Modifiable Risk Factors for Non-Communicable Diseases in Kuwait: A Review of Public Adherence, Barriers, and Recommendations

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Abstract

Communicable diseases have historically posed significant challenges to public health. While the transmission of infectious pathogens has been contained in most countries, the global health landscape has shifted toward an increasing burden of non-communicable diseases (NCDs). The major categories of NCDs—cardiovascular diseases, cancer, chronic respiratory diseases, and diabetes mellitus—account for approximately 41 million deaths annually, representing 74% of global mortality. This growing burden necessitates urgent measures to alleviate the escalating strain on healthcare systems. Accordingly, our narrative review explores modifiable risk factors for NCDs, the adherence of the Kuwaiti population to these risk factors, and barriers to adopting healthy lifestyle behaviors. Applying predefined keywords and quality appraisal of the evidence, our review identified several modifiable NCD-associated risk factors in Kuwait, including insufficient fruit and vegetable intake, tobacco use, environmental pollutants, excessive body weight, and unhealthy sleep patterns. Plausible sociocultural and environmental barriers in Kuwait to health-promoting behaviors are the Arid climate and over-availability of ultra-processed food. We recommend adopting a hypo-caloric Mediterranean diet, engaging in regular physical activity, maintaining healthy sleep patterns, and avoiding tobacco exposure as pivotal approaches to managing NCD risk in the Kuwaiti population. Even though our review focuses on Kuwait, comparable trends of rising NCD rates and sociocultural and environmental constraints are likely present across other Gulf Cooperation Council (GCC) member states, suggesting that these recommendations may have regional relevance. Future research and targeted public health initiatives will be essential to promote these lifestyle modifications and address shared challenges across the region.

Keywords: Non-Communicable Diseases; Risk Factors; Cardiovascular Disease; Cancer; Chronic Respiratory Disease; Diabetes Mellitus; Kuwait; Gulf Cooperation Council; GCC.

Introduction

Communicable diseases have historically posed a significant challenge to public health.[1] While advances in sanitation and the widespread implementation of national immunization programs have substantially reduced the transmission of infectious pathogens in most countries, the global health landscape has shifted toward an increasing burden of non-communicable diseases (NCDs). The major categories of NCDs—cardiovascular diseases, cancer, chronic respiratory diseases, and diabetes mellitus—account for approximately 41 million deaths annually, representing 74% of global mortality.[1] This alarming statistic underscores the pandemic-like scale of NCD-related mortality.[1,2]

Confronted with this escalating healthcare challenge, the six member states of the Gulf Cooperation Council (GCC) allocate a combined $50 billion annually to NCD-related expenditures.[3] Among them, the State of Kuwait dedicates 3.9% of its gross domestic product (~$5.2 billion) towards managing NCDs.[3] NCD-related expenditures include direct healthcare costs, such as diagnosis and treatment of diseases, as well as indirect costs, including workforce absenteeism and premature retirement. Despite substantial financial investments in NCD management,

funding for empirical research targeting primary and secondary prevention has remained limited, accounting for only 1–2% of global health aid since the early 2000s,[4] indicating a research emphasis disproportionately focused on tertiary prevention.

Furthermore, the NCD epidemic in Kuwait stems from a complex interplay of global, national, and individual determinants.[5-11] Globalization, which has transformed and interconnected economies, is recognized as a primary driver of this rise.[5] In addition to its economic impact, globalization has shaped cultural and behavioral norms through migration and the diffusion of societal standards. At the national level, urbanization serves as a pivotal socio-environmental determinant that contributes to an increased prevalence of NCDs by fostering unhealthy lifestyle behaviors.[6-11] Urban living, coupled with technological advancements, encourages sedentary behaviors, diminishes physical activity levels, and increases ultra-processed food consumption—all well-established individual modifiable risk factors for NCDs.[7-11] The interaction between determinants creates a reciprocal cause-and-effect chain,[10] underscoring the need for coordinated global public health policies, typically implemented through top-down approaches.[12,13] While top-down policies hold potential, there is urgency in addressing individual modifiable risk factors through bottom-up approaches to alleviate the escalating pressure on healthcare systems in the short term. Such an approach requires a comprehensive literature review that evaluates modifiable risk factors, public adherence to these risk factors, and barriers to maintaining a healthy lifestyle. This comprehensive data can guide recommendations aimed at mitigating NCD risk at the individual level.

