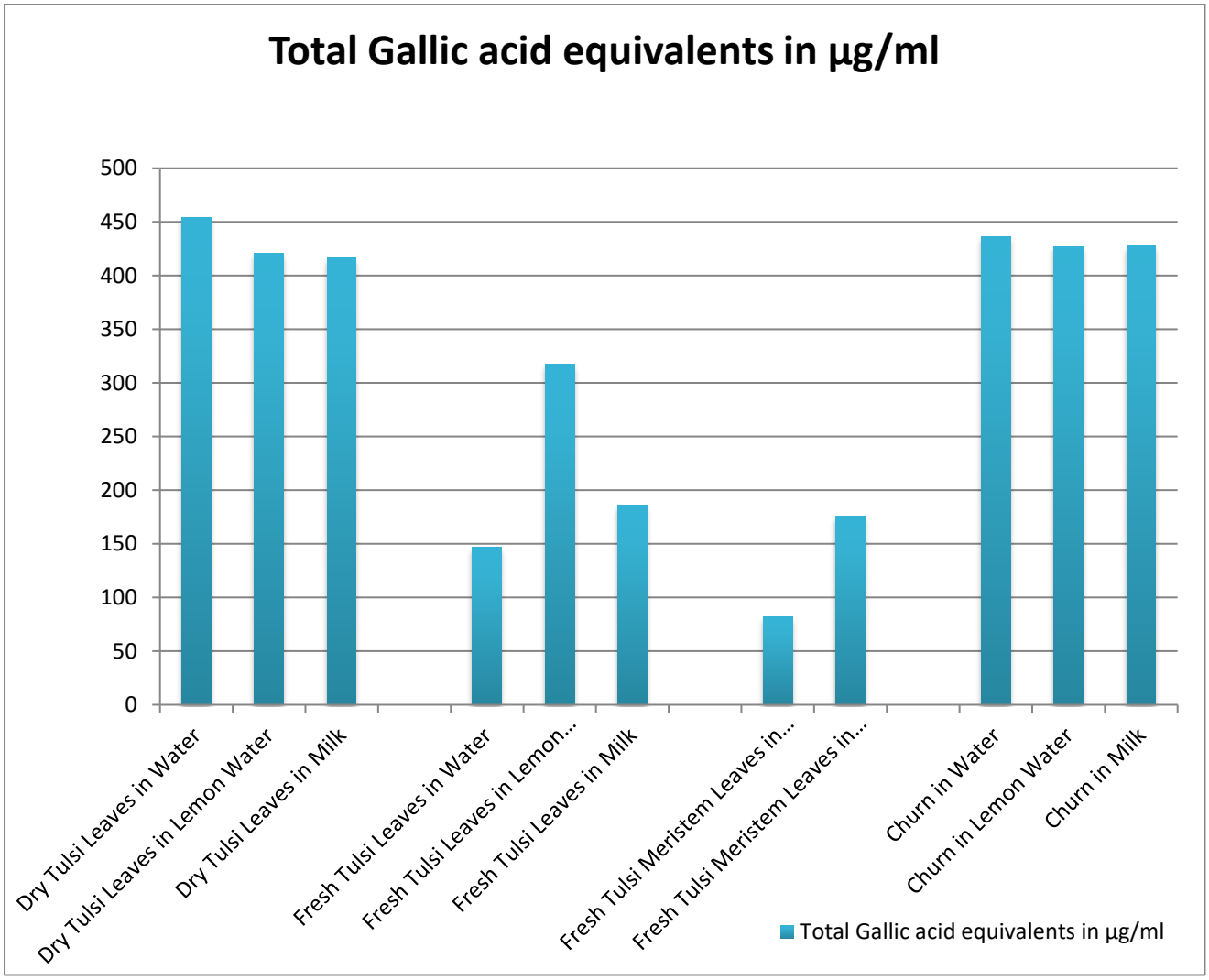


Figure 5 : Total Gallic Acid Equivalents of Extracts (µg/ml)

