Yoga and Diabetes

Multi Centric Research Study

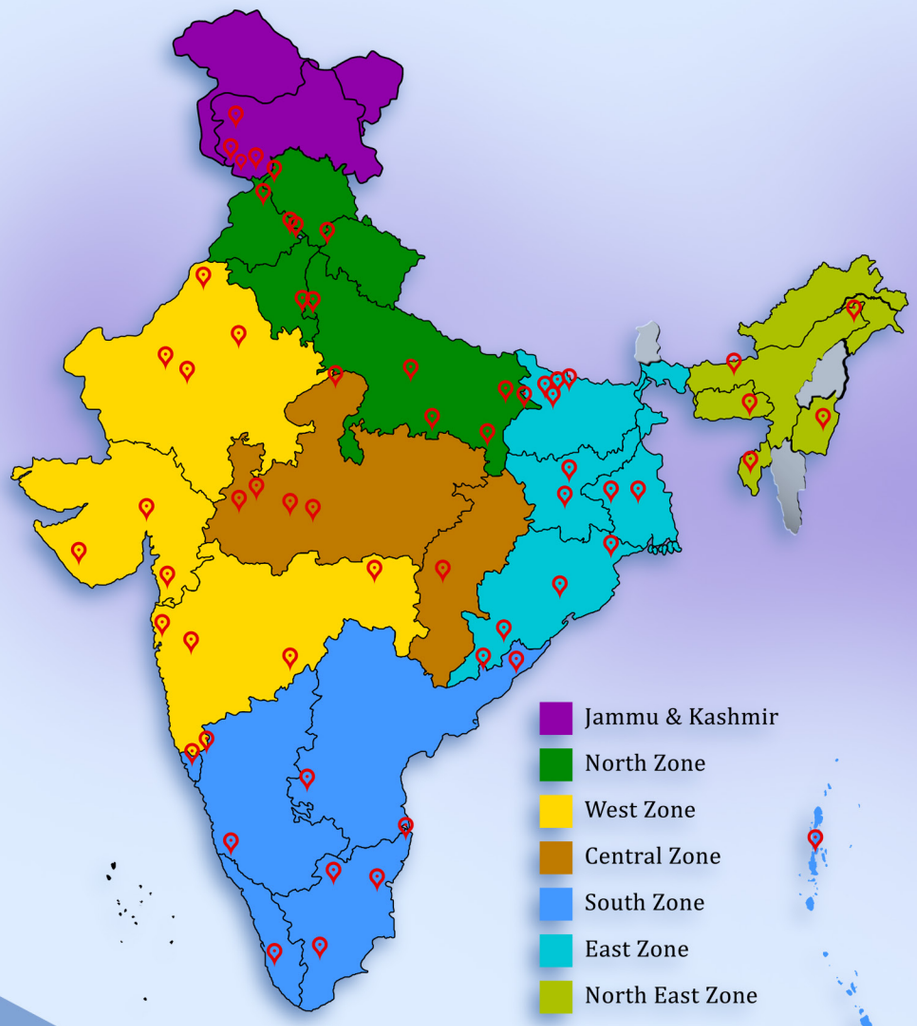
Niyantrita Madhumeha Bharata Abhiyaan

नियंत्रित
मधुमेह
भारत

Start Yoga
Control Diabetes

Project Report

Oct, 2016 - Oct, 2017



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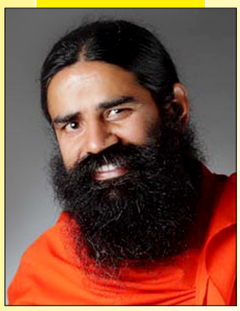

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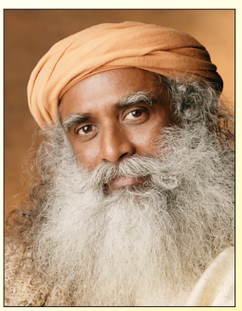

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Executive Summary

Summary of Planned Proposal

'Yoga and Diabetes, a Multi Centric Randomized Controlled Study'

Background

Diabetes, one of the major life style diseases that has increased in epidemic proportions is associated with poor health outcomes including cardiovascular and microvascular complications as well as a negative impact on psychosocial wellbeing. Further, diabetes related complications, increased risk of hospitalization and mortality lead to elevated health costs and social burden. Prior studies have sought to draw links between yoga based lifestyle and biopsychosocial wellbeing among diabetics. This Yoga based National Diabetes Control Program was planned to target adults with prediabetes, a population known to be at high risk for Type 2 diabetes and known an newly diagnosed diabetics in the population.

Aims

1. To conduct a multicentre research Study to assess the prevalence of prediabetes and diabetes in a population known to be at high risk for Type 2 diabetes development, newly diagnosed type 2 diabetes and previously known diabetes.
2. Multicentre randomized, population-based control study to assess the efficacy of yoga-based lifestyle change in prediabetics and type 2 diabetics.

Objectives

1. To understand the prevalence of prediabetes, newly diagnosed type 2 diabetes and previously known diabetes in a representative sample of the Indian population
2. To evaluate the prevalence of yoga practitioners
3. Evaluate the effect of yoga based lifestyle in prediabetes, newly diagnosed type 2 diabetes and previously known diabetes.
4. Evaluate the effect of yoga practice on primary prevention and the conversion from pre-diabetes to type 2 diabetes.
5. Evaluate the effect of yoga based lifestyle among prediabetes, newly diagnosed type 2 diabetes and previously known diabetes on self-care management, stress, dietary habits and physical activity

Sample Size Calculation

Based on the available data of conversion of prediabetes to diabetes in six and twelve months, to show any significant reduction in conversion of prediabetes to diabetes within 3 months [before the next international day of yoga in June 21st 2017], the required number of prediabetics was calculated (by the statistical experts of NIMHANS, Bengaluru), to be two cohorts of 6000 each, yoga and control (total 12,000). To allow for drop outs (50%), we planned for double the number i.e. 24,000; as the known prevalence of prediabetes in India is around 10%, in order to get this 24,000 prediabetics, we planned to screen 240,000 (2.4 lakh) household population above the age of 20 years round the country.

This was planned to be a pan India multi center study covering all states including union territories. Selection of the number of districts per state was based on the population size reported in the 2011 census data (http://censusindia.gov.in/). The number of districts/state was planned to be one per ten (1:10) available districts in the state. Based on this, 60 districts to be selected to get the adequate sample size; in each district, screen 4000 persons/district between 20-80 years from all states of India; of these screen 2000 urban and 2000 rural adult house hold population; total number to reach 2.4 lakhs. Thus, with an expected prevalence of 5-10% prediabetes and diabetes, the number to be recruited for the study was 800 subjects from each district, 400 urban and 400 rural.

Study Design: Two groups randomized wait-list controlled multi-centre design.

Arms-*Experimental group:* routine Standard Diabetes Management Education + Yoga Based Lifestyle Program.

Wait list control group: routine Standard Diabetes Management Education alone.

Allocation: Randomized cluster allocation

Endpoint Classification: Efficacy Study

Time Frame: baseline and 3 months follow up after intervention before June 2017

Summary of Implementation

The project had the following steps:

1. Development of a common yoga protocol

A focused group discussion (FGD) was organized by the Indian Yoga Association (IYA) for preparing the common yoga protocol of yoga based life style change for diabetics and prediabetics. The team of 16 experts in the FGD included senior yoga masters from different yoga traditions, yoga researchers and diabetologists.

2. Ethical clearance

The institutional ethical committee of Indian Yoga Association cleared the proposal after scrutinizing the complete project proposal, informed consent forms followed by a presentation by the PI.

3. Selection and training of research personnel and therapists

Interviews were conducted by members of the research team of IYA and the PI, after giving website advertisements for Research associates (RA) and Senior research fellows(SRF). Two research associates and 35 SRFs who satisfied the selection criteria were selected. 1200 yoga volunteers (20/district) from different yoga organizations were selected based on their yoga experience. Orientation training (2-5 days) of yoga volunteers for diabetes movement (YVDMs) for teaching the common protocol was organized in each district.

4. Randomized Selection and Recruitment

A total of 60 districts from 28 states [About one per ten (1:10) available districts in the state as per 2011 census data (http://censusindia.gov.in)] were selected. We planned to screen 4000, (2000 urban and 2000 rural) house hold population between 20-80 years of age in each selected district . In order to screen 2.4 lakhs adult house hold population equally from all states of the country, the number of districts to be selected in each state was finalized using a ratio of 1:10, e.g., 5 districts if there are 50 districts in a state. Required number of districts in the 7 zones (N,E,W,S,C,J&K and NE) of the state map were marked randomly.

List of all villages with 150 to 175 households (population ranging from 500 to 1000) was prepared; of these four representative villages, 2 neighboring villages for yoga and two neighboring villages for control, were selected randomly. Yoga and control villages were separated by 10 km within the district.

Selection in urban population was done by selecting one town or a city randomly from the list of towns and cities in the district. The list of the wards with a house hold population of 2000 in the town / city was obtained; two zones on the map of the town separated by 2 to 5 kms were marked; one ward for yoga and one ward for control was selected randomly from the list of wards in that zone.

