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Non-communicable diseases (NCDs) and their burden- A review

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Abstract

Non-communicable disease (NCDs) refers to those conditions which are chronic, evolve slowly, and progress relentlessly. WHO defines NCDs as diseases of long duration, and with generally slow in progression. The burden of non-communicable diseases continues to increase in the low- and middle income countries despite the widely available evidence for effective interventions. Chronic diseases- mainly cardiovascular disease, cancer, chronic respiratory diseases, and diabetes- were contribute to around 38 million (68%) of all the deaths globally and to about 5.87 million (60%) of all deaths in *India*; more than 80% of these deaths occurred in low-income and middle-income countries. NCDs have negative impact on individuals, and family economic production and wellbeing. Modification of *Asbab-e-Sitta Zarooriya* and lifestyle is pragmatic approach for the control of non-communicable disease.

Keywords: non-communicable diseases (NCDs), lifestyle disorder, NCD burden

Introduction

Non-communicable diseases (NCDs) encompass a vast group of diseases such as cardiovascular diseases, cancer, diabetes and chronic respiratory diseases. NCDs contribute to around 38 million (68%) of all the deaths globally and to about 5.87 million (60%) of all deaths in *India* [1]. The factors which aid progress and development in today's world such as globalization of trade, urbanization, ease of global travel, advanced technologies, etc., act as a double-edged sword as they lead to positive health outcomes on one hand and increase the vulnerability to poor health on the other hand as these contribute to sedentary lifestyles and unhealthy dietary patterns [2]. High prevalence of tobacco and alcohol use in the community along with increase in unhealthy dietary practices and decrease in physical activity contributing to increase in biological risk factors which in turn leads to increase in non-communicable diseases (NCD) [1-3].

Non-communicable diseases have replaced communicable diseases as the most common causes of morbidity and premature mortality worldwide. Overall, NCDs kill 38 million people every year; 28 million of which occur in low-and middle-income countries [4]. Epidemics of non-communicable diseases (NCDs) are either emerging or accelerating in most developing countries. *India* is also experiencing a growing burden of NCDs claiming over 5.87 million lives in a year [5]. The probability of dying between the ages of 30 and 70, from four major NCDs (cardiovascular diseases, cancer, chronic respiratory diseases and diabetes) for both sexes is as high as 26% [5]. In the year 2011, 53% of all deaths were due to NCDs, this proportion has gone up to 60% in 2014 [6], and projections indicate a further increase to 67% of total deaths by 2030 [6]. There are estimated 2.8 million cases of cancer, 39 million with chronic respiratory diseases, 64 million with cardiovascular diseases [7] and 69 million people with diabetes [8]. Economic impact of NCDs in *India* (2012-2030) can be judged from a study which estimates that the cumulative cost associated with CVDs, diabetes, chronic respiratory diseases and mental health was US\$ 6.15 trillion in 2010 (approx. Rs. 38,302,200 crore) [9]. Up to 80 percent of *Indians* incur huge out pocket expenses on medical care, resulting in debt and devastation; 39 million *Indians* are pushed into poverty annually, due to diagnostic and treatment costs [10]. As a result of this multi-dimensional effect at individual, household, health system, and macroeconomic level, NCDs

are being labeled as a global 'chronic emergency'.

W.H.O. have identified that most NCDs are a result of four particular lifestyle related behavioural risk factors like tobacco use, physical inactivity, unhealthy diet, and the harmful use of alcohol that lead to four key metabolic/physiological changes e.g., raised blood pressure (BP), overweight/obesity, raised blood glucose and raised cholesterol levels^[11].