Accordingly, our narrative literature review aims to synthesize contemporary research on modifiable risk factors for NCDs and propose recommendations for mitigating NCD risk in Kuwait through behavioral modifications. Four secondary objectives support our overarching aim: (i) synthesizing international literature on modifiable risk factors for the four main NCDs; (ii) evaluating the adherence of Kuwaiti citizens to these risk factors; (iii) identifying specific sociocultural and environmental factors that influence adherence to modifiable NCD-risk factors in Kuwait; and (iv) providing evidence-based recommendations for pragmatic lifestyle modifications to reduce NCD-risk among the Kuwaiti population.

Methods

We performed a narrative literature review using predefined keywords to identify relevant studies and incorporated quality control measures. While such criteria are not obligatory for narrative reviews, their inclusion was intended to enhance transparency and maintain scientific rigor throughout the review process.

We searched the PubMed, ProQuest, and Google Scholar databases for studies published between January 1, 2014, and September 1, 2024, using the following keywords in isolation or combined with Boolean operators (e.g., "AND" and "OR"): "NCD," "non-communicable disease," "CVD," "cardiovascular diseases," "hypertension", "DM," "diabetes mellitus", "cancer," "tumor," "neoplasm," "pulmonary disease," "respiratory disease," "COPD," "chronic obstructive," "chronic obstructive pulmonary disease," "asthma", "obesity," "overweight," "body mass index," "Kuwait," "dietary factors," "diet", "nutrition", "physical activity", "exercise", "sports", "walking", "insufficient activity", "sedentary lifestyle", "smoking", and "barriers". Primary screening of the title and abstract read was conducted (WK) to determine whether the articles were relevant and worth reading for secondary screening in full-text content. In addition, the reference list of full-text articles was scanned to identify additional relevant articles that were potentially missed due to absent or incomplete keywords.

The inclusion criteria followed the PICOS framework, which stands for population, intervention, comparison, outcome, and study design framework (Table 1). Exclusion criteria include failing to fit the conceptual framework of the article and studies published in any language other than English.

Table 1: Conceptual framework of the article.

Population	**Citizens of the State of Kuwait**
Intervention	(i) Exposure to modifiable risk factors for NCDs†
	(ii) Exposure to healthy lifestyle behaviors
	(iii) Disease observation‡
Comparison	(i) Intragroup control
	(ii) Intergroup control
Outcome	(i) Prevalence rates of NCDs
	(ii) (reduced) risk of developing NCDs and/or all-cause mortality
	(iii) Description of the disease pathogenesis‡
Study design(s)	(i) Observational

(ii) Narrative or systematic review

† NCDs = non-communicable diseases; ‡ = related to review studies only.

Quality appraisal

The quality of the literature included in the narrative review was assessed using the modified Downs and Black checklist. Questions 4, 8, 14, 15, 17, 19, 21, 22, 23, 24, and 27 were excluded from the checklist due to the non-interventional nature of the studies. Additionally, references 14, 31, and 53 were deemed ineligible for quality assessment as they were web-based resources. Each article was reviewed (WK) and assigned a quality score, which could range from zero to seventeen.

Results

Most of the literature received a moderate quality control score (Figure 1). Various modifiable risk factors for the four major NCDs were identified, many of which are interrelated and not mutually exclusive. Accordingly, the most prominent modifiable risk factor(s) are discussed within the respective NCD categories, while shared biological risk factors are addressed in the section on self-management recommendations.

