REVIEW ARTICLE

Non-communicable diseases' risk factors in Iran; a review of the present status and action plans

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Abstract

Non-communicable Diseases (NCDs) are the leading causes of death globally, imposing a heavy burden on the healthcare systems, especially in low- and middle-income countries. Iran is a country in the Middle-East region with an aging population and changing disease risk factors, and now is facing NCDs as the major health problem of the country. Investigating NCDs' risk factors and tackling preventable ones is the main intervention to control their heavy burden. In this review, we discussed the most critical risk factors in Iran and the implemented programs and action plans to control them. A better knowledge on current status of risk factors and plans to tackle them, could help policymakers effectively rule policies and allocate resources to curb heavy burden of NCDs in Iran.

Keywords Non-communicable diseases · Risk Factor · Prevention and control · Iran · Epidemiology · Review

Introduction

Non-communicable diseases (NCDs) are the top causes of premature mortality and disability globally, which impose a heavy burden on the healthcare development of countries. NCDs were responsible for 74.4% (95% Uncertainty Interval (UI): 72.8–75.7) of all deaths and 63.8% (95% UI: 61.4–66.0) of disability-adjusted life years (DALYs) in 2019 Globally [1]. The importance of NCDs has been highlighted in the 2030 Sustainable Development Goals (SDGs) to reduce all deaths caused by NCDs by one third until 2030 [2]. It is estimated that 80% of all NCDs mortalities happen in low- and middle-income countries [3] and Iran, as an example of middle-income countries, is exposed to NCDs since 83.5% (95% UI: 82.6–84.3) of all deaths and 78.1% (95% UI: 76.2–80.1) of all burden of diseases were due to this group of diseases in 2019 [1, 4, 5]. Iran is in a transition period because of population aging, changing disease risk factors,

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and replacement of infectious diseases by NCDs, including cardiovascular diseases (CVDs), high blood pressure, diabetes mellitus, mental and psychiatric disorders, alcohol and substance abuse, and traffic injuries [6]. To handle NCDs, we should know about NCDs' risk factors and have action plans to reduce them [7].

NCDs' risk factors are classified into modifiable and non-modifiable categories. Non-modifiable ones are variables that are out of an individual's control, like age, gender, ethnicity, and genetic factors. Modifiable variables are ones that can be changed by individuals like lifestyle, social, and cultural factors. The four main NCDs (CVDs, diabetes mellitus, cancers, and chronic respiratory diseases) are in relation with preventable lifestyle risk factors like unhealthy diet, physical inactivity or low physical activity, obesity and overweight, smoking and harmful use of alcohol, which need programs to deal with [8–10]. The Global Burden of Disease (GBD) study categorizes all risk factors of diseases into three main categories: environmental and occupational, behavioral, and metabolic risk factors. Many of these risk factors are responsible for NCDs in different aspects [11].

Some risk factors are more prominent in Iran because of unhealthy dietary habits such as high salt intake and previous high consumption of saturated oil, physical activity barriers, and widespread tobacco use [12–16]. For Conducting this review, we searched the PubMed, Scopus, and Google Scholar databases for the keywords "Non-Communicable Diseases", "Risk Factor", "Iran", "Epidemiology", "Prevention", and "Action Plan" through all fields of an article and all types of articles, without a language and time restriction. Also, we searched grey literature in various search engines. Following, we discussed the findings and properties of these risk factors in Iran. Statistics of the epidemiology of each risk factor are provided by the GBD 2019 database and Iran STEPs (Stepwise approach to surveillance) 2016 survey [1, 17].