The antioxidant activity (an indication of anti-inflammatory activity) of different extracts was assessed in terms of equivalents of gallic acid. Dry tulsi showed higher activity as compared to fresh tulsi which can be explained from the fact that the antioxidants in dry leaves will be more concentrated as compared to those in fresh leaves. Churn having several antioxidant constituents like haritaki, also exhibited considerable amount of antioxidants irrespective of the media used.(Table 4 and Figure 5)

Inhibition Of Protein Denaturation

Table 5: Measure of Turbidity produced due to protein Denaturation

SL. No.	EXTRACTS	Optical Density at 660nm
1.	Blank	0
2.	Control (Define control)	0.007
3.	Ibuprufen	0.007
4.	Churn	0.006
5.	Dry Tulsi Leaves (Pellet)	0.011
6.	Fresh Tulsi Leaves (Pellet)	0.004
7.	Fresh Tulsi Leaves (Supernantant)	0.010

Table 6 : Absorbance due to denatured proteins

SL No.	SAMPLE	Optical density at 660nm	Absorbance at 280nm
1.	Blank	0	0
2.	Control	0.066	1.0
3.	Test	0.062	1.0
4.	1:100 diluted Control	-	0.210
5.	1:100 diluted Test	-	0.142

No significant change in the optical density was seen with extracts as compared to control (which contained buffer and BSA). A decrease in the absorbance was expected with the extracts due to inhibition of protein denaturation but the absorbance values were too low to be compared. Therefore a different method to asses inhibition of protein denaturation was standardized by measuring absorbance at 280nm (since as the protein gets denatured on heating it will show greater absorbance at 280nm.)

Also we further intend to use NATIVE GEL ELECTROPHORESIS to track the protein denaturation and its subsequent inhibition by various herbal extracts.

Table 7: Measure of Nitric Oxide Production by NPS using Griess Reagent

SL No.	Concentration of Sodium Nitroprusside (m M)	Absorbance at 700nm	
		Dilution done with Phosphate Buffer	Dilution done with 500µg/ml Gallic Acid
1.	0	0	0
2.	10	0.195	0.215
3.	20	0.292	0.425
4.	40	0.518	0.704
5.	60	0.663	0.925
6.	80	0.761	1.159
7.	100	0.912	1.076