Thus, we selected two wards from a town/city and four villages in each district for screening. With an expected prevalence of 5-10% prediabetes and diabetes, the number to be recruited for the study was 800 subjects (400 urban and 400 rural) from each district.

5. Screening

1.Jammu & Kashmir Zone: Jammu

2,North East: Arunachal Pradesh, Assam, Manipur, Meghalaya, Tripura

3.North Zone: Chandigarh, Delhi, Haryana, Madhya Pradesh, Punjab, Uttar Pradesh, Uttarakhand.

4. West Zone: Gujarat ,Maharashtra, Rajasthan

5.Central Zone: Bihar, Chattisgarh, Madhya Pradesh

6.East Zone: Jharkhand, Odisha, West Bengal

7.South Zone: Andaman & Nicobar, Andhra Pradesh, Karnataka, Kerala, Pondicherry, Tamil Nadu .

Door to door survey was conducted by using screening forms and mobile apps. by the team of YVDMs under the continuous supervision of SRFs, monitored and guided by RAs.

6. Assessments and Selection of subjects

Assessment camps were organized in each village/ward; detailed assessments along with blood tests were carried out for all those with diabetes and those with high and medium scores on Indian diabetes rating scale (IDRS). A total of 50,199 subjects were registered.

7. Intervention

Yoga villages / wards: The integrated yoga based life style module prepared by the expert committee of IYA was taught by the trained YVDMs in 9 day camps (2hours/day) in the yoga villages/wards.

Control villages / wards: these participants had a medical checkup and advice after the assessment and selection; they were told that they would be taught yoga protocol after completion of third month assessments.

6. Follow up

Weekly follow up visits were conducted in both control and yoga villages / wards. In some of the villages daily classes were conducted on demand by the village authorities.

7. Final assessment

Final assessments were conducted by the YVDMs as per plan after 3months in both control and yoga villages / wards.

Summary of Results (all India)

This multicenter randomized control nationwide study had two main objectives.

1. To look at the prevalence of diabetes in the entire Indian population in 2017.

In the present study (completed between Feb. to May 2017), we observed a prevalence of **10.3% of known diabetics** (self-reported taking diabetes medication), in the screened population in the randomly selected rural and urban population of 60 districts in 28 states including union Territories of India. The prevalence of known diabetics (excluding the newly diagnosed ones) varied from 6 % (central zone) to 15.7% (south zone.) [6 % in central zone,.7.5% in Jammu Kashmir zone, 9% in east zone, 9 in north east zone, 9.2% in north zone, 12.4% in west zone,15.7% in south zone].

The percentage of newly diagnosed diabetics in screened population was 5.87 %

Based on the IDRS risk profile, there were1.33% in the low risk group, 7.07% in the moderate risk group and 9.20% in the high risk group.

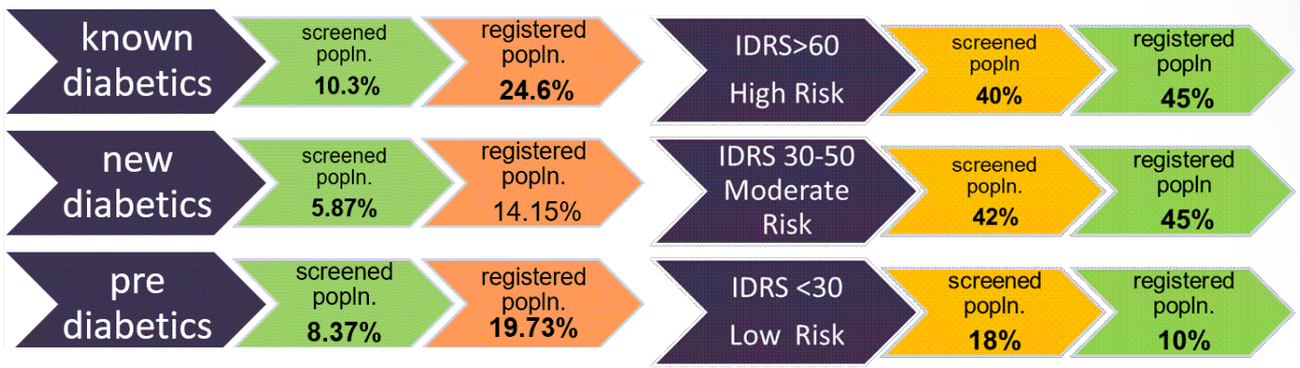
The percentage of Prediabetics in screened population was 8.27%

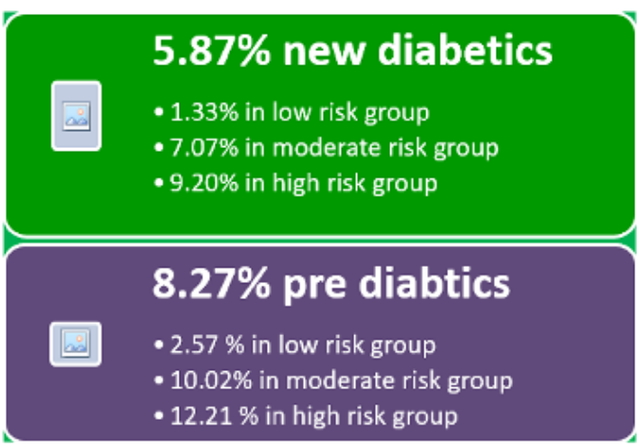
Based on the IDRS risk profile, 2.57% were in the low risk group, 10.02% were in the moderate risk group and 12.21% were in the high risk group.

Indian Council of Medical Research and Department of Health Research, Ministry of Health

and Family Welfare, Government of India study (Anjana et al) conducted a survey in 3 phases (between 2008 -2016) in 15 states of India. The reported prevalence based on oral glucose tolerance test was 7·3%. The prevalence of diabetes varied from 4·3% in Bihar to 10·0% in Punjab and was higher in urban areas (11·2%, 10·6–11·8) than in rural areas (5·2%, 4·9–5·4; p<0·0001) and higher in main land states (8·3%, 7·9–8·7) than in north east zone(5·9%, 5·5–6·2%).[*The Lancet (diabetes endocrinology) 5;8. 2017*].

Thus, there is an increase in the national prevalence of diabetes from 7.3 % (ICMR study based on IGT) to 16.3 % (10.3 % known + 6% newly diagnosed) in 2017(present rapid survey of NMB based on HbA1C).



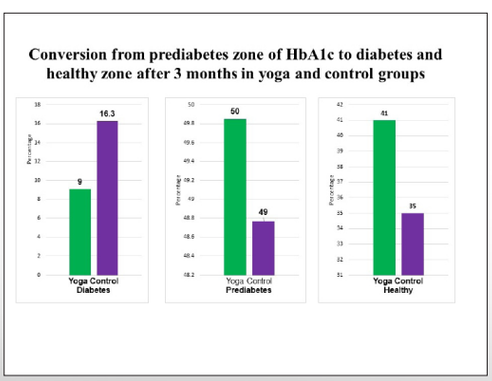


2. The second objective was to look at the effect of yoga based life style intervention in primary prevention within 3 months by comparing yoga group with control group in a randomized control study in entire Indian subcontinent.

Conversion of prediabetics to healthy or diabetes zone based on HbA1c values after 3 months

	yoga	control	Difference	P*
Healthy	41%	34.98%	6.02%	<0.001
Diabetes	9.09%	16.26%	7.16%	<0.001
Prediabetes	49.85%	48.77%	1.08%	0.01

* McNemar's test
9% became diabetic in yoga 16% became diabetic in control.
41% became healthy in yoga ; 35% became healthy in control.

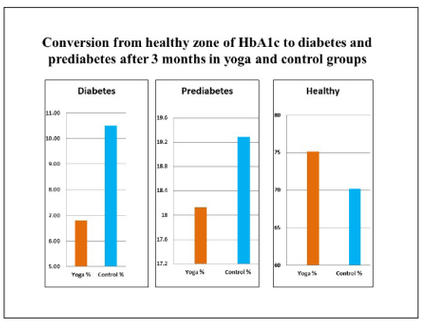


In the control group of the registered population 16.3 % of prediabetics (HbA1c between 5.8% to 6.3%)became diabetics (HbA1c ≥ 6.4%) after 3mnths. In the yoga group 9.1 % who were prediabetics (HbA1c between 5.8% to 6.3%) became diabetic (HbA1c ≥ 6.4%) after 3mnths. Thus, the **difference between yoga and control group was 7.2 %. (p< 0,001 Mc Nemar's).**

In the control group 35 % of prediabetics (HbA1c between 5.8% to 6.3%) reached healthy range (HbA1c ≤ 5.7%) after 3months. in the yoga group 41 % of prediabetics (HbA1c between 5.8% to 6.3%) moved to healthy range (HbA1c ≤ 5.7%) after 3 months. **The difference between yoga and control group was 6%. (p< 0,001 Mc Nemar's).**

Conversion of healthy to prediabetes or diabetes			
HbA1C categories	**Yoga**	**Control**	**Difference**
Healthy	**75.1%**	**70.18%**	5%
Diabetes	6. 8 %	**10.5%**	**3.7%**
Prediabetes	**18.13%**	19.29%	1.16%

- **75% remained healthy in yoga group while 70% remained healthy in control group**
- **6.8 % became diabetic in yoga and 10.5% became diabetic in controls**



Conversion of non diabetics to prediabetes or diabetes

In the yoga group, 6.8 % became diabetic and in the control group 10.5% became diabetic with a difference of 3.7%. Further, 75% remained healthy in yoga group while 70% remained healthy in control group with a difference of 5 %.

