Original Article

Vol. 9, No. 2, 111-118
https://doi.org/10.15280/jlm.2019.9.2.111

Journal of Lifestyle Medicine

Is Master Health Checkup the Answer to Tackle the Rising Non-Communicable Disease Burden in India? - A Cross-Sectional Study

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Background: Master Health Checkup (MHC) is a battery of tests done to detect and identify Non Communicable Diseases (NCDs) early. But it should also be noted that some tests in MHC have no known benefits for otherwise healthy adults. This study was conducted to evaluate the usefulness of MHC in a hospital based setting.

Methods: A cross-sectional study was conducted among 337 subjects aged 18 years and above who attended the MHC Clinic during the study period. They were subjected to interview and various biochemical investigations to estimate the number of newly diagnosed, clinically relevant abnormalities among apparently normal adults using standard guidelines. Categorical data summarized as frequencies with percentages. Chi-square test was used to compare proportions.

Results: Among the 337 participants, 244 were apparently normal with a gender distribution as 109 (44.7%) males and 135 (55.3%) females. The study was able to newly detect 12.3% with Type 2 diabetes, 37.7% in pre-diabetic stage, 54.1% with anaemia, 42.2% with dyslipidemia, 11.5% with hypothyroidism, 27% with liver disorders and 6.5% with renal disorders, about which the participants were unaware of. Females also had statistically significant association with dyslipidaemia and hypothyroidism compared to males with a p-value of 0.004, 0.026 respectively. Apparently normal participants aged > 35 years had strong statistical association with diabetic status and dyslipidemia compared to those aged between 18 - 35 years (p-value 0.001).

Conclusion: Based on the results from the study it is evident that a significant number of NCDs were newly identified by Master Health checkup (MHC).

Key Words: Non-communicable disease, Health facility, Health check up

INTRODUCTION

In the past, emphasis on morbidity due to infectious disease has been the mainstay of healthcare systems in most developing countries, including India [1]. With changing patterns of lifestyle, westernization and deviation from our cultural practices, Indians are becoming more vulnerable to non-communicable diseases like diabetes, hypertension, dyslipidemia, coronary artery disease and malignancies [2]. Well known risk factors such as tobacco, harmful alcohol use, un-

Received: December 28, 2018, Accepted: May 8, 2019

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healthy diet and physical inactivity are on the rise [3]. Out of the estimated 56 million deaths worldwide in 2012, 38 million could be attributed to chronic non-communicable diseases, principally cardiovascular disease, cancer and chronic respiratory disease. Cardiovascular diseases, especially coronary heart disease (CHD), have assumed epidemic proportions worldwide leading to 17.5 million deaths in 2012. More than 75% of these deaths occurred in developing countries [4].

In contrast to developed countries, where mortality from CHD is rapidly declining, it is increasing in developing countries [5]. Adults living with diabetes have almost quadrupled since 1980 to 422 million people worldwide [6,7]. The number of people with diabetes in India, currently around 40.9 million, is expected to rise to 69.9 million by 2025 with continuing trends [8]. Obesity and metabolic syndrome is seen to plague much of the population [9]. Dyslipidemia is a major risk factor for macro-vascular complications in patients with type-2 diabetes mellitus (T2DM) and affects 10-73% of this population [10]. Also Asian Indians have higher risk of CHD than whites [11]. They are found to develop CVD at a younger age than other populations [12]. Other notable diseases which need to be concentrated on include anaemia, non-alcoholic fatty liver disease, thyroid dysfunction and renal disorders. This alarming rise of iceberg diseases highlight the need for an universal umbrella test which covers the rising chronic diseases without overtly missing out on communicable diseases [13].

A solution may be found in the relatively recent multi-phasic test, known as "The Master Health Checkup" (MHC). A MHC or periodic health check is useful as it can help to detect and identify diseases or the warning signs of an impending disease very early. This makes treatment a lot more effective, less expensive and less invasive. In addition to detecting such diseases before a patient turns seriously ill, such periodic checkups also gives a detailed update on various health parameters like cholesterol levels, blood sugar levels, blood pressure and body weight. This helps to gauge the overall health and it enables health care providers to assess health risks and advise patients on lifestyle on dietary measures to counter such risks. All general health checks share a common goal: to reduce morbidity and mortality by detecting disease or modifiable risk factors at an earlier stage—implicitly assuming that this will improve clinical outcomes compared with waiting until symptoms develop [14]. But it should also be noted that there are some tests in MHC that there are no known benefits for otherwise healthy adults. Also, unnecessary tests like imaging with CT scans or MRIs might unnecessarily expose patients to radiation.