Tobacco use is a known or probable cause of about 25 diseases including heart disease; cancer, stroke, chronic obstructive pulmonary disease and digestive tract disease. Smokeless tobacco use causes oral cancer in the lip, tongue, mouth and throat areas and digestive system cancers. The relationship between alcohol consumption and health and social outcomes is complex and multi-dimensional. Alcohol consumption is linked to more than 60 disease conditions including liver cirrhosis, several cancers (liver, laryngeal and oesophageal cancers), injuries and hemorrhagic strokes. Low consumption of fruit and vegetables has been identified as a risk factor in the development of a range of chronic diseases, including coronary heart disease, stroke and many forms of cancer. Physical inactivity leads to obesity, dyslipidemia (lower high-density lipoprotein levels), insulin resistance, diabetes mellitus and high blood pressure levels. Physical inactivity is a well-established risk factor for coronary heart disease (CHD) and is associated with about a twofold increase in risk of CHD^[12].

An increasing trend in NCDs risk factors has been observed globally during the two decades from 1990 to 2010; high blood pressure (27% increase), smoking (3% increase), alcohol use (28% increase), low fruits and vegetables intake (29% increase), high body-mass index (82% increase), and high fasting plasma glucose (58% increase)^[13].

In India, a population based screening survey from Kerala reported that only 11.4 per cent of study participants had blood pressure in the normal range and all others had either hypertension or pre-hypertension^[14]. The study conducted by Indian council of medical research-India Diabetes (ICMR-INDIAB) in 3 states of India (Tamil Nadu, Maharashtra and Jharkhand) and 1 union territory (Chandigarh), which covered a population of 213 million people, revealed that 13.9% subjects had hypercholesterolemia, 29.5% had hyper-triglyceridemia, 72.3% had low HDL-C, 11.8% had high LDL-C levels and 79% had abnormalities in one of the lipid parameters^[15]. A recent population based survey from central India showed subnormal HDL levels in 50 per cent of the participants^[16]. The National Family Health survey shows that 12.1% men and 14.8% women in India are either overweight or obese^[17].

An increase in the prevalence of such risk factors is responsible for the increase in NCDs. Evidence suggests that 40-50% of non-communicable disease related, premature deaths can be prevented, if risk factors are controlled.¹¹ It is rational and makes perfect sense and therefore the action to prevent these major chronic diseases should focus on controlling these risk factors. These risk factors are measurable and thus knowing the present levels of risk factor exposure will be useful in predicting future risk and driving the public health policy. W.H.O. has recommended surveillance of common NCD risk factors with the STEPS approach using standardized instruments and protocols for collecting, analyzing and monitoring trends of risk factors within and across countries.

Non-Communicable Diseases

Non-communicable disease (NCDs) refers to those conditions which are chronic, evolve slowly, and progress relentlessly^[18]. WHO defines NCDs as "diseases of long duration, and with generally slow in progression"^[19]. EURO symposium in 1957^[20] gave the definition of chronic diseases and conditions as: "An impairment of bodily structure and/or function that necessitates a modification of the patient's normal life, and has persisted over an extended period of time". The commission on chronic illness in USA^[20] has defined chronic diseases as "comprising all impairments or deviations from normal, which have one or more of the following characteristics": are permanent, leave residual disability, are caused by non-reversible pathological alteration, require special training of the patient for rehabilitation, may be expected to require a long period of supervision, observation or care. In short, there is no international definition of what duration should be considered long-term, although many consider that chronic conditions are generally those that have had duration of at least 3 months^[20].

According to the World Health Organization's (WHO) definition, non-communicable diseases include:-

- Cardiovascular diseases (CVDs)
- Cancers
- Chronic non-specific respiratory diseases (e.g., chronic bronchitis, asthma)
- Diabetes
- Neuro-psychiatric conditions (mental disorders, epilepsy, Alzheimer's)
- Musculoskeletal conditions (e.g. arthritis)
- Various skin diseases

Among these, the leading chronic diseases are: cardiovascular diseases (CVDs), chronic obstructive pulmonary disease (COPD), diabetes mellitus and cancer^[21].