3. Other salient observations of the study

- Hypertension was highest in north east and high in central zone.
- Hyperlipidemia was highest in south.
- Cardiac disease, strokes, neuropathy, vascular disease and smoking were highest in the east zone.
- Life style – there were several differences in stress levels, diet pattern, physical activity, family history, tobacco and alcohol use.

4. Pre post results in 4 groups -new diabetics, known diabetics, pre diabetics and non-diabetics.

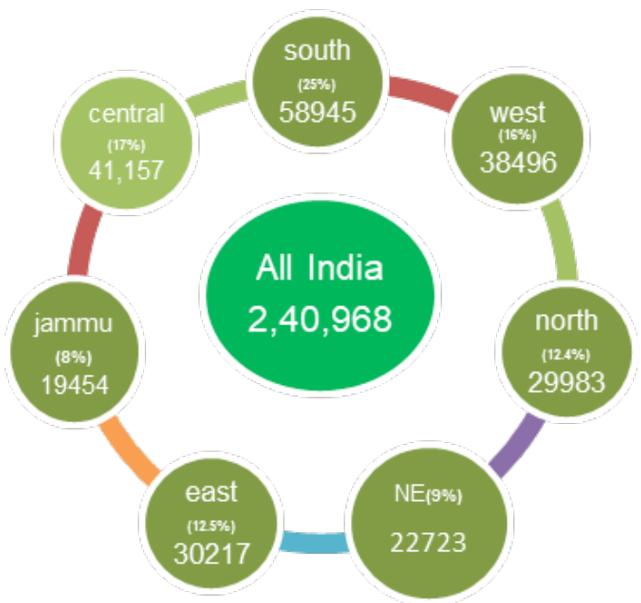
- There was 15-20% reduction in blood glucose values in yoga group in newly diagnosed diabetics.
- There was significantly better reduction in yoga group than control group in blood glucose variables and lipid profile in newly diagnosed diabetics.
- The changes in the blood glucose and lipid profile was non-significant in known diabetics.
- In prediabetics blood glucose (HbA1c) reduction and decrease in lipids in yoga group was significant.
- In the non diabetic healthy group, there was non-significant increase (within normal

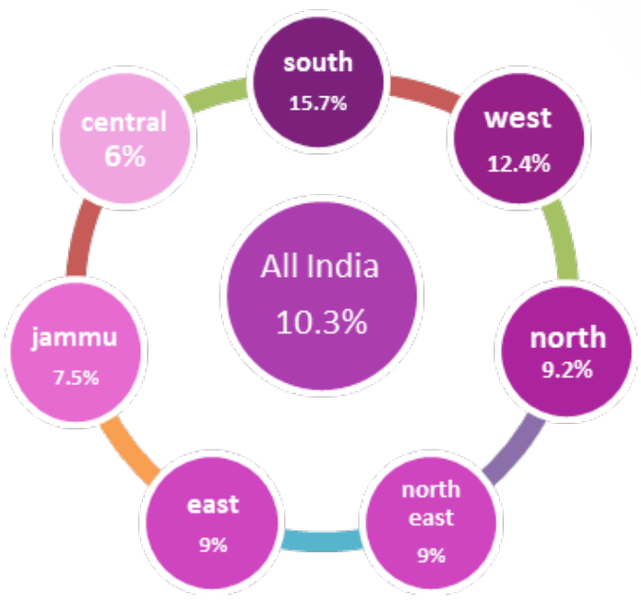
ranges) of blood glucose and lipid profile.

Results in Screened Population

Summary of Prevalance in 2,40,968 Screened General Urban and Rural Population.

Prevalence of Diabetes in Screened Population									
Duration of Diabetes %	Overall	Central	East	Jammu	North	North East	South	West	
Known Diabetes %	10.3	6.0	9.0	7.5	9.2	9.0	15.7	12.4	Highest Prevalence in SZ
1-11 Months	7.4	5.3	6.7	7.7	8.9	10.2	7.9	6.2	
1-5 Yrs	51.7	51.3	**56.5**	53.6	51.9	51.6	50.9	49.9	> 10yrs Highest WZ
10-20 Yrs	13.3	13.4	11.0	11.2	12.6	13.7	13.9	**14.3**	
5-10 Yrs	24.8	26.8	22.7	25.4	24.2	22.5	24.5	**26.2**	≤ 5rs –highest EZ
Above 20 Yrs	2.8	3.2	3.1	2.2	2.5	2.1	2.7	**3.4**	

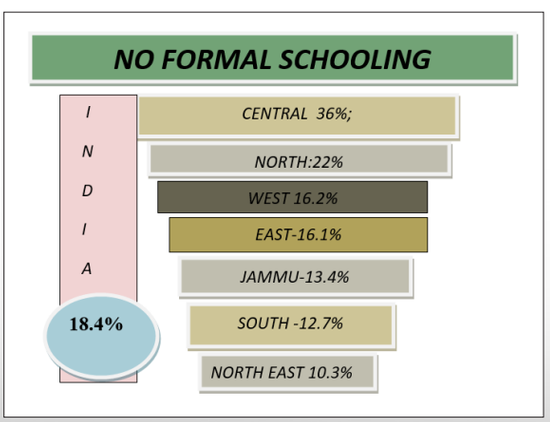




Socio-demographic Data

Age: The mean age of the screened population was similar in both urban 41.1 (13.8) years and rural 41.6 (13.8) population. The sample was also almost equally represented below and above the mean age. There was a higher proportion of people less than 45 years in both rural and urban India.

Gender: The gender distribution of the screened population was similar in both urban and rural population : 48% males and 52% females.



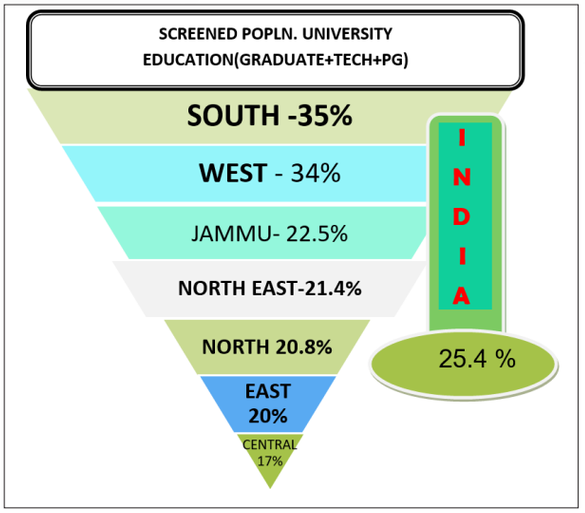
Marital status: The marital status of the screened population was marginally higher in rural than urban population :89% rural and 87% urban.

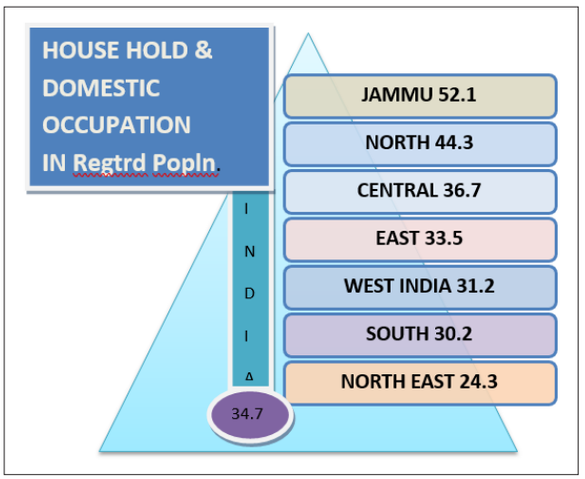
Education: High school and above: 63%; 54% in rural and 71% in urban. Only primary school educated: 19 % -23% in rural and 15% in urban. No formal education 18%-rural 23% and 14% urban.

Education of head of the family: High school and above: 77% -87% in rural and 69% in urban. Only primary school: 19 % - 11% in rural and 26% in urban. No formal education: 4%- rural 3% and 5% urban

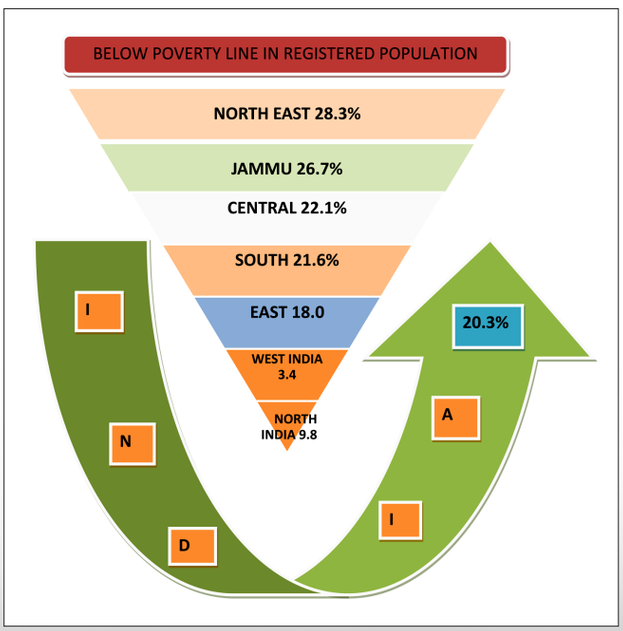
Occupation: 44% had household and domestic occupation -47% in rural and 43% in urban; 14% agriculture – higher in rural (21%) than urban (8%). 41% were employed in other occupations-32% in rural and 50% in urban. None were unemployed.