General health checks are regularly performed in the USA and UK, with the National Health Service Health Check programme being introduced in the UK in 2009 [15]. Health Check programmes has also been initiated in the Netherlands and Australia [16]. Existing knowledge has conflicting outcomes. Some studies [17-21] are on the positive end of the spectrum, noting that screening for multiple diseases at once was beneficial both in the long and short run, substantially reducing mortality and worry from patients. But few studies [22-24] found that there was no substantial gain from such screening. An Indian study [25] found that the prevalence of diabetes is high in urban India and there is a large pool of subjects with impaired glucose tolerance at a high risk of conversion to diabetes. Studies from India are very limited and very few had covered the whole spectrum of the checkup. Thus, this study was conducted with an objective to estimate the number of newly diagnosed, clinically relevant abnormalities among apparently normal adults attending Master Health Checkup Clinic in a tertiary care hospital and to study the factors associated with each clinical abnormality and their inter-relationships with each other. As very few studies had concentrated on the outcomes and validity of MHC's in India, this study may play a role in highlighting these outcomes.

MATERIALS AND METHODS

A cross-sectional descriptive study was conducted among all male and female adults (18 years and above) who attended the Master Health Checkup Clinic in SRM General Hospital & Research Centre, Chennai, India and were willing to take part in the study during the study period (February to July 2018) were included. People aged below 18 years, pregnant women and those who were too sick to participate were excluded from the study. Approval for the research protocol was obtained from the Institutional Ethics

Committee (1236/IEC/2017).

A written informed consent was obtained from the willing participants, after substantiating a rapport with them. The nature and purpose of the study clearly explained to them in the language they can best comprehend. Doctor-patient confidentiality was furnished to the participant and strictly adhered to. A basic, pre-tested structured questionnaire was used to record basic demographic data including age, gender, address, highest educational qualification, occupation and socio-economic status (using modified B.G. Prasad scale, 2017), complaints which the participant presented with and whether or not the participant has any pre-existing disease, along with the number of years he/she has had it for.

The study participants were subjected to following biochemical investigations - Haemoglobin, Total WBC count, Total RBC count, Platelets, ESR, Peripheral Smear, Urine routine (including urine glucose and ketone bodies), Serum electrolytes, Fasting Blood Sugar, Postprandial Blood Sugar, HbA1C, Cholesterol, Triglycerides, HDL, VLDL, Bilirubin (total, indirect and direct), Alkaline Phosphatase, AST, ALT, GGT, Albumin, Globulin, Serum Urea, Creatinine, Uric Acid, Thyroid function tests, Prostate Specific Antigen or PAP smear, X-ray, ECG and Abdominal ultrasound. Participants were instructed to fast for 10 hours prior to testing. They were provided with a standard urine sample container and will be taught to collect a clean morning sample. The first blood sample was collected on an empty stomach for all biochemical tests other than PPBS. The second sample was collected 2 hours after a standard Oral Glucose Tolerance Test (75 gram glucose) to measure PPBS.

Anemia was defined as hemoglobin $<$ 12 g/dL in women & $<$ 13 g/dL in men, in accordance with World Health Organization (WHO) criteria [26]. Pre diabetes was defined as Fasting Blood sugar (FBS) levels $\geq$ 110 mg/dL to 126 mg/dL fasting blood glucose & $\geq$ 140 mg/dL to 200 mg/dL postprandial blood glucose levels (PPBS). Participants were considered Diabetic if FBS $\geq$ 126 mg/dL fasting blood glucose & PPBS $\geq$ 200 mg/dL [27]. Total cholesterol/High Density Lipoprotein (TC/HDL) ratio of $>$ 3.5 was considered as Dyslipidemia [28]. We referenced thyroid values with the American Thyroid Association's Professional guidelines [29], Liver impairment guidelines [30] and renal impairment according to National Kidney Foundation guidelines [31].

The data was entered and analyzed in Statistical Package for Social Sciences (SPSS) version 15.0. Categorical data was summarized as frequencies with percentages. Chi-square test was used to compare proportions. A p-value of $<$ 0.05 was considered statistically significant.