Burden of NCDs

Non-communicable diseases (NCDs) kill 40 million people each year, equivalent to 70% of all deaths globally. Each year, 15 million people die from a NCD between the ages of 30 and 69 years. Cardiovascular diseases account for most NCD deaths, or 17.7 million people annually, followed by cancers (8.8 million), respiratory diseases (3.9 million), and diabetes (1.6 million). These 4 groups of diseases account for over 80% of all premature NCD deaths^[19]. As population will age, annual NCD deaths are projected to rise substantially, to 52 million in 2030. Annual cardiovascular disease mortality is projected to increase by 6 million and cancer mortality by 4 million^[20].

In terms of burden of disease, measured in DALYs, chronic diseases were responsible for an estimated 49% of the total worldwide burden of disease. Cardiovascular diseases (including coronary heart disease and stroke) and diabetes mellitus were responsible for 12% of the total burden of disease, and cancers and chronic respiratory diseases for an additional 9%^[22].

Indian Scenario

India is experiencing a rapid health transition with a rising burden of NCDs causing significant morbidity and mortality, both in urban and rural population, with considerable loss in potentially productive years (age 35-64

years) of life. NCDs are estimated to account for about 60 percent of all deaths^[6]. It is estimated that by 2020, two out of three Indian deaths will be due to NCDs^[23]. In terms of DALY, NCDs account for more than two-fifth (43%) of the DALYs and among this group, cardiovascular diseases, diabetes, cancers together account for 40% of the NCD-related DALYs in India.^[7] According to the National sample survey organization (NSSO) 60th round, NCDs in India are responsible for 40% of hospital stay with an out of pocket expense of 47.3%^[24]. Annual Income loss to households associated with NCDs is roughly Rs. 280 billion^[25].

In the ICMR study on assessment of burden of NCDs in India^[26], the prevalence rates of diabetes varied from 103 per thousand to 124 per thousand in these studies. The overall prevalence rate of diabetes in urban and rural areas combined was estimated as 62.47 per thousand. Projection estimates show that the number of people with diabetes in India is 40.9 million and is expected to rise to 69.9 million by 2025^[27]. The prevalence of coronary heart disease is reported to be between 6.5% and 13.2% in urban India and 1.6% and 7.4% in rural India^[28]. The stroke prevalence is in between 136 and 842/100,000 population in urban areas and 143 and 165/100,000 populations in rural areas^[28]. Projection of National Commission on Macroeconomics and Health (NCMH) report, 2005, shows that asthma is expected to rise from 28.3 million to 35.9 million by the year 2016^[29]. The prevalence of chronic obstructive pulmonary disease among men in India ranges between 2.1% to 9.4% in north India and 1.4% to 4.0% in South India^[29].

More than 20% of the population has at least one chronic disease and more than 10% have more than one. Chronic diseases are widespread in people who are younger than 45 years and in poorer populations^[18]. While the present high burden of NCD deaths is itself an adequate reason for public health attention, a greater cause for concern is the early age of these deaths in India compared to the developed countries. India also loses a substantial number of lives during the productive years of its citizens.

The potentially productive years of life lost (PPYLL) due to CVDs in the age group of 35-64 was 9.2 million in 2000 and is expected to rise to 17.9 million in 2030^[30]. Considering the high cost of medicines and longer duration of treatment, NCDs constitute a greater financial burden to low income groups. Studies carried out in India have shown that the cost of treating NCDs such as diabetes has doubled from 1998 particularly among urban households^[31]. Low income groups spent a higher proportion of their income on diabetes care (urban poor 34% and rural poor 27%). In India, the treatment costs for an individual with diabetes are 15–25% of their household earnings. One in four Indian families in which a family member has heart disease or stroke has catastrophic expenditure, pushing 10% of these families into poverty. Where families have no access to affordable care, they forego care or risk financial ruin; the poor end up suffering the worst^[33].