Review of the major risk factors

Unhealthy diet

An unhealthy diet -as a subcategory of behavioral risk factors- is one of the leading risk factors of NCDs and responsible for the majority of chronic diseases and their mortality rates [16, 18]. An unhealthy diet has unfavorable effects on the physical and psychological aspects of the body and increases morbidity and mortality of diseases by defected body recovery systems [19, 20]. This potential risk factor affects populations independent of age, gender, and sociocultural conditions [18]. Several studies showed suboptimal dietary habits in the Iranian population [16, 19–21]. According to the GBD 2019, about 16.5% (95% UI: 13.3–19.5) of total deaths in 2019 in Iran were attributed to the dietary risk factors, comprising more than

64,424 (95% UI: 52,234–76,488) deaths nationally. Also, 7.5% (95% UI: 6.1–8.9) of total DALYs were attributable to these risk factors, comprising for about 1,473,685 (95% UI: 1,208,551–1,739,207) years [1]. Here we discuss one of the most important ones, which is high salt intake.

A higher amount of salt intake as a dietary risk factor of diseases is one of the main causes of hypertension development, one of the main risk factors of CVDs [15]. Also, excessive salt intake has a role in developing gastric cancer, the third major cause of cancer mortality globally [22, 23]. Iran STEPs 2016 survey revealed higher levels of salt intake in the Iranian population, in which 97.66% of the population uses a minimum of 5 grams of salt per day [15]. While WHO (World Health Organization) recommended daily salt intake is less than five g/day, and the American Heart Association number is less than 2.3 g/day for adults, this number in Iran was 9.52 g/day (95% CI: 9.48–9.56) [15, 24, 25]. About 1.2% (95% UI: 0.2–4.7) of NCD deaths and 0.6% (95% UI: 0.1–2.4) of NCD DALYs were attributable to high sodium intake in 2019 in Iran [1]. WHO introduced SHAKE protocol to reduce salt intake, which stands for surveillance, harness industry, adopt standards for labeling and marketing, knowledge, and environmental interventions [25]. Several policies provided by countries are food labeling, product reformulation, price and tax interventions, restriction on children's salt intake, and educational campaigns [26]. In Iran, traffic-light labeling on products started in 2014 and became mandatory for companies in 2016. Nevertheless, the major obstacle against this intervention is limited information of people about the labeling and its practical benefits. Therefore, there is a need to increase public knowledge through media and general education [15, 27].

Insufficient physical activity

Low or insufficient physical activity (IPA) is one of the major behavioral risk factors of diseases, accounting for 4.4% (95% UI: 2.4–7.2) of deaths and 1.9% (95% UI: 1.1–3.2) of DALYs of NCDs in 2019 in Iran. [1] The Iran STEPs 2016 survey showed a high prevalence of IPA, about 54.7% (95%CI: 54.0-55.3) of the total population, defined according to WHO recommendation, which is less than 600 Metabolic Equivalent of Task (MET) per week. Also, there was a remarkable gender disparity that IPA was higher in women. Mainly, Iranians' physical activity took place in the work domain and lack of recreational activities. Besides, IPA was significantly associated with a positive history of diabetes (OR: 1.25, 95% CI: 1.07–1.47, P: 0.005) [14]. Increasing urbanization and lifestyle changes in the Iranian population were thought to be the leading causes of IPA since the burden was higher in big capital cities of Iran [10]. Preferring to have physical activities with family members, lack of friends, and time have shown to be the main barriers to female physical activity in Iran [28].

Therefore, implementing programs to promote physical activity in Iran is necessary.

Obesity and overweight

Obesity is a significant public health concern globally, and its increasing prevalence in various developing and developed countries has led to a global pandemic, concerning health authorities [29, 30]. Also, obesity and overweight in children and adolescents are significant global and regional concerns [31]. Obesity and overweight are categorized as a metabolic risk factor for diseases and are defined by high body mass index (BMI). Based on the WHO categorization, $25 \leq BMI < 30$ is defined as overweight, and $BMI \geq 30$ is defined as obesity. Also, class I obesity is $30 \leq BMI < 35$, class II obesity is $35 \leq BMI < 40$, and class III obesity is $40 \leq BMI$ [32]. Evidence shows a consistent increase in BMI, contributes to higher rates of CVDs, cancers, diabetes, osteoarthritis, and chronic kidney disease. Also, the most attributable deaths to obesity and overweight are due to CVDs [32]. This risk factor showed to have strong associations with behavioral risk factors like high-calorie consumption and low physical activity, too [33].