RESULTS

1. Sociodemographics

Among the 337 participants, 156 (46.3%) were male and 181 (53.7%) were female. 90 (26.7%) were in the 18-35 age group while the majority (203 or 60.2%) were in the 36-59 age group and 44 (13.1%) were in 60 and above age group. 8 (2.4%) of the population was illiterate, 48 (14.2%) had studied upto high school and 102 (30.3%) upto high school. 127 (37.7%) were graduates while 52 (15.2%) had done post-graduation or higher studies. 56 (16.6%) had professional or white collar jobs, 86 (25.5%) were skilled workers, 39 (11.6%) were semi-skilled workers, 15 (4.5%) were unskilled workers, 94 (27.9%) were homemakers, 10 (3%) were students and 37 (11%) were unemployed. 94 (27.9%) of the participants attended on their own accord to check if they were healthy. 176 (52.2%) had been referred by doctors. 44 (13.1%) had taken their tests as a part of their job requirement. 23 (6.8%) picked the package as they found it to be affordable when compared to individual testing. 40 (11.9%) were sponsored by the company in which they were working in and the remaining 297 participants (88.1%) took care of their own expenditure.

2. Previous history of any disease

Among all the study participants 93 (27.6%) of them had previous history of some disease. Out of these subjects, 44 (47.3%) were diabetic, 12 (12.9%) were dyslipidemic, 27 (29%) were hypertensive, 4 (4.3%) had bronchial asthma, 2 (2.2%) were epileptic, 2 (2.2%) had renal disorders, 14 (15.1%) had thyroid disturbances, 4 (4.3%) had osteoarthritis, 1 (1.1%) had liver disease, 4 (4.3%) had previous history of cancer, 2 (2.2%) had known heart disease and 2 (2.2%) had had tuberculosis. Some of the participants had also reported as having two or more diseases (Fig. 1).

3. Morbidities among apparently normal participants

In the present study 244 study participants were apparently normal with a gender distribution as 109 (44.7%) males and 135 (55.3%) females. Several clinically relevant abnormalities were detected among these apparently normal subjects. Haemoglobin levels were in the anaemic range for 132 (54.1%) among which 107 had mild anaemia and 25 had moderate anaemia. 31 (12.7%) were found to be hypocalcemic, 22 (9%) had microalbiminuria and 16 (6.5%) had glycosuria. 30 (12.3%) of the study group was newly diagnosed with diabetes mellitus while 92 (37.7%) had Impaired Glucose Tolerance (IGT). 103 (42.2%) were found to be dyslipidaemic and 28 (11.5%) of them were in the hypothyroid range. On ultrasound examination, it was found that 52 (21.3%) appeared to have fatty liver, hepatomegally, cysts and/or hemangioma, 14 (5.7%) had cholelithiasis, 16 (6.5%) had renal disorders like renal calculi, contracted kidney and bladder disease. Among the 135 females, 37 (27.4%) had uterine fibroids, adenomyosis, atrophic or bulky uteri, and/ or endometrial polyposis. 20 (14.8%) appeared to have polycystic ovaries and 6 (4.4%) had cervical or pelvic inflammatory disease (Table 1).

4. Age and gender on morbidity profile

In order to study the factors associated with the morbidity profile among apparently normal participants haemoglobin, serum calcium, urine protein, urine glucose levels, diabetic status, lipid and thyroid profile were studied using Chi Square test against gender and age group. Among 132 participants who were anaemic 95 (72%) of them were females compared to 37 (28%) males. This difference was statistically significant using Chi Square test ($p < 0.0001$). Among 31 study participants who were hypocalcemic, majority (93.5%) of them were females which was statistically significant ($p < 0.0001$) compared to males (6.5%). Females also had statistically significant association with dyslipidae-

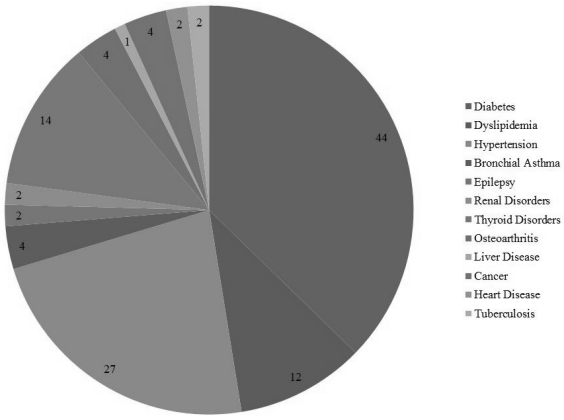

Fig. 1. Preexisting disease profile among the study participants (N = 93).