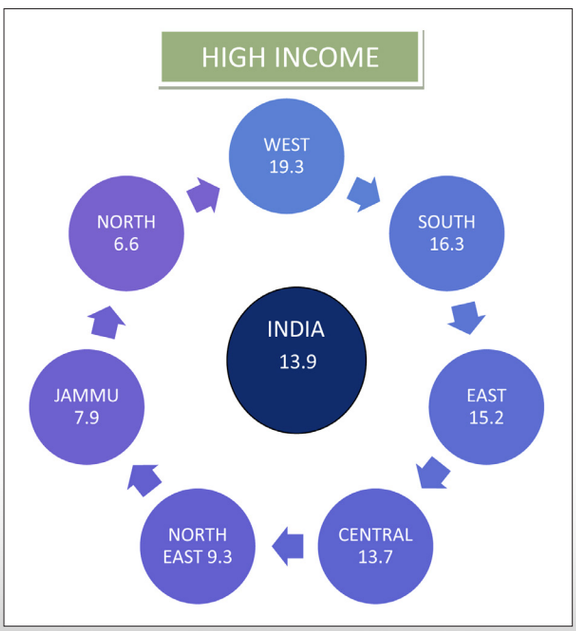
Occupation of the head of the family: this differed widely from that of the participant.21% were professionals. 14 % in rural and 26 % in urban population.37% were clerical shop owners or farmers; there was no difference between rural and urban. 42 % were skilled workers-rural 50 % and urban 37%





Family income: 9% were below poverty line (<1806 / month) - 13% in rural and 6% in urban.12 % were in upper class ; 6 % in rural and 17 % in urban population





Vital Parameters

Vital Parameters in Screened Population

Variable	All India	Central	East	Jammu	North	North East	South	West	Comment
Waist Circumference M (SD)	87.4 (11.2)	86.3 (12.4)	83.8 (9.5)	**90.5** (9.9)	88.4 (12.5)	86.4 (10.5)	88.6 (10.2)	88.6 (11.7)	Highest in JZ
Height M (SD)	157.7 (9.7)	158.2 (9.8)	155.4 (9.4)	**159.5** (9.3)	157.6 (9.3)	155.8 (9.3)	158.0 (9.7)	158.7 (10.0)	Tallest -JZ
Hip Circumference M (SD)	92.2 (11.7)	89.0 (11.2)	87.3 (9.7)	92.4 (10.9)	93.6 (11.8)	91.5 (9.4)	93.4 (12.3)	**96.3** (12.1)	Highest WZ
Weight M (SD)	61.1 (12.1)	60.3 (12.1)	57.9 (10.7)	**63.2** (11.2)	61.8 (13.5)	59.4 (11.3)	61.8 (12.5)	62.8 (12.4)	Highest JZ
BMI M (SD)	24.6 (4.7)	24.2 (4.6)	24.0 (4.5)	24.9 (4.4)	**25.0** (5.1)	24.5 (4.6)	24.7 (4.7)	**25.0** (5.0)	Highest WZ &NZ
BP Systolic M (SD)	126.3 (16.5)	120.8 (11.3)	122.9 (15.8)	**128.5** (13.8)	125.4 (18.4)	127 .3 (18.6)	125.8 (18.9)	126.7 (18.0)	Highest JZ
BP Diastolic M (SD)	82.9 (10.9)	81.1 (6.9)	79.6 (9.7)	**84.5** (11.0)	81.8 (11.1)	84.0 (11.6)	82.7 (10.9)	84.1 (10.8)	Highest JZ

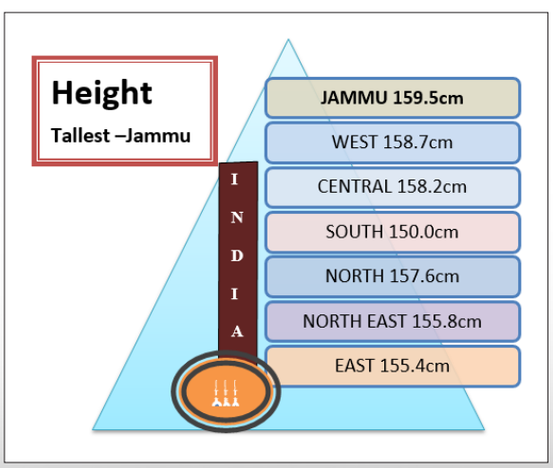
Height: mean height of the population was 158 cms. Marginally higher in urban (158 cms) than rural (157 cms)population.

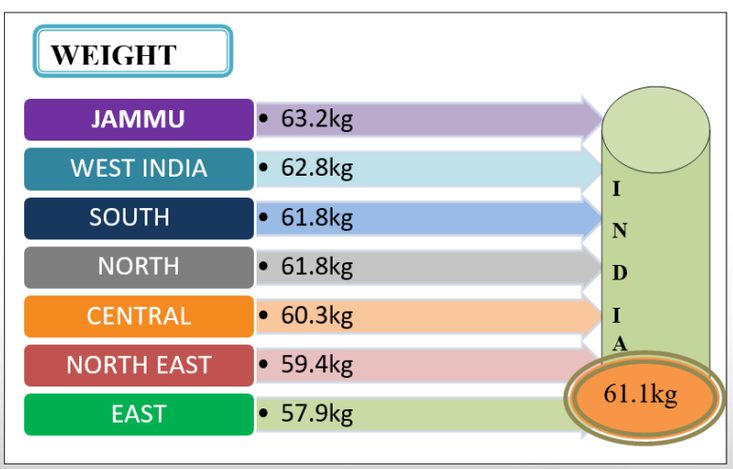
Weight: Mean weight was 61 Kgs in whole group; marginally lower in rural 61.5Kg than urban (62.6Kg) population.

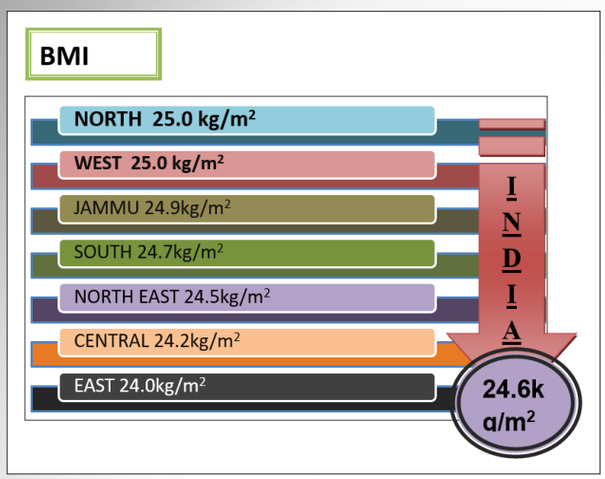
BMI: Mean BMI was 24.6 - lower in rural (24.1) than urban (25.1)population.

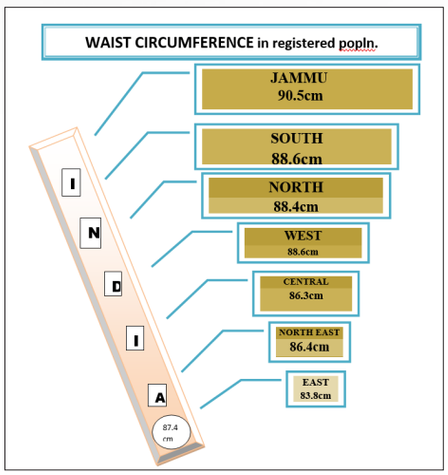
Waist circumference: 87.4cms in whole group; lower in rural (86.3cms) than urban (88.5 cms) population.

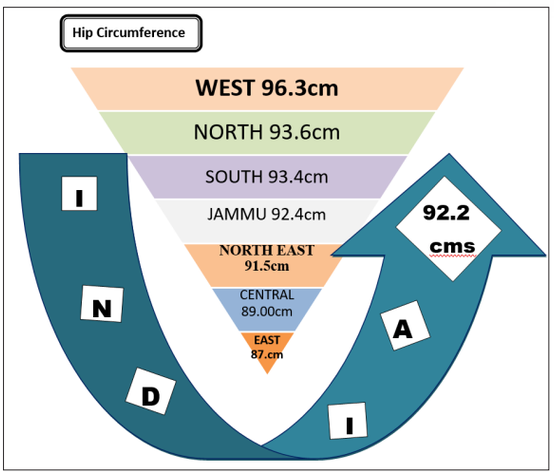
Hip circumference: 92cms in whole group; Lower in rural (91.3cms) than urban (93cms)population.