Major NCD'S

Cardiovascular diseases (Amraz-e-Qalb)

Ischemic heart disease (IHD) is the leading cause of death in economically developed countries and is rapidly assuming serious dimensions in developing countries. According to the WHO, an estimated 17 million people died from cardiovascular disease (CVD) in 2005 comprising 30% of

all global deaths and of these nearly 80% of deaths took place in low and middle income countries like India^[34]. According to the World Heart Federation, 35% of all CVD deaths in India occur in those aged 35-64 years. Coronary heart disease (CHD) is the commonest CVD accounting for 90-95% of all cases and deaths^[35].

Diabetes Mellitus (Ziabetes)

India is currently experiencing an epidemic of Type 2 diabetes mellitus (T2DM) and has the largest number of diabetic patients. It is often referred to as the diabetes capital of the world. International Diabetes Federation (IDF) 2009 report revealed that the total number of diabetic subjects in India is 50.8 million^[36]. In a study conducted as a part of the National non-communicable diseases (NCD) risk factor surveillance, in different geographical locations (North, South, East, West/Central) in India, where major risk factors were studied using modified WHO STEPS approach and diabetes was diagnosed based on self-reported diabetes diagnosed by a physician, found that the overall prevalence of self-reported diabetes was highest in Trivandrum in Kerala (9.2%), followed by Chennai in Tamil nadu (6.4%) and Delhi (6.0%). This was followed by Ballabgarh in North India (2.7%), Dibrugargh in East India (2.4%) and the lowest was observed in Nagpur in West/Central India (1.5%)^[37].

Cancer (Sartan)

Nearly 56% of the estimated deaths from cancer occur in the developing world^[38]. The pooled data of six population based cancer registries Bangalore, Barshi, Bhopal, Chennai, Delhi and Mumbai was used in estimating indices of burden of disease. The six population based cancer registries cover a population of 34 million that is, 18.4 million males and 15.6 million females. The number of cases of cancer in 2004 was approximately 8.2 lakh. The number of cancer cases among males being around 3.9 lakh, and among females was 4.3 lakh^[38]. Tobacco related cancers constituted 40.43 % of all cancers in males. Among females, high incidence rates were reported for breast cancer (20.01/100,000), cervix (14.42/100,000) and ovary (5.6/100,000) which together accounted for 59% of all cancers in women^[38]. In India, the most prevalent forms of cancer among men are tobacco-related cancers including lung, oral, larynx, esophagus, and pharynx. Amongst Indian women, in addition to tobacco-related cancers, cervix, breast, and ovarian cancers are also prevalent. India currently has the highest prevalence of oral cancer cases in the world as a result of the popularity of chewing tobacco in its rural regions^[39].

Chronic Lung Diseases (Amraz-e-Riya Muzmin)

Recent estimates from India suggest that in 2005 chronic diseases accounted for 53% of all deaths and 44% of DALYs lost, with chronic respiratory disease accounting for 7% deaths and 3% DALYs lost^[40]. According to the National Family Health Survey (NFHS 3), the prevalence of asthma was 1,600 persons/100,000^[41]. It is estimated that there are more than 12 million adults with COPD in India with prevalence rates varying depending upon the population studied and the methodology used. In males the prevalence varies from 2.12% to 9.4% in north India.

Risk Factors of Non-communicable diseases (NCD)

Risk factors are defined as any attribute, characteristic or exposure of an individual, which increase the likelihood of

developing a disease or injury ^[42]. The major (modifiable) behavioural risk factors identified in the World Health Report 2002 ^[43] are tobacco use, harmful alcohol use, unhealthy diet (low fruit and vegetable consumption) and physical inactivity. On the other hand, the major biological risk factors identified are overweight/ obesity, raised blood pressure, raised blood glucose and raised total cholesterol.

Behavioural Risk Factors

Tobacco Use

Tobacco use and exposure comes in both smokeless and smoking forms. Smokeless tobacco is consumed in unburnt forms through chewing or sniffing and contains several carcinogenic, or cancer-causing, compounds. Smokeless tobacco has been associated with oral cancer, hypertension, heart disease and other conditions. Smoking tobacco, by far the most commonly used form globally, contains over 4000 chemicals, of which 50 are known to be carcinogenic.