High BMI as a major metabolic risk factor of diseases, attributed about 18.8% (95% UI: 13.2–24.7) of deaths and 12.9% (95% UI: 9.3–16.7) of DALYs of NCDs in 2019 in Iran [1]. Iran STEPs 2016 survey revealed a 59.3% (95% CI: 58.7–59.9) prevalence of overweight and obesity among Iranian adults aged older than 18 years old. This study showed obesity prevalence of 15.3% (95% CI: 14.7–15.9) in males and 29.8% (95% CI: 29.0-30.5) in females, and the difference was significant (P-value < 0.001). The highest prevalence of this risk factor was in the 55–64 age group [29]. Iran is pursuing the prevention and control of overweight and obesity as one of the main risk factors of NCDs, as a target of NCDs national action plan to reach SDGs risk reduction goals. However, much more effective policies and efforts are required to control this critical risk factor in Iran, alongside the ongoing research on this risk factor [7, 34, 35]. Global estimations also predict that controlling this risk factor through nation control programs is difficult due to the complexity and nature of this risk factor and deficiencies of action plans [32].

High fasting plasma glucose

High fasting plasma glucose (FPG) is one of the major metabolic risk factors leading to many NCDs, which the most important one is diabetes mellitus [36]. In 2019, 20.1% (95% UI: 15.6–28.1) of deaths and 11.5% (95% UI: 9.5–14.0) of DALYs due to NCDs were attributed to high FPG in Iran [1]. Associated with the global initiatives to control diabetes and high FPG globally, Iran provided the National Program for Prevention and Control of Diabetes (NPPCD)

since 2004 to protect populations against diabetes and provide effective care for diagnosed individuals with diabetes [37, 38]. The first report of this program released in 2016 highlighted that despite the wide availability of glucose-lowering agents and insulin, control of diabetes is suboptimal in Iran, and chronic complications of diabetes threaten the diabetic patients vastly [38].

A national study based on the Iran STEPs 2016 survey estimated high population attributable fractions of deaths in the Iranian population attributed to pre-diabetes and diabetes conditions, and findings challenged the effectiveness of the medical and epidemiologic interventions of diabetes control in Iran [39]. However, the national programs of diabetes control by the rural primary healthcare workers (the Behvarz workers) are shown to be very effective and successful in controlling this essential metabolic risk factor in Iran, suggesting improving and expanding primary healthcare services to control diabetes and high FPG more efficiently [40]. Other national investigation on insulin-pen use in Iran revealed no superiority of more expensive insulin-pens to the traditional vials and syringes of insulin in controlling the glycemic and lipid profile of patients. Results of this survey suggested improving adherence to treatment and cost-effectiveness of diabetes treatment in Iran for better control of the condition nationally [41].

High blood pressure

Hypertension (HTN) is of the main risk factors of CVDs, the major subcategory of NCDs. HTN is estimated to be responsible for more than half of deaths due to stroke and ischemic heart disease in adults globally. High systolic blood pressure is the major element in hypertension, causing damages to the cardiovascular system [22]. In 2019, high systolic blood pressure was responsible for about 30.6% (95% UI: 26.4–34.5) of deaths and 13.8% (95% UI: 11.5–16.2) of DALYs attributed to NCDs in Iran [1]. A recent investigation on HTN prevalence on the Iranian population using Iran STEPs 2016 study results found a high prevalence of this disease based on different guidelines, suggesting early interventions like lifestyle modifications in young adults and patients with comorbidities, as these groups were more prone to the condition [42]. Similar to control of high FPG in Iran, control of high blood pressure showed to be very successful by the rural primary healthcare providers, suggesting expansion in this sector of the health system [40]. An evaluation of metabolic risk factors in a national survey highlighted control of high blood pressure as the major risk factor through diet, lifestyle, and pharmacological interventions to improve the profile of metabolic risk factors in Iran [30]. Awareness of HTN and pre-hypertension is also shown to be low in Iran, and studies recommended to educate effectively and aware people of this important metabolic risk factor [43]. Community trials are proved to be effective in

handling the prevalence of HTN and improving the awareness, treatment, and control of this major public health issue in Iran [44]. Regarding controlling this risk factor in the Iranian population, the Ministry of Health and Medical Education ran a national program of blood pressure control of all the population older than 30 years old, pregnant women, and patients with kidney diseases in 2019.