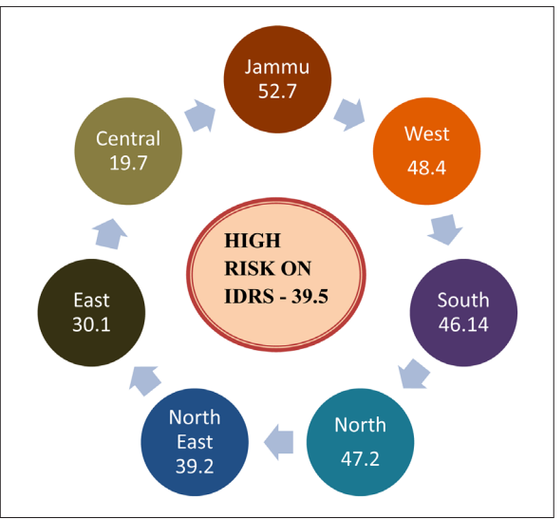


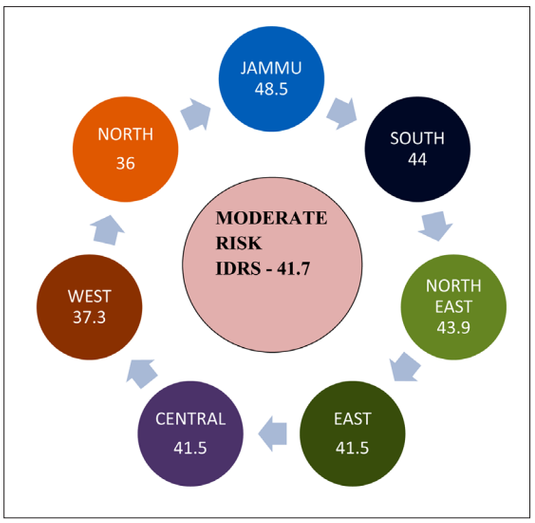
Systolic BP : 126.3 mm of Hg in whole group;lower in rural(126mm of Hg) than urban (127 mm of Hg) population .

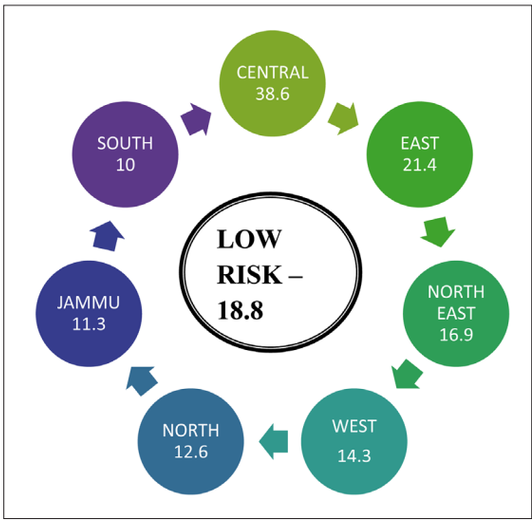
Mean diastolic BP : 83 mm of Hg in whole group; lower in rural(82mm of Hg) than urban (84 mm of Hg) population .

IDRS

IDRS Score:







- 81.5 % of the screened population was in high + moderate risk on IDRS.
- 39.5% were in high risk; 37% in rural and 42.5% in urban population.
- 42 % were in moderate risk - 43% in rural and 40.7% in urban population.
- IDRS scores were higher in urban than rural population.

IDRS Scores in Screened Population								
	Overall	Central	East	Jammu	North	North East	South	West
High risk on IDRS >60	39.5	19.7	30.1	**52.7**	47.4	39.2	**46.14**	**48.4**
Moderate risk IDRS 30-50	41.7	41.7	48.5	36	40	43.9	44	37.3
Low risk	18.8	**38 .6**	21.4	11.3	12.6	16.9	10	14.3

Rural Urban Distribution of IDRS in Screened Population									
Zone	Screening IDRS			Rural			Urban		
	High >60	Moderate 30-50	TotalH+M	High >60	Moderate 30-50	TotalH+M	High>60	Moderate 30-50	Total H+M
South	46.14	44	90.14	47.6	41	86.6	44.3	45.8	90.1
North	47.4	40	87.4	42.8	43.5	86.3	37.2	33.7	70.9
North East	39.2	43.9	83.1	32.2	45.1	77.3	42.4	42.9	85.3
Jammu	52.7	36	88.7	47	40.8	87.8	56.8	32.4	89.2
Central	19.7	41.7	61.4	13.1	43.5	56.6	24.7	40.4	65.1
East	30.1	48.5	78.6	29.6	48.6	78.2	30.5	48.5	79
West	48.4	37.3	85.7	43.4	40.3	83.7	53.3	34.5	87.8

Known diabetics: Highest in south zone -15.7% , then WZ -12.4%. Least in Central Z - 6%.
High risk: highest in jammu-52.7% followed by west zone-48% and south zone -46%. Least in central zone.
Area: Rural higher risk than urban in south and north zones

IDRS Factors in Screened Population									
Age	All India	Central	East	Jammu	North	North East	South	West	
<35 Years	36.8	**40.4**	38.3	33.4	36.1	35.2	38.2	33.2	CZ -High % of low risk age = least DM
>= 50 Years	30.0	26.6	27.6	31.5	28.5	28.1	30.6	36.3	
35-49 Years	33.3	33.0	34.1	35.0	35.4	36.7	31.3	30.5	
Physical Activity	**All India**	**Central**	**East**	**Jammu**	**North**	**North East**	**South**	**West**	
Mild Exercise	36.8	14.6	48.8	57.3	41.9	38.1	38.6	34.5	CZ-high% of vig ex = low DM
Moderate Exercise	26.7	26.9	28.2	32.5	21.4	41.7	19.4	24.5	
No Exercise	22.1	10.7	14.6	8.6	32.2	13.1	**35.5**	32.1	SZ- high % of no exercise = highest DM
Vigorous Exercise	14.5	**47.8**	8.3	1.7	4.5	7.1	6.5	8.9	

IDRS Factors in Screened Population									
Age	All India	Central	East	Jammu	North	North East	South	West	
<35 Years	36.8	40.4	38.3	33.4	36.1	35.2	38.2	33.2	CZ -High % of low risk age = least DM
Family History	**All India**	**Central**	**East**	**Jammu**	**North**	**North East**	**South**	**West**	
Both Parent Diabetic	2.4	1.4	1.7	1.3	2.0	1.2	5.3	2.7	CZ -Least = least DM
One Parent Diabetic	13.6	9.1	12.7	10.5	11.5	12.6	20.7	15.3	SZ- highest risk = highest DM
Non-Diabetic Parents	84.0	89.5	85.7	88.2	86.5	86.2	74.0	82.0	
Waist Circumference	**All India**	**Central**	**East**	**Jammu**	**North**	**North East**	**South**	**West**	
High Risk	23.4	11.3	11.0	32.3	30.7	22.4	32.6	27.9	CZ- Least = least DM
Moderate Risk	33.4	29.5	33.1	42.4	30.5	34.1	33.5	34.8	SZ- Highest = highest DM
Normal	43.2	59.2	55.9	25.3	38.8	43.5	33.9	37.4	
IDRS Factors: all four factors are highest in south zone accounting for highest prevalence of known diabetes (17.6%). All four factors are the least in central zone accounting fro least prevalence (6%)									

IDRS Factor : family history: 13.6% had h/o one parent diabetic; lower in rural (11%) than urban (16%). 2.4% had both parents diabetic; lower in rural (2%) than urban (3%). Family history of diabetes in high risk population recruited for the study was 11.5 % fathers and 10% mothers; 6.7% brothers ; 5% sisters; 5.4% of other relatives. Higher in urban than rural population.

IDRS Factor: waist circumference: 23.4% had high risk range of IDRS; lower in rural (19%) than urban (27%).

IDRS Factor: physical activity: 22% had high risk with nil exercise; higher in rural (23%) than urban (21.5%).