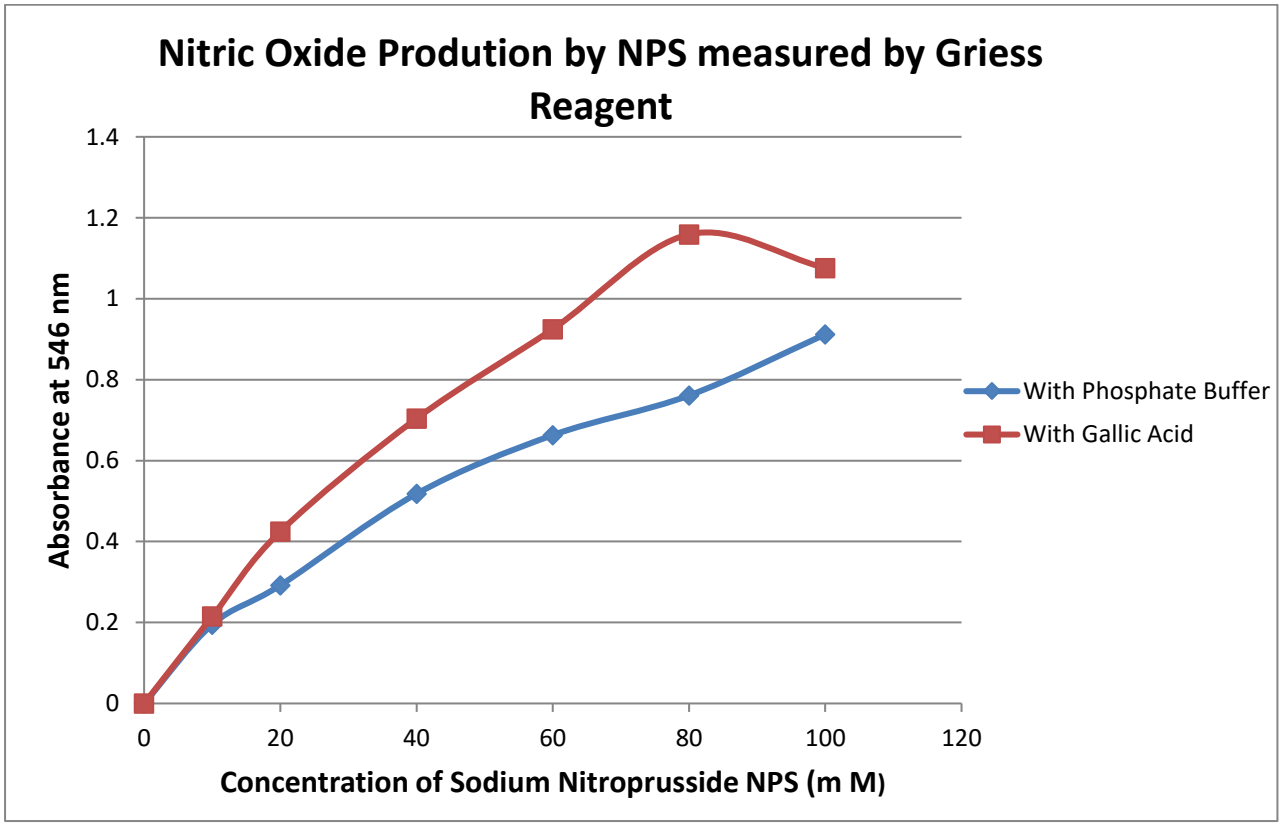


Figure 6: Nitric Oxide production by Sodium Nitroprusside (NPS) as measured by Griess Reagent. shows that with increasing concentrations of Sodium Nitroprusside there is an increase in Nitric Oxide production as measured by Griess Reagent. Though Gallic Acid does not show any Nitric Oxide scavenging as is expected according to the principle of the assay.

Table 8: Measure of Nitric Oxide Scavenging by Ascorbic Acid and Ibuprufen

SL No.	Concentration of Ascorbic Acid/ Ibuprufen (µg/ml)	Absorbance at 546nm	
		Ascorbic Acid	Ibuprufen
1.	0	0	0
2.	25	0.042	0.001
3.	50	0.084	0.000
4.	100	0.149	0.001
5.	150	0.265	0.000
6.	200	0.669	0.007
7.	300	1.251	0.002