Dyslipidemia

An elevated level of plasma cholesterol is one of the major preventable risk factors for atherosclerosis and CVDs. High levels of low-density lipoprotein-cholesterol (LDL-C) and low levels of high-density lipoprotein-cholesterol (HDL-C) are more related to this condition. Iran STEPs 2016 survey revealed that 80% of the Iranian adult population have dyslipidemia. 69.2% of this population had low HDL-C, 39.5% had high other cholesterol levels, and 28% had high triglyceride. Dyslipidemia was more prevalent in men and adults aged 35–49 years old [13]. High LDL-C as a significant risk factor of diseases contributed to the 16.1% (95% UI: 12.2–20.5) of deaths and 7.8% (95% UI: 6.2–9.7) of DALYs of NCDs in 2019 in the Iranian population [1]. Another study highlighted that about 80% of people with dyslipidemia were unaware of their condition, which showed a healthcare gap between primary and secondary care [45]. A large-scale nation-wide investigation on population attributable fraction of hypercholesterolemia in the Iranian population showed higher rates of the attributable burden of this condition in the pre-hypercholesterolemic population, highlighting the importance of focusing on people with an intermediate increase in plasma cholesterol (200–240 mg/dl) since this group consists of a larger group of population in Iran [46]. Despite the high prevalence of dyslipidemia, obesity, and unhealthy lifestyle in Iran, lipid profile has a favorable trend. This control of lipids is mainly explained by lower consumption of saturated and hydrogenated oil and higher usage of liquid oil, implemented by the government [47, 48]. More public education and screening plans for intermediate- and high-risk groups are needed to control this risk factor effectively.

Tobacco use and smoking

Tobacco use is responsible for a heavy burden of NCDs since the three most related diseases to smoking are lung cancer, chronic obstructive pulmonary disease, and ischemic heart disease [49, 50]. Cigarette smoking is the most common way of tobacco use in Iran; however, hookah is the most common form in women [51]. Tobacco use as one of the major behavioral risk factors of diseases contributed to about 14.1% (95% UI: 13.3–15.0) of deaths and 9.2% (95% UI: 8.0-10.3) of DALYs due to NCDs in 2019 in Iran [1]. Iran STEPs 2016 survey showed that 9.6% of participants were current

cigarette smokers, and a majority of them aged 45–70 years old. Besides, the prevalence of cigarette smoking is much higher in male participants. Turkish ethnicity, self-employment, and lower education level were associated factors with more smoking [12]. WHO introduced the Framework Convention on Tobacco Control (FTCT) in 2005 and the MPOWER (Monitor tobacco use, Protect people, Offer help, Warn, Enforce bans, Raise taxes) package in 2008, consisting of six components to control tobacco use [52]. Since the legislation of FTCT in 2005 in Iran, different policies and MPOWER-based programs have been conducted to control smoking. Recent investigations showed that Iran had prepared the required regulations and infrastructures to control this ominous phenomenon [53]. Such efforts should be continued and get appropriate supports from related authorities in the future.

Alcohol consumption

Alcohol consumption was the seventh leading cause of mortality and disability-adjusted life years in 2016 globally, mostly affecting age groups 15–49 years old [54]. Alcohol use was responsible for about 0.7% (95% UI: 0.5-1.0) of deaths and 0.7% (95% UI: 0.6–0.9) of DALYs attributed to NCDs in 2019 in Iran. Alcohol consumption caused about 2976 (95% UI: 2244–3996) deaths in 2019 in Iran by all causes of death [1]. Cultural and religious beliefs and traditional medicine have always suppressed alcohol consumption in Iran, but smuggling and illegal alcohol production is a major problem and source of alcohol consumption [55, 56]. Nowadays, alcohol-related problems, like abuse disorder, aggression, suicide, and different injuries, are major growing health problems in Iran that need further planning [57–59]. Proper policies toward this risk factor and appropriate decisions could help to control effectively this public health issue.