- **Prevalence of known diabetes in screened population**

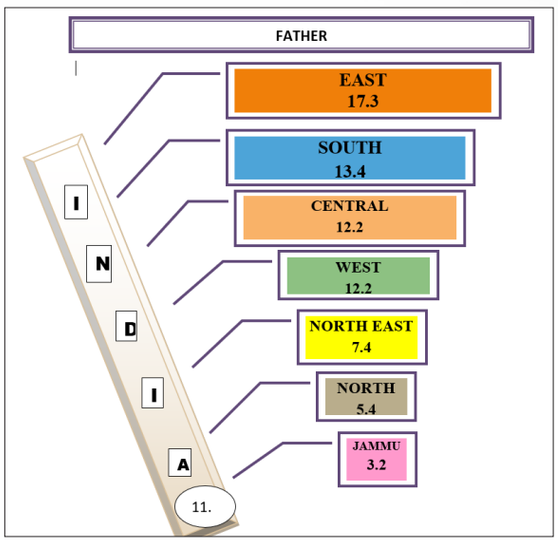
  10.3 % of the population had known diabetes. Lower in rural (8.4%) than urban (12%)

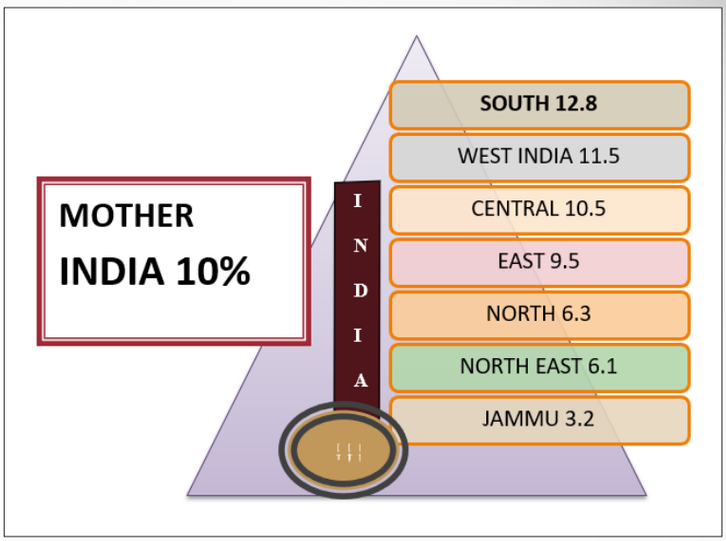
  Of these known diabetics, 52 % had it for 1-5 years; higher in rural (56%) than urban (49%). Most of these (51-52%) were taking treatment.

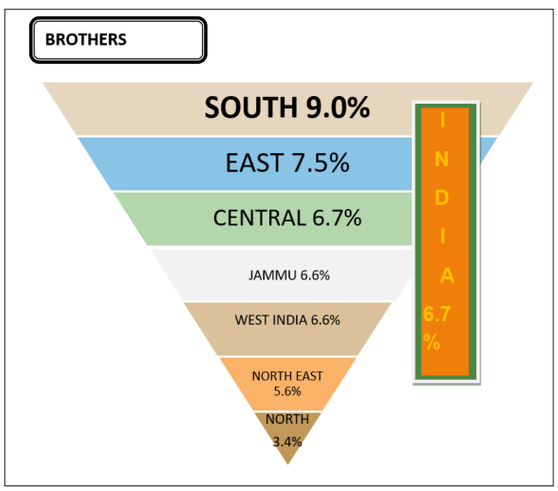
- **Prevalence of newly diagnosed diabetics in screened population** was 6 % (rural 2.1% + urban 3.9%)

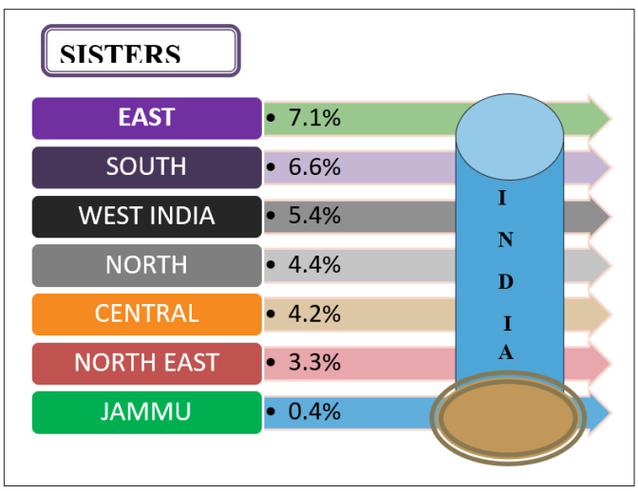
- **Prevalence of pre-diabetics in screened population** was 8.3 % (rural 3.3% + urban 5 %)

- **Prevalence of known diabetics in the Registered Population (N=50,199)**









The prevalence of self reported known diabetics in registered population was 19.8%. Marginally lower in rural (19.5%) than urban (20%) population.

60% reported that they had excellent to good control of their blood glucose levels, much lower in rural (56%) than urban (65%). Poor control was higher in rural (29%) than urban (26%).

Family history of diabetes in registered population

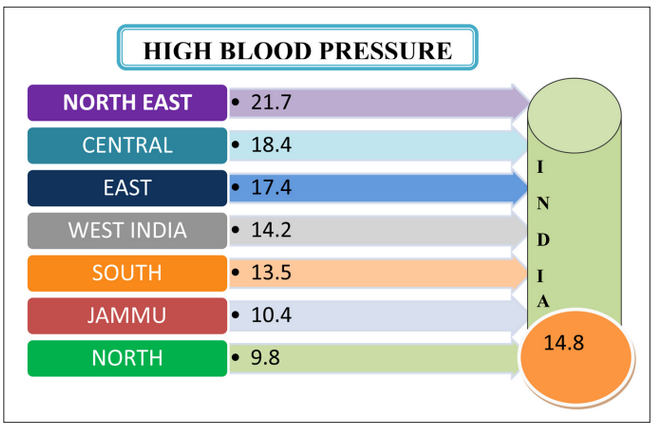
Relative	All India	Central	East	Jammu	North	North East	South	West	Comment
Father	11.5	12.2	**17.3**	**3.2**	5.4	7.4	13.4	12.2	Highest EZ least JZ
Mother	10.0	10.5	9.5	**3.2**	6.3	6.1	**12.8**	11.5	Highest SZ least JZ
Brother	6.7	6.7	7.5	**0.6**	3.4	5.6	**9.0**	6.6	Highest SZ least JZ

Sister	5.1	4.2	**7.1**	**0.4**	4.4	3.3	6.6	5.4	Highest EZ least JZ
Others	5.4	4.2	**12.1**	**0.3**	2.7	3.4	6.0	4.4	Highest EZ least JZ
Strong family history in south and east zone probably bcz of strong consanguinity Least family factor in Jammu									

Associated conditions and complications

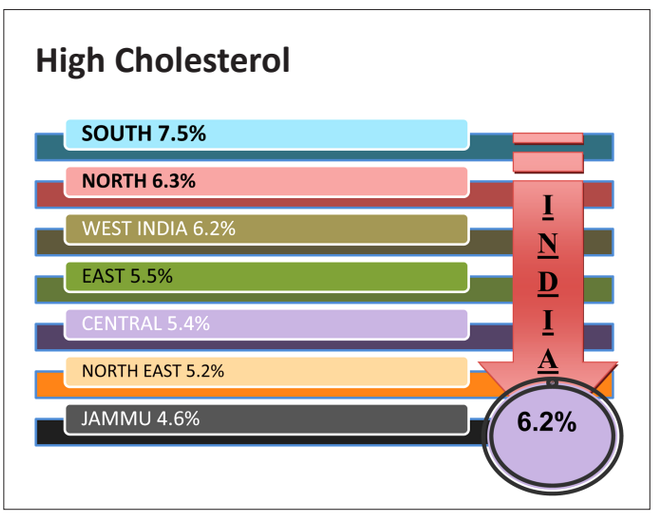
Hypertension

- 15 % of the subjects in registered population had known hypertension; Prevalence higher in urban (15.5%) than rural (14%).
- 12% out of 15 % were taking medication for hypertension. Similar percentages in urban and rural population



Hyperlipidemia

- 6% had hyperlipidemia (high cholesterol) and were taking medication. Lower in rural (5.4%) than urban (6.8%).
- **Other associated conditions:** 8.4% had history of other associated diseases; lower in rural (7.3%)than urban (9.3%).



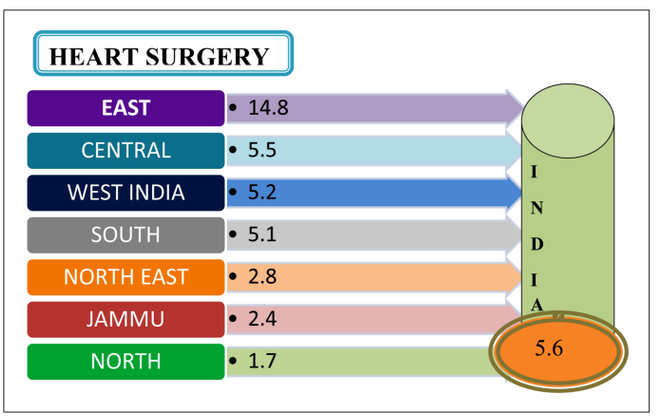
Complications of diabetes

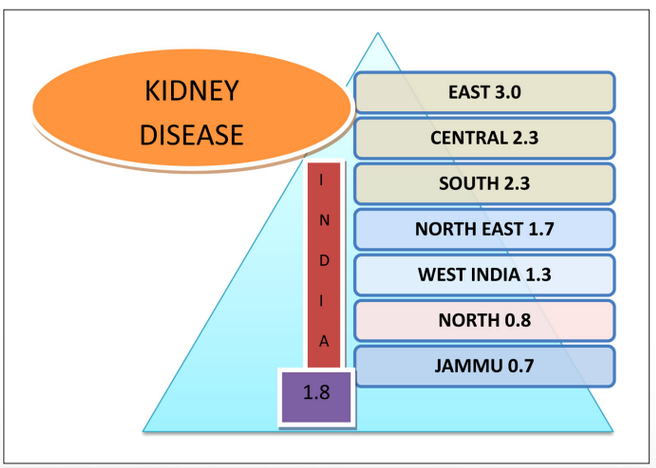
Summary of Complications of Diabetes in registered population in 7 Zones