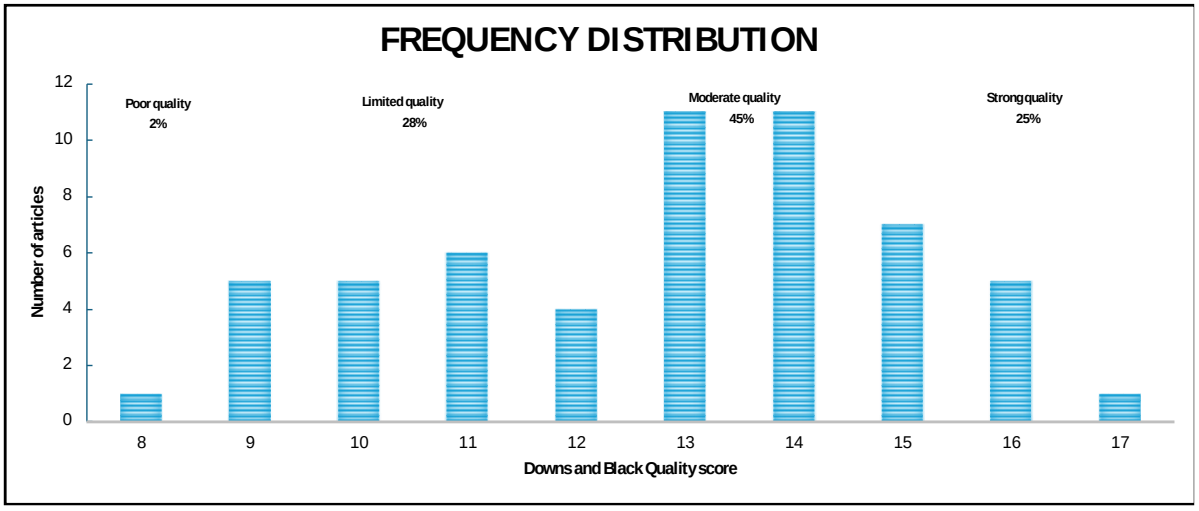

Figure 1: Frequency distribution of the Downs and Black quality checklist.

Cardiovascular diseases

Modifiable risk factors for cardiovascular diseases

According to recent estimates from the World Health Organization, it is reported that 17.9 million people die from cardiovascular diseases (CVDs) each year on a global scale.[14] Modifiable risk factors are associated with the pathogenesis and management of CVD.[15] In particular, the harmonized individual-level data of 112 cohort studies showed that a combined population-attributable fraction of body mass index, systolic blood pressure (SBP), non-high-density lipoprotein cholesterol, current smoking, and diabetes mellitus might be attributed to 57.2% and 52.6% of CVD cases among women and men, respectively.[15] Contemporary research suggests that SBP remains the most critical modifiable risk factor for CVD.[16] Collected SBP data is a valuable indication tool for screening for increased CVD risk later in life, with a 17% increase for every 10mmHg rise in SBP.[17] Elevated SBP functions as an indicator of hemodynamic strain on target organs and may serve as an initial sign of chronic subclinical inflammation,[16] a shared biological risk factor with cancer.[18]

Elevated SBP is a physiological outcome of an accumulative effect of more distal modifiable risk factors, including adherence to a diet excessive in salt and refined sugars, combined with a low polyphenols content found primarily in fruits and vegetables.[19,20] Unsurprisingly, pre-emptive blood pressure screening and adherence to a healthy diet as a therapeutic approach for blood pressure lowering seem to reduce vascular-related and all-cause mortality.[17,19,21]

Adherence of Kuwaiti citizens to modifiable risk factors for cardiovascular diseases

The prevalence of hypertension, defined as a systolic blood pressure of ≥140 mmHg and/or diastolic blood pressure of ≥90 mmHg, is 43% in the Middle East.[22] In Kuwait, a blood pressure screening conducted at a dental office found that 50.1% of participants had high blood pressure.[23] Notably, 38% of these individuals were previously undiagnosed and unaware of their hypertension.[23]

Research conducted on the dietary patterns of Kuwaiti individuals revealed that a high consumption of salt and refined sugar, along with an insufficient intake of fruits and vegetables, contributes to approximately half of cardiometabolic deaths in the country.[24] These risk factors align with current research, suggesting that those risk factors may elevate SBP,[19,20] a significant risk factor for CVD.[16] The inappropriate consumption of salt and refined sugars may be linked to frequent fast food intake, with 81% of young adults reporting consuming these foods more than twice a week.[25] Additionally, the reliance on imported products in Kuwait has contributed to the widespread availability of ultra-processed foods—high in salt and preservatives—in local supermarkets and dining establishments.[26]