Discussion

In this report, we reviewed the current status of NCDs' risk factors and action plans of Iran to stop the major risk factors including important behavioral and metabolic ones contributing the most to the burden of NCDs in Iran. It is proved that the best for controlling the NCDs epidemic is primary prevention. The WHO STEPs program is the recommended framework for NCDs and their related risk factors surveillance program. This plan consists of continuous data gathering for better policy-making [60]. Iran has successful experience of seven rounds of STEPs survey and handled significant challenges [61]. In the Iran STEPs 2016 survey, a total number of 30,541 individuals from 30 provinces went under three study steps, including questionnaires, physical examinations, and biochemical measurements. In the mentioned survey, three major

categories of risk factors including lifestyle risk factors, metabolic risk factors, and injuries, were assessed [17, 62].

After specifying the status of NCDs, countries need to design and implement appropriate policies and interventions or modify their current policies to tackle NCDs' risk factors. WHO, according to the experience of other countries, provides the best-buy interventions that provide highly cost-effective and feasible interventions, especially for low- and middle-income countries. These interventions are recommended for handling different risk factors and NCDs such as tobacco use, harmful alcohol use, unhealthy diet, physical inactivity, CVDs, diabetes, and cancers [63]. Furthermore, WHO provides special packages for reducing some of the main risk factors for NCDs such as MPOWER and SHAKE, designed for tackling tobacco and salt intake, respectively [25, 52].

Iran has many prosperous achievements in controlling NCDs, and their related risk factors, such as tackling tobacco use, reduced consumption of saturated oil, and control of traffic accident burden [64]. In order to reach the reviewed targets, several actions have been executed for tackling NCDs nationally. Iran has established the Iranian Non-Communicable Diseases Committee (INCDC) and developed NCDs national action plan in 2015 with a multi-sectoral collaboration of researchers and healthcare authorities [7, 65]. Another activity was the implementation of the Islamic Republic of Iran's adaptation of WHO's Package of essential NCDs (IraPEN) interventions for primary healthcare in four main districts from 2016 until now [66, 67]. Some of the interventions that have been executed in recent years are increasing the people's knowledge about the importance of the harmful effects of NCDs' risk factors, including food labeling and community campaigns [27, 68].

INCDC developed and introduced the recent action plan for prevention and control of NCDs for 2015 to 2025 encompassing the nine global targets of WHO "NCD global action plan" by 2025 compared to 2010, including a 25% relative reduction in mortality of four main NCDs, a 10% relative reduction in harmful alcohol consumption, a 20% relative reduction in IPA, a 30% relative reduction in high salt intake, a 30% relative reduction in the prevalence of tobacco use, a 25% relative reduction in the prevalence of raised blood pressure, stop the rise of diabetes and obesity, a 70% target of receiving treatment to prevent heart attacks and strokes, and an 80% availability of medicines for major NCDs, and four additional specified targets for Iran including zero trans fatty-acids in foods, a 20% relative reduction in mortality due to traffic injuries, a 10% relative reduction in mortality due to drug abuse, and 20% increase in access to treatment of mental disorders for the period of 2015 to 2025 [69, 70]. Conducting such a national action plan is affected by various elements including policy and political issues, the existence of reliable data on NCDs, and the existence of practical solutions to tackle these risk factors. To effectively manage these obstacles a triple stream strategy of problem identification stream, political stream, and policy stream of options and interventions is utilized to reach the final goal of NCD prevention and control in Iran [71].