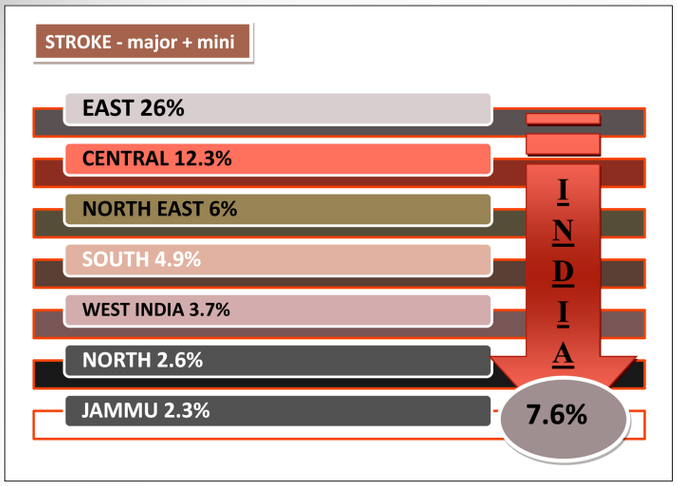
No	Variable	Jammu & Kashmir	North East	North	East	West	South	Central	All India
1	% of diabetics	13.4	19.1	23.2	22.2	19.0	21.9	16	19.8
2	% with hypertension	10.4	21.7	9.8	17.6	14.2	13.5	18.4	15
3	% with high cholesterol	4.6	5.2	6.3	5.5	6.2	7.5	5.4	6

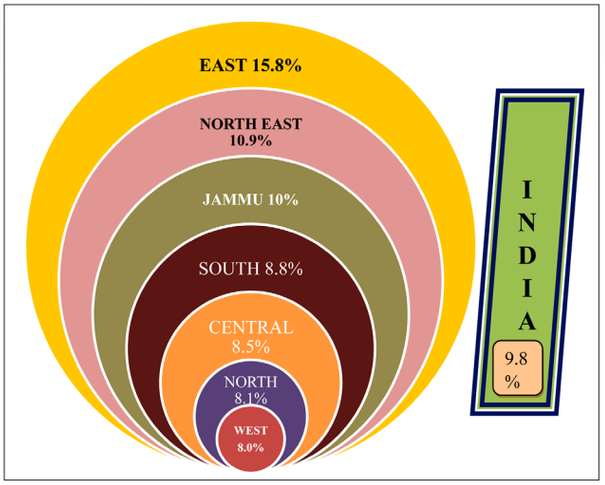
4	% with Open heart surgery	1.3	1.5	1	5.4	3.1	3	3.4	3
5	% with Stroke	1.4	1.8	2.2	4.1	2.4	2.9	7	3.4
6	% with Eye Injury	18.1	18.8	13.3	17.3	13.2	13.7	15.5	15
7	% with Diabetes eye damage	10.0	3.7	8.1	15.8	8.0	8.8	8.5	15
8	% with Peripheral Neuropathy	10.3	17.7	12	18.8	15.8	12	30	15.5
9	% with Peripheral Vascular problems	10.0	17.0	10.3	24.6	15.3	14	27	16
Hypertension was highest in north east. Hyperlipidemia was highest in south. Cardiac disease, strokes, neuropathy, vascular disease and smoking were highest in east.									

- Heart disease: 3% had open heart surgery .Similar percentages in rural and urban .
- Kidney disease: 1.8 % had renal complications of diabetes; Similar percentages in rural and urban.
- Brain: 4 % had history of major stroke. Much higher in rural (5.2%) than urban (3.4%).
- 3.4% had history of mini strokes; higher in rural than urban.
- Eyes: 10% had history of eye problems specific to diabetes with 6.4 % with h/o laser treatment for eyes; lower in rural (14.5%)than urban (15.7%).
- 15% had history of related eye problems such as Glaucoma, Cataracts, Macular Degeneration, Retinal Disease, Blindness or Dry Eyes; lower in rural (14.5%) than urban (15.7%).



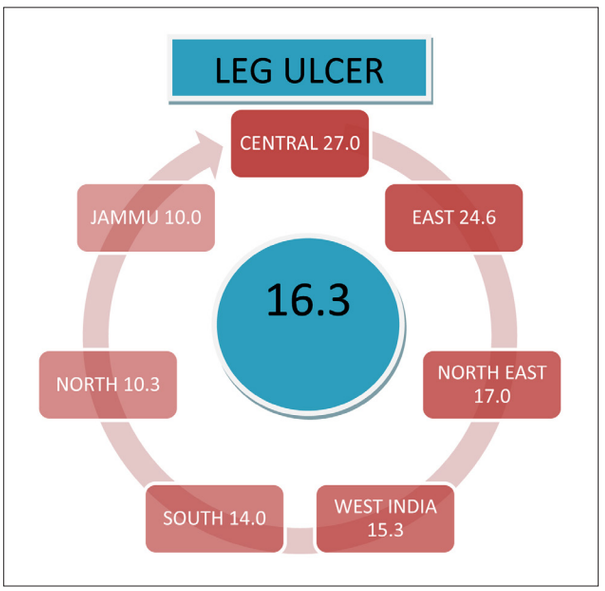






Peripheral vascular complications

- 16 % had history of leg ulcers; higher in rural (17%) than urban (16%).
- 15% had leg pain on walking due to vascular insufficiency. Higher in rural (15.5%) than urban(14.8%).



Life style

1	Work Stress	3.41	4.56	5.05	3.01	3.68	3.45	5.37	5.46
2	Daily Smoking	4.5	1.48	2.26	12.4	12.1	1.51	2.26	2
3	Alcohol use	3.5%	15.8%	12.6 %	10.0%	8.8%	7 %	8.3 %	10%
4	Staple Food	60.9% wheat 26% rice	90.4% rice 4.9% Wheat.	58.4% wheat 26.8% rice	18.0% wheat 52.7% rice	66.4% wheat 17.6% rice	14.9% wheat, 61.8% rice	66% wheat 25.7% rice	37% Wheat 46% rice
5	Mild exercise <30mins/ day	30.6%	24.5%	33.9%	18.9%	27.3%	19.4%	31.7%	11.3%
6	poor Quality of sleep %	8.8	6.2	8.5	8.2	3.5	5.5	22.2	20

Stress : On numerical rating scale ranging from 0-10:

- The mean work stress was 5.4 marginally lower in rural than urban.
- Mean family related stress was 5.6; marginally lower in rural than urban.
- Mean health related stress was 5.4; marginally higher in rural than urban.
- Mean social stress was 4.8; marginally higher in rural than urban.
- Mean of other stresses was 4.5; higher in rural than urban population.

Tobacco use

- 8 % said that they did tobacco smoking ; higher in rural than urban population.
- Average number of tobacco smoking was 2 / week; higher in rural than urban population. 31% were smoking > 10yrs. marginally lower in rural than urban population.
- 9.6 % used smokeless tobacco .8.6 % used daily. All of them said they were not using smokeless tobacco currently. Average duration of use of smokeless tobacco was 3 years. Marginally lower in rural than urban popln. But the numbers who were using within 6 months was higher in rural than urban population.

Alcohol

Only 10 % said that they have used alcohol some time in their life time ever .Of these 34% have been using it for > 10yrs. 47% of them use alcohol daily. 50 % consume English hard liquor.

Diet

- Staple food of 46 % of Indian population. is rice. Lower in rural than urban. Staple food of 37 % of Indian population. is wheat. More in rural than urban. This is followed by ragi (13%), jowar (1.5%), bajra (0,9%)and maize (0.4%) .
- 20% of high risk group said that they never consumed any fiber .28% consume usually and 52 % sometimes. Of these 36% consume vegetables. 53% said they consume fruits some times; 26% daily; similar distribution in rural and urban popln. 41% said they consume fruit drinks some times 44% rarely. 14% never consume fruit drinks.
- 50% said they consume meat some times; 16% often; similar distribution in rural and urban popln.33% never/rarely consume meat .
- 52% said they consume fried food some times; 16% often; similar distribution in rural and urban popln. 33% never/rarely consume fried food.
- Cooking oil: 46% of the screened population was mustard oil users. More in rural (54%) than urban (40%).20% used sunflower oil; lesser % in rural (16%) than urban (24%).

Physical activity

- 74% did < 30minutes of daily physical activity. 77% rural and 72% in urban

- 12% did moderate intensity exercises.
- 7% did vigorous physical exercises; similar in rural and urban. Of these 58% did moderate intensity exercises < once a month; 16% did > 5 days a week;14% rural and 17 % in urban
- In daily life 42% had sedentary habits (very little activity). 20% had occupation that involved vigorous physical activity.- 20% in rural and 19% n urban.

Sleep

79% said that their quality of sleep was good .20% had poor quality of sleep. Poorer in rural (23%) than urban (19.6%). 74% took< 30 minutes to fall asleep each night.4% took > 1.5 hrs to fall asleep.