There are currently about 1 billion smokers in the world. Manufactured cigarettes represent the major form of smoked tobacco. Current smokers are estimated to consume about 6 trillion cigarettes annually ^[44]. Risks to health from tobacco use result not only from direct consumption of tobacco but also from exposure to second-hand smoke ^[45]. Almost 6 million people die from tobacco use and exposure each year, accounting for 6% of all female and 12% of all male deaths in the world ^[46]. Of these deaths, just over 600,000 are attributable to second-hand smoke exposure among non-smokers ^[45], and more than 5 million to direct tobacco use (both smoking and smokeless) ^[45, 46].

By 2020, annual tobacco-related deaths are projected to increase to 7.5 million ^[47], accounting for 10% of all deaths in that year. Smoking is estimated to cause about 71% of all lung cancer deaths, 42% of chronic respiratory disease and nearly 10% of cardiovascular disease. Smoking is also an important risk factor for communicable diseases such as tuberculosis and lower respiratory infections ^[48].

Harmful use of alcohol

The harmful use of alcohol is a major risk factor for premature deaths and disabilities in the world. Hazardous and harmful drinking was responsible for 2.3 million deaths worldwide in 2004, which amounts to 3.8% of all deaths in the world. More than half of these deaths occurred as a result of NCDs, including cancers, cardiovascular disease and liver cirrhosis. An estimated 4.5% of the global burden of diseases measured in DALYs is caused by harmful use of alcohol. Cancers, cardiovascular disease and liver cirrhosis are responsible for a quarter of this burden ^[46, 49]. There is a direct relationship between higher levels of alcohol consumption and rising risk of some cancers, liver diseases and cardiovascular diseases. The relationship between alcohol consumption and ischemic heart and cerebrovascular diseases is complex. It depends on both the amount and the pattern of alcohol consumption.

Unhealthy Diet

Approximately 16 million (1.0%) DALYs and 1.7 million (2.8%) of deaths worldwide are attributable to low fruits and vegetables consumption ^[46, 50]. Adequate consumption of fruit and vegetables reduces the risk for cardiovascular diseases, stomach cancer and colorectal cancer ^[51, 52]. There is convincing evidence that the consumption of high levels of high-energy foods, such as processed foods that are high

in fats and sugars, promotes obesity compared to low-energy foods such as fruits and vegetables ^[50].

The amount of dietary salt consumed is an important determinant of blood pressure levels and overall cardiovascular risk ^[53]. A population salt intake of less than 5 grams per person per day is recommended by W.H.O. for the prevention of cardiovascular disease ^[53]. However, data from various countries indicate that most populations are consuming much more salt than this ^[54]. It is estimated that decreasing dietary salt intake from the current global levels of 9-12 grams per day to the recommended level of 5 grams per day would have a major impact on reducing blood pressure and cardiovascular disease.

There is convincing evidence that saturated fat and trans-fat increase the risk of coronary heart disease and that replacement with mono-saturated and polyunsaturated fat reduces the risk ^[55]. There is also evidence that the risk of type-2 diabetes is directly associated with consumption of saturated fat and trans-fat and inversely associated with polyunsaturated fat from vegetable sources ^[56].

Insufficient physical activity

Approximately 3.2 million deaths and 32.1 million DALYs (representing about 2.1% of global DALYs) each year are attributable to insufficient physical activity ^[46]. People who are insufficiently physically active have a 20-30% increased risk of all-cause mortality compared to those who engage in at least 30 minutes of moderate intensity physical activity on most days of the week ^[57]. Participation in 150 minutes of moderate physical activity each week (or equivalent) is estimated to reduce the risk of ischemic heart disease by approximately 30%, the risk of diabetes by 27%, and the risk of breast and colon cancer by 21-25% ^[46, 57]. Additionally, physical activity lowers the risk of stroke, hypertension and depression. It is a key determinant of energy expenditure and thus fundamental to energy balance and weight control ^[57].