It seems that the executed actions are successful. According to the report of NCDs Countdown 2030, it is expected that Iran can achieve a one-third reduction in mortality from NCDs by 2030, since mortality from four main NCDs is declining fast enough based on reports [72]. A recent investigation on analysis of WHO NCD policies implementation in 151 countries showed that Iran and Costa Rica had the highest percentages of all policies implemented as 86.8%, while the mean NCD policy implementation score was 49.3% (Standard Deviation: 18.4%) among all examined countries in 2017. In this survey, the overall nutrition-related policies were the most implemented and policies related to alcohol consumption and IPA were the most neglected globally [73]. A lately conducted analysis on gaps of national targets of NCD action plan in Iran showed that among 105 actions and best-buy interventions recommended by WHO, only 12 of them were not considered in the national action plan of Iran, and only one of the best-buys Group's interventions was not included in the action plan, which was vaccination against human papillomavirus (HPV) in girls aged 9–13 years-old [74]. Achieving the targets needs persistent efforts and supports by the government and pertinent organizations [17, 72]. Also, NCDs should be included in current and future research priorities like personalized medicine and health policies to reach global health targets [75, 76].

Other countries also are implementing action plans to control the burden of NCDs. An investigation on 30 State Members of the Organization for Economic Co-operation and Development (OECD) showed these countries have adopted 44 individual policies in three main principles of system strengthening strategies, improved health service delivery, and better population health to tackle NCDs [77]. Another survey on the implementation of WHO best-buy NCD interventions in seven Asian countries in 2018 found that progress of implemented policies among these countries varied a lot and the significant obstacles of implementation gaps were insufficient funding, limited organizational capacity, inadequate sectoral actions, and a lack of monitoring and evaluation system of policy implementation [78]. Another survey in India revealed four levels of implementation gap including community level, healthcare facility level, public health system and management level, and policy and research level that need to be handled to combat the NCDs [79]. A good example is the Pacific Monitoring Alliance for NCD Action (MANA) that Pacific countries leaders have developed to monitor the Pacific NCD Roadmap, the NCD policy and legislation program in mentioned countries [80]. Countries in the African region also adopted multi-sectoral action plans to prevent and control NCDs in this region since the prevalence and burden of NCDs are significantly rising in these countries [81, 82].

Emergent conditions like the ongoing COVID-19 pandemic affect health systems in different ways. NCDs are essential

in two aspects during this pandemic. First, this critical disease group increases the risk of COVID-19 infection, severity, and mortality [83]. Second, the COVID-19 pandemic has compromised the effective care and control of NCDs [84, 85]. The synergistic combination of the two pandemics, also called a syndemic, imposes a heavy burden on health systems worldwide. Therefore, health authorities and policymakers of all countries need to consider the significant burden of NCDs during and after the ongoing pandemic of COVID-19 and notice that neglecting NCDs in this period could potentially lead to a catastrophe in the post-COVID era [86, 87]. Iran, as a country with an ongoing active epidemic of NCDs and highly affected population with the COVID-19 infection, and with limited resources, needs to prioritize and implement the best policies to curb the possible vicious outcomes [88, 89].

In this study, we reviewed the most important NCD risk factors in Iran and Iran's action plan to prevent and control them, using the most recent available data and literature. Also, investigations on the implementation of this action plan were reviewed. It is suggested that public health and health policy researchers focus on the more neglected areas of risk factors like IPA and provide data on practical action plans to improve physical activity profile in Iran. Additionally, the impact of the COVID-19 on the patients with NCDs should be noticed with special consideration as these patients are vulnerable to a heavy burden both during and after the pandemic period.

Conclusions

Public health authorities and policymakers should consider the most crucial risk factors reviewed in this paper. Proper action plans are required to stop or slow the burden of the most prevalent risk factors, including unhealthy diet, especially high salt intake, insufficient physical activity, tobacco use and smoking, and dyslipidemia. Appropriate management of these risk factors through multiple prevention levels could successfully avert the incidence and burden of NCDs in Iran.

Compliance with ethical standards

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