Yoga awareness in screened general population

Yoga Awareness in Screened Population

Yoga	All India	Central	East	Jammu	North	North East	South	West	Comment
Yoga Practitioners yes%	11.7	9.4	5.3	28.6	7.1	7.4	**14.8**	10.5	Highest in SZ
Can Yoga Prevent DM? Yes%	91.1	62.5	83.8	98.7	92.7	89.4	98.1	94.5	Majority said yes Least in CZ
Can Yoga change Life Style? Yes %	92.2	64.5	87.3	99.0	93.5	91.6	98.6	95.2	
5-15% of population was already doing yoga in registered population. There seems to be good awareness about role of yoga in prevention of DM and changing life style									

- 11.7 % of the population was already practicing yoga. Lower in rural (7.7%) than urban(15. 3%).
- 91 % said that they do believe that yoga can prevent diabetes. 90% in rural and 93% in urban .
- 92 % said that they do believe that yoga can help in changing their life style. 90% in rural and 94% in urban.

Results after Intervention in Yoga and Control Groups

Pre post results in new diabetics

- Mean blood glucose reduced significantly better in yoga than control group in new diabetics
- Fasting blood glucose reduced significantly in yoga and control group in new diabetics
- Post prandial blood glucose reduced significantly better in yoga than control group in new diabetics
- HbA1C reduced significantly better in yoga than control group in new diabetics
- Total cholesterol reduced significantly in both yoga and control group in new diabetics
- Triglycerides reduced significantly only in yoga and non sig. in control group in new diabetics
- HDL reduced significantly in both yoga and control groups in new diabetics
- LDL reduced significantly only in yoga and non sig. in control group in new diabetics
- Cholesterol : HDL ratio reduced significantly only in yoga and non sig. in control group in new diabetics
- LDL: HDL RATIO reduced significantly only in yoga and non sig. in control group in new diabetics.
- VLDL reduced significantly only in yoga and non sig. in control group in new diabetics.

Pre post results in known diabetics

- PPBS: There was non-significant reduction in both yoga and control groups after 3 months.
- FBS: There was significant reduction in yoga group ; non significant reduction in control group; significant difference between groups after 3 months.
- HbA1c: There was non-significant reduction in both groups.
- Mean blood glucose : There was non-significant reduction in both groups.
- Cholesterol: There was significant reduction in yoga group; non significant reduction in control ; non sig difference between groups.
- HDL cholesterol : There was non-significant reduction in both groups.
- LDL cholesterol : There was significant reduction in both groups; non significant difference between groups.
- VLDL cholesterol :There was non-significant reduction in both groups. non significant

difference between groups.

- Cholesterol :HDL ratio: There was non-significant reduction in both groups.
- LDL:HDL ratio: There was significant reduction in both groups. With non significant difference between groups.

Pre post results in prediabetics

- Post prandial blood glucose reduced significantly in both yoga and control group with non significant difference between groups.
- Fasting blood glucose reduced significantly in both yoga and control group with non significant difference between groups.
- HbA1C reduced significantly only in yoga group with significant difference between groups.
- Mean blood glucose reduced significantly only in yoga group with significant difference between groups,
- Cholesterol reduced significantly in groups with significant difference between groups.
- Triglycerides increased non- significantly in both groups with non-significant difference between groups.
- HDL- Cholesterol reduced significantly in both groups with significant difference between groups.
- LDL Cholesterol reduced significantly in both groups with non-significant difference between groups.
- Cholesterol : LDL ratio increased significantly in control group with significant difference between groups.
- LDL : HDL ratio reduced significantly in both groups with non-significant difference between groups.
- VLDL reduced non-significantly in both groups .

Pre post results in non diabetic normal cohort

- Mean PPBS value which was below normal range increased in both groups significantly with non-significant difference between groups.
- Mean FBS value increased in both groups significantly within the normal range with non-significant difference between groups.
- Mean blood glucose increased in both groups significantly within the normal range with significant difference between groups.

- Mean HbA1c increased in both groups significantly within the normal range with significant difference between groups.
- Mean total cholesterol reduced non-significantly in both groups.
- Mean triglyceride value increased in yoga group(within the normal range) non-significant in control and between groups.
- Mean LDL value decreased in yoga group (within the normal range) ; non-significant in control and between groups.
- Mean HDL value decreased in yoga and control groups (within the normal range) with non-significant difference between groups.
- VLDL value increased in yoga group(within the normal range) with non-significant in control and between groups.
- LDL: HDL RATIO decreased in yoga significantly with non signifcan reduction in control group.
- Cholesterol: HDL RATIO increased in both groups significantly with non significant difference between groups.

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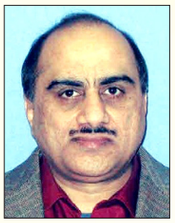

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Speech of Hon'ble Prime Minister of India at 69th United Nations General Assembly on September 27, 2014

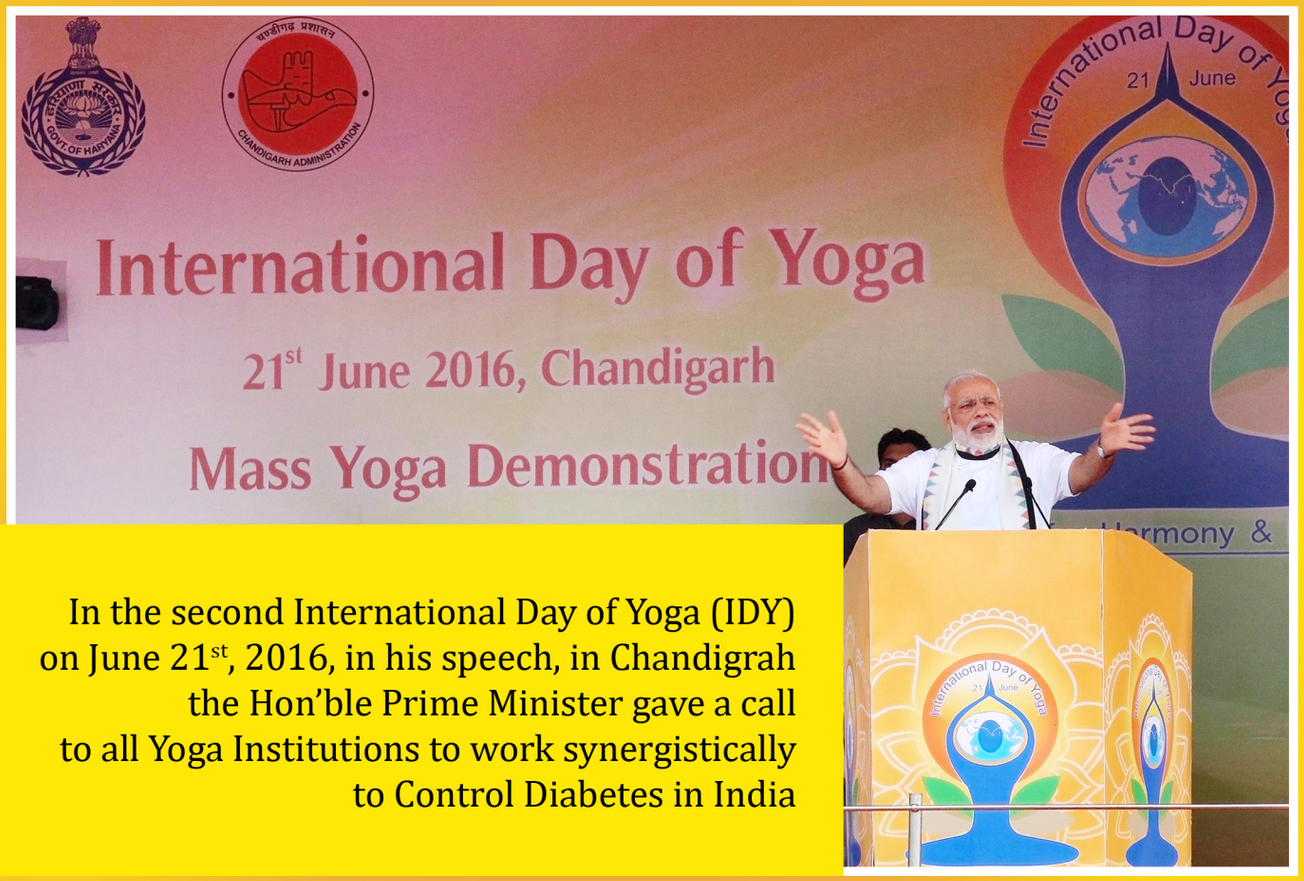
Message from

Hon'ble Prime Minister Shri Narendra Modi Ji

"Yoga is an invaluable gift of our ancient tradition. It embodies unity of mind and body; thought and action; restraint and fulfillment; harmony between man and nature; a holistic approach to health and well being. Yoga is not about exercise but to discover the sense of oneness with ourselves, the world and the nature.

By changing our lifestyle and creating consciousness, it can help us deal with climate change.

Let us work towards adopting an International Yoga Day."



In the second International Day of Yoga (IDY) on June 21st, 2016, in his speech, in Chandigrah the Hon'ble Prime Minister gave a call to all Yoga Institutions to work synergistically to Control Diabetes in India