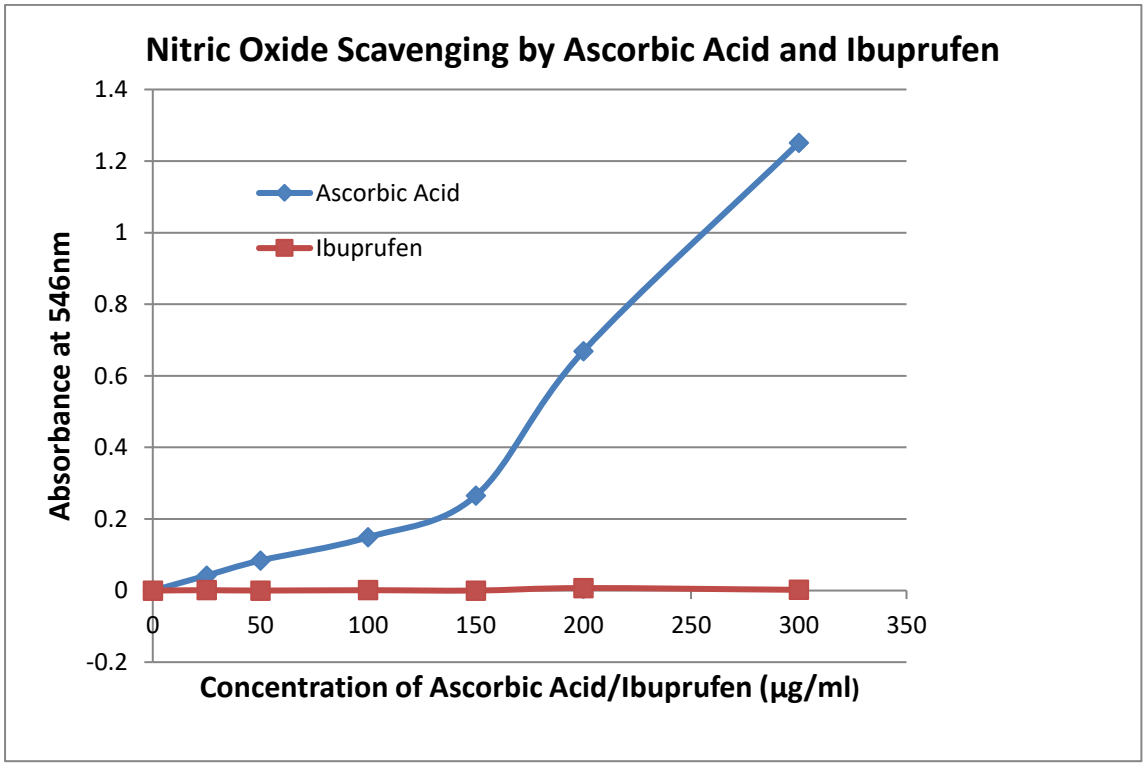


Figure 7: Nitric Oxide Scavenging by Ascorbic Acid and Ibuprufengraph shows that with increasing concentrations of Ibuprofen , it showed Nitric Oxide scavenging as is expected according to the principle of the assay indicating that Ibuprofen has good Anti-Inflammatory properties.But , Ascorbic Acid did not

show any scavenging rather it resulted in increased Nitric Oxide production acting as a pro-inflammatory agent.

Table 9: Gallic Acid Standard

SL No.	Concentration of Gallic Acid (µg/ml)	Absorbance at 546nm
1.	Blank	0
2.	Control	0.07
3.	25	0.065
4.	50	0.063
5.	75	0.069
6.	100	0.077
7.	150	0.092
8.	200	0.096

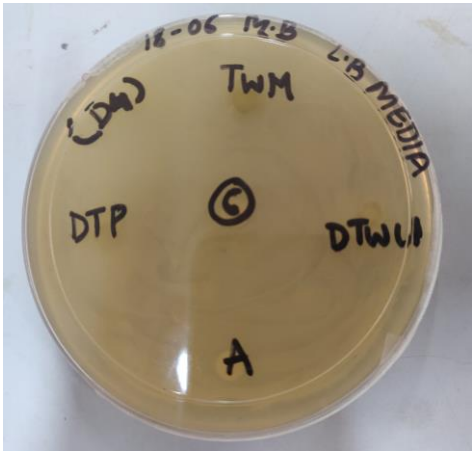
Table 10 : Nitric Oxide Scavenging by different Extracts

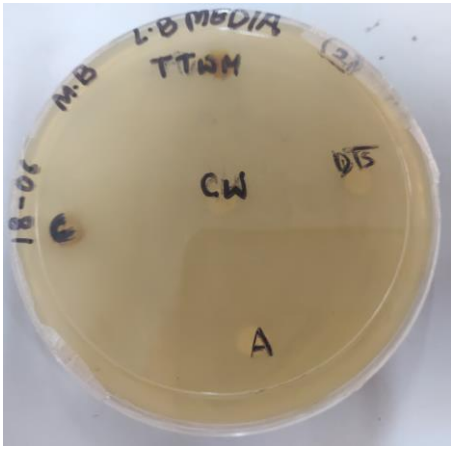
SL No.	EXTRACTS	Absorbance at 546nm
1.	Dry Tulsi Leaves in Water	0.474 ± 0.029
2.	Dry Tulsi Leaves in Lemon Water	0.509 ± 0.023
3.	Dry Tulsi Leaves in Milk	0.710 ± 0.031
4.	Fresh Tulsi Leaves in Water	0.467 ± 0.046
5.	Fresh Tulsi Leaves in Lemon Water	0.523 ± 0.033
6.	Fresh Tulsi Leaves in Milk	0.989 ± 0.035
7.	Fresh Tulsi Meristem Leaves in Lemon Water	0.497 ± 0.033
8.	Fresh Tulsi Meristem Leaves in Milk	1.145 ± 0.049
9.	Churn in Water	0.693 ± 0.055
10.	Churn in Lemon Water	1.095 ± 0.050
11.	Churn in Milk	1.438 ± 0.145

The NO scavenging activity of different extracts was to be assessed for which ascorbic acid was to be used as a standard. However, ascorbic acid seemed to be acting as a pro-oxidant instead of an antioxidant which is suggested by the increasing absorbance with increasing concentrations of ascorbic acid.