Table 1. Morbidity profile among apparently normal study participants (N = 244)

Variables	Number	Percentage
Haemoglobin levels (mg/dl)		
Normal	112	45.9
Anemia	132	54.1
Mild anemia	107	
Moderate anemia	25	
Serum Calcium levels (mg/dl)		
Normal	213	87.3
Hypocalcemia	31	12.7
Urine albumin levels		
Nil	222	91.0
Microalbuminuria (1+)	20	8.2
Microalbuminuria (2+)	2	0.8
Urine Glucose levels		
Nil	228	93.4
Trace	1	0.4
1+	9	3.7
2+	5	2.0
3+	1	0.4
Diabetes		
Normal	122	50.0
Impaired Glucose Tolerance	92	37.7
Diabetic	30	12.3
Lipid Profile		
Normal	141	57.8
Dyslipidemia	103	42.2
Thyroid Profile		
Normal	216	88.5
Hypothyroid	28	11.5
Hepato-biliary Disease		
Fatty Liver, Hepatomegaly, cyst, Hemangioma	52	21.3
Cholelithiasis	14	5.7
Renal Disease		
Renal calculi, contracted kidney, bladder disease	16	6.5
Gynecological Disorders (n=135)		
Fibroids, Adenomyosis, Atrophic/bulky Uterus, Endometrial polyp	37	27.4
Polycystic Ovaries	20	14.8
Cervix, Pelvic inflammatory disease	6	4.4

mia and hypothyroidism compared to males with a p-value of 0.004, 0.026 respectively (Table 2). To study the effect of age in developing morbidities, the participant age was grouped into categories. As only 15 subjects were aged 60 years & above, the age group was grouped into 2 categories as 18-35 years and > 35 years. Apparently normal participants aged > 35 years had a strong statistical association with diabetic status and dyslipidemia compared to those aged between 18-35 years (p = 0.001). Other morbidities were not statistically associated.

5. Diabetic status and morbidity profile

The present study also analyzed the effect of having diabetes with other co-morbidities. It was found that 63 (47.7%) of participants who were anemic, had pre diabetes, which was higher compared to other groups. This difference was statistically significant (p = 0.002). 40.9% of the participants with albuminuria and 81.2% of participants with glycosuria had blood sugar levels in diabetic range with a statistically significant difference between other groups (p < 0.0001). The majority of the participants with dyslipidemia (53.5%) had normal blood sugar levels (Table 3).

DISCUSSION

The present study was intended to find out any clinically relevant abnormalities among apparently healthy study participants. Hence, 244 participants who had no known clinical abnormality were included for analysis. It was found that 54.1% of the participants who were apparently normal had anaemia which was higher than 26.7% as found by other study [2]. 12.3% (30 subjects) were newly diagnosed with diabetes which is comparable to results of other studies [2,25,32] which reported 12.8%, 12.1%, 12% respectively. Also 37.7% were prediabetic in the present study which was also comparable to other study [2] which reported the same as 45.8%. The slight variations may be due to the fact that the other study had more participation from the older age groups. Two studies [25,33] correlate with this study in that there is no statistical significance in gender variation with respect to diabetes, but one study [34] found prevalence was slightly higher in women (11.2%) than men (10.6%). Also

Table 2. Association between gender and morbidity profile among apparently normal study subjects using Chi-square test (N = 244)

Morbidity status	Male, n (%)	Female, n (%)	Total	p-value
Haemoglobin levels (g/dL)				
Normal	72 (64.3)	40 (35.7)	112	< 0.0001*
Anemia	37 (28.0)	95 (72.0)	132	
Serum calcium levels (mg/dL)				
Normal	107 (50.2)	106 (49.8)	213	< 0.0001*
Hypocalcemia	2 (6.5)	29 (93.5)	31	
Urine albumin levels				
Nil	95 (42.8)	127 (57.2)	222	0.061
Albuminuria	14 (63.6)	8 (36.4)	22	
Urine Glucose levels				
Nil	101 (44.3)	127 (55.7)	228	0.657
Glycosuria	8 (50)	8 (50)	16	
Diabetes				
Normal	62 (50.8)	60 (49.2)	122	0.054
IGT/Pre diabetes	32 (34.8)	60 (65.2)	92	
Diabetic	15 (50.0)	15 (50.0)	30	
Lipid Profile				
Normal	74 (52.5)	67 (47.5)	141	0.004*
Dyslipidemia	35 (34.0)	68 (66.0)	103	
Thyroid profile				
Normal	102 (47.2)	114 (52.8)	216	0.026*
Hypothyroid	7 (25.0)	21 (75.0)	28	

*Significant as p < 0.05.