Metabolic/Physiological Risk Factors

Overweight/Obesity

Worldwide, 2.8 million people die each year as a result of being overweight ^[58] (including obesity) and an estimated 35.8 million (2.3%) of global DALYs are caused by overweight or obesity ^[46]. Overweight and obesity lead to adverse metabolic effects on blood pressure, cholesterol, triglycerides and insulin resistance. Risks of coronary heart disease, ischemic stroke and type-2 diabetes mellitus increase steadily with increasing body mass index (BMI), a measure of weight relative to height ^[58]. Raised BMI also increases the risk of cancer of the breast, colon/rectum, endometrium, kidney, oesophagus (adenocarcinoma) and pancreas ^[43].

Mortality rates increase with increasing degrees of overweight, as measured by BMI. To achieve optimal health, the median BMI for adult populations should be in the range of 21 to 23 kg/m², while the goal for individuals should be to maintain a BMI in the range 18.5 to 24.9 kg/m². There is increased risk of co-morbidities for BMIs in the range of 25.0 to 29.9 kg/m² and moderate to severe risk of co-morbidities for a BMI greater than 30 kg/m² ^[58].

An estimated 205 million men and 297 million women over the age of 20 were obese in 2008—a total of more than half a billion adults worldwide ^[59]. The prevalence of overweight and obesity were highest in the WHO Region of the

Americas (62% for overweight in both sexes, and 26% for obesity). In all WHO regions, women were more likely to be obese than men.

Raised Blood Pressure

Raised blood pressure Worldwide, raised blood pressure is estimated to cause 7.5 million deaths, about 12.8% of the total of all annual deaths [46]. This accounts for 57 million DALYs or 3.7% of total DALYs. Raised blood pressure is a major risk factor for coronary heart disease and ischemic as well as hemorrhagic stroke [60]. Blood pressure levels have been shown to be positively and progressively related to the risk for stroke and coronary heart disease [61]. In some age groups, the risk of cardiovascular disease doubles for each incremental increase of 20/10 mmHg of blood pressure, starting as low as 115/75 mmHg [62].

In addition to coronary heart diseases and stroke, complications of raised blood pressure include heart failure, peripheral vascular disease, renal impairment, retinal haemorrhage and visual impairment [63]. Treating systolic blood pressure and diastolic blood pressure so they are below 140/90 mmHg is associated with a reduction in cardiovascular complications.

Raised cholesterol

Raised cholesterol levels increase the risks of heart disease and stroke [64]. Globally, a third of ischaemic heart disease is attributable to high cholesterol. Overall, raised cholesterol is estimated to cause 2.6 million deaths (4.5% of total) and 29.7 million DALYs, or 2.0% of total DALYs [54]. Raised total cholesterol is a major cause of disease burden in both the developed and developing world as a risk factor for ischemic heart disease and stroke. For example, a 10% reduction in serum cholesterol in men aged 40 has been reported to result in a 50% reduction in heart disease within five years; the same serum cholesterol reduction for men aged 70 years can result in an average 20% reduction in heart disease occurrence in the next five years [65].

Conclusion

As far as non-communicable diseases are concerned; these conditions arise because of an inappropriate management of *Asbab sitta Zarooriya* (six essential factors) over a long period of time. Inappropriate management of these essential factors leads to change in the *mizaj* of person; any change in the *mizaj* brings change in person's state of health. For example overeating and sedentary lifestyle increase *barudat* in the body, which increase the likelihood of developing the obesity. Therefore, the main approach in Unani medicine for the prevention of these diseases is maintenance of balanced temperament under varying conditions of life through moderation in *Asbab sitta Zarooriya* and the therapeutic approach to the same is evacuation of the abnormal/excess humour and strengthening the affected organ system by dietotherapy, lifestyle modifications, and use of medicinal herbs.

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