Therefore, gallic acid was also tried as the standard. Contrary to the principle of the assay,the absorbance increased with increasing concentration of gallic acid. However, the increase was not as significant as observed with ascorbic acid suggesting that gallic acid has no effect on the production of NO.
Ibuprofen which is a known anti-inflammatory drug showed negligible absorbance when used as the standard suggesting that it is acting as a scavenger of NO.
Since a graph could not be plotted using ascorbic acid or gallic acid as the standard, this method needs to be further standardized in order to assess the NO scavenging activity of different extracts and thus their anti-oxidant and anti-inflammatory activity.

Antibacterial Assay: Disk Diffusion Method:





DTP = Dry Tulsi Pellet
TWM = Tulsi with Warm Milk
DTW = Dry Tulsi in Water
A = Ampicillin
C = Control (Water)

C = Churn
TTWM = Tulsi and Turmeric in Warm Milk
DTS = Dry Tulsi Supernatant
A = Ampicillin
CW = Control (Water)

The antibacterial assay was performed using disc diffusion method using ampicillin as control. Zones of clearance were to be observed around different extracts. However, there was no clearance around the ampicillin control suggesting that the bacterial strain used was resistant to ampicillin. Hence, this assay needs to be repeated.

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Certificate

This is to certify that the project report entitled **"COMPUTATIONAL APPROACHES FOR THE DESIGN OF NOVEL ANTIVIRAL INHIBITORS FOR DENGUE INFECTION"** submitted by **MANSI PANDIT** to the Department of Computer Science, Jamia Millia Islamia, New Delhi, for the partial fulfillment of the requirements of the degree of **M.Sc.(Bioinformatics)**, is a record of the original bonafide work carried out by her under my/our guidance and supervision. The report has reached the requisite standards for submission.

The results contained in this report have not been submitted in part or full to any other university or institute for the award of any degree or diploma.

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Identification of mitochondrial specific proteome isolated from glioblastoma cell line U87MG by proteomics approach

Dissertation Project work submitted in partial fulfilment for the award of degree in
Master of Science in Microbiology

By

Ayushi Rana
Enrollment no. 18-05366
Batch 2018-2020

Department of Biosciences
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CERTIFICATE

This is to certify that present work entitled "**Identification of mitochondrial specific proteome isolated from glioblastoma cell line U87MG by proteomics approach**" submitted to the Department of Biosciences, Jamia Millia Islamia, New Delhi in partial fulfilment of the requirement for the award of the degree of Master of Science in Microbiology, embodies faithful record of work carried out by **Ayushi Rana** at the Department of Biochemistry, Sri Venkateswara College, University of Delhi.

P. Ravindra Varma

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To explore the various signaling pathways associated with Glioma stem cells.

Dissertation

By

Nisha Pandey

Enrolment No: 19MBT020

Submitted

In the partial fulfillment of the requirements of the award of the Degree of

Master of Science

In

Biotechnology

(2019 - 2021)

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CERTIFICATE

This is to certify that the M.Sc. dissertation entitled "**To explore the various signaling pathways associated with glioma stem cells**" submitted by **Nisha Pandey** to the Department of Biotechnology, Jamia Millia Islamia, New Delhi, in the partial fulfillment of the requirements of the degree of Master of Science (Biotechnology), is a record of the original bonafide work carried out by her under my guidance and supervision. The report has reached the requisite standards for submission to the best of my knowledge, understanding and belief.

Moreover, the results contained in this report have not been submitted by part or full to any other university or institute for the award of any degree or diploma.

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Project Report of Summer Internship done under Sri -Venkateswara Programme for Research and Innovative Academics (SRI-VIPRA)

On

TO STUDY GEOTACTIC AND PHOTOTACTIC BEHAVIORAL RESPONSES OF *Drosophila melanogaster* AGAINST DIFFERENT STIMULI AND THEIR INTERPRETATION

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