Table 3. Association between diabetic status and co morbidities among apparently healthy study subjects using Chi square test (N = 244)

Category	Normal, n (%)	Prediabetes, n (%)	Diabetes, n (%)	Total	p-value
Haemoglobin levels					
Normal	67 (59.8)	29 (25.9)	16 (14.3)	112	0.002*
Anemia	55 (41.7)	63 (47.7)	14 (10.6)	132	
Serum Calcium levels					
Normal	106 (49.8)	81 (38.0)	26 (12.2)	213	0.963
Hypocalcemia	16 (51.6)	11 (37.7)	04 (12.9)	31	
Urine albumin levels					
Nil	115 (51.8)	86 (38.7)	21 (9.5)	222	< 0.0001*
Albuminuria	7 (31.8)	06 (27.3)	9 (40.9)	22	
Urine Glucose levels					
Nil	122 (53.5)	89 (39.0)	17 (7.5)	228	< 0.0001*
Glycosuria	0 (0.0)	03 (18.8)	13 (81.2)	16	
Dyslipidemia					
Yes	76 (53.9)	59 (41.8)	6 (4.3)	141	< 0.0001*
No	46 (44.7)	33 (32.0)	24 (23.3)	103	
Thyroid Profile					
Normal	8 (28.6)	15 (53.6)	5 (17.9)	28	0.055
Hypothyroid	114 (52.8)	77 (35.6)	25 (11.6)	216	

*Significant as $p < 0.05$.

the present study found statistical association with diabetic status and increasing age which correlated to a similar study [25] showing a steady rise of both prediabetes and diabetes with increasing age. Presence of Urine glycosuria and albuminuria were statistically associated with the diabetic status of the participants. ($p < 0.0001$) in the study.

42.2% of apparently normal participants had dyslipidemia (Total cholesterol/HDL ratio > 3.50) which is high compared to 29.8% reported by a similar study [35] because in their study they included only non-diabetics. One study [2] reported 89.2% of them as having dyslipidemia. This variation could be because they used very broad definition for dyslipidemia than what was used in the present study. Female gender and increasing age had significant association with dyspipidemia. Similar results were reported by other studies [2,35]. 41.8% of the pre-diabetes subjects were dyslipidemic in the present study.

About 28 (11.5%) of subjects were hypothyroid in the present study, which is slightly higher than 8.7% reported in a similar study [2]. The present study had a higher representation of females compared to males (135 females, 109 males) and the sample size of the other study [2] was less (149 subjects) compared to this study (244 subjects). This could explain the variability. Also 27% had undetected hepato-biliary disorders (Fatty liver, Hepatomegaly, cyst, Hemangioma and Cholelithiasis) compared 40.9% as reported by other study [2] which could be due to higher representation of male subjects in their study. 6.5% had renal disorders (Renal calculi, contracted kidney, bladder disease) which is similar to other study (4.9%) [2].

The present study was able to newly detect many chronic diseases about which the participants were unaware of. Thus 12.3% of Type 2 diabetes, 37.7% in pre-diabetic stage, 54.1% of participants with anaemia, 42.2% with dyslipidemia, 11.5% with hypothyroidism, 27% with liver disorders and 6.5% with renal disorders were identified. These chronic illnesses can be given intervention at this stage itself so that disease related complications can be averted in the later stages of the diseases. In a systematic review of six randomized control trials done by Si et al [16], it was found that General practice-based health checks were associated with statistically significant, albeit clinically small, improvements in surrogate outcome control, especially among high-risk patients compared to usual care in middle aged populations. But in a Multiphasic Health Check Up evaluation among 5150 participants who were urged to annual checkups and similar number of controls who were not so urged were followed up for 16 years. It was found that the two groups

did not differ to a statistically significant degree in mortality from all other causes [18].

MHCs can be used as screening tool for early detection of NCDs and may help in adopting timely interventions in this era of increasing life style diseases.

CONCLUSION

India, like many other developing countries, is moving towards the "epidemic" of Non-Communicable Diseases (NCDs) as life expectancy increases with advances in healthcare and lifestyle changes. Thus the country needs a road map to solve this burden of NCDs among the population especially elderly. Based on the results from the study it is evident that a significant number of NCDs were newly identified by Master Health checkup (MHCs).

ACKNOWLEDGEMENTS

We are grateful to Indian Council of Medical Research (ICMR) for granting 10,000 Indian Rupees (INR) under Short Term Studentship (STS) Project to conduct the study [Reference Id: 2019-02483]. We sincerely thank the Department of Community Medicine, SRM Medical College & RC, SRM IST for constant support during various stages of the study. We also thank each one of the study participants who cooperated to be a part of this study.

Indian Council of Medical Research (ICMR) granted 10,000 Indian Rupees (INR) under Short Term Studentship (STS) Project to conduct the study; Reference Id: 2018-02483.

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