The literature shows that the reported consumption of fruits and vegetables among Kuwaitis varies.[24,27,28] That said, all the findings agree that there is low daily consumption,[24,27,28] with one study reporting that some Kuwaitis do not consume any fruits and vegetables on a daily basis.[28] Taste is cited as the primary motivator for consuming fast food[25] while being described as a barrier to consuming fruits and vegetables.[27] In a qualitative study among Kuwaiti students, it was found that most respondents (84.1%) had poor nutritional knowledge,[29] which could contribute to their poor food choices,[30] and might be a mediator between diet and the high prevalence of hypertension and CVD in Kuwait.[24]

Cancer

Modifiable risk factors for cancer

In 2020, cancer was the second leading cause of death globally, responsible for nearly 10 million deaths.[31] In the United States, approximately 1.7 million people are diagnosed with cancer each year, representing roughly 5.5% of the population.[12] Empirical evidence from the U.S. suggests that around 40% of all cancer cases and 44% of cancer-related deaths (excluding nonmelanoma skin cancers) can be attributable to modifiable risk factors.[32] Notably, 28.5% of cancer deaths are linked to the use of tobacco-containing products, and 7.3% are associated with excessive body weight.[32]

The strong association between the use of tobacco products and cancer incidence is reflected in an almost 25-fold increase in the odds of developing lung cancer among tobacco smokers compared to non-smokers.[33] In Kuwait, around 78.2% of lung cancer cases in men are caused by current smoking.[34] Tobacco smoke contains over 8000 chemical compounds, 70 of which are classified as carcinogens by the International Agency for Research on Cancer.[12] Unfortunately, the clinical treatment options for lung cancer are limited, contributing to its notably low five-year survival rates compared to other cancers. Furthermore, biological factors may elucidate the link between excessive body weight and cancer risk. The overexpression of pro-inflammatory cytokines, such as interleukin-6, resulting from excess adipose tissue in overweight and obese individuals may increase cancer risk by inhibiting cancer cell apoptosis.[12]

Adopting a healthier lifestyle can help mitigate the modifiable risk factors of cancer. For instance, research indicates that quitting smoking before the age of 40 can restore up to nine years of life, offsetting the decade lost by the average smoker.[12] Furthermore, weight loss achieved through a hypo-caloric diet has demonstrated effectiveness as an anti-inflammatory intervention for chronic inflammation, evidenced by reductions in pro-inflammatory cytokine biomarkers.[35]

Adherence of Kuwaiti citizens to modifiable risk factors for cancer

Smoking is engrained in Arab culture but has become a matter of considerable concern in Kuwait due to high prevalence rates and associated health risks.[12,32-34] Reports indicate that around 45% of males and 12% of females smoke tobacco.[36,37] Research also suggests that 29.5% of adults use e-cigarettes,[38] 10% smoke shisha (known as *Argilah*),[39] and 14.4% of parents do not enforce a household smoking ban, exposing adults and children to second and third-hand smoke.[40] The prevalence of smoking, however, may be underestimated in qualitative studies due

to social desirability bias and the societal stigma associated with female smokers in the Arab culture.[34] These alarming statistics are associated with a relative risk factor (RR, 95% CI) in Gulf residents of 2.5 (2.00-3.13) for developing esophagus cancer, 8.96 (6.73–12.1) for lung cancer, and 2.77 (2.17–3.54) for urinary bladder cancer, among other cancer sites.[34]

Moreover, excessive body weight, the second most significant modifiable risk factor after tobacco smoking,[32] presents a substantial problem in Kuwait, with prevalence rates mirroring global highs.[37,41] In the national surveillance report, 37% of the 3589 evaluated participants were found to be overweight (body-mass index {BMI} 25–29.9 $kg \cdot m^2$), while 40.3% were classified as obese (BMI ≥30 $kg \cdot m^2$).[37] An equally concerning issue is the prevalence of overweight and obesity among schoolchildren, with rates of 20.19% and 28.39%, respectively.[41] In addition to dietary factors such as the nutritional density of food, macronutrient composition, and the excessive consumption of calories, it is conceivable that barriers to adhering to a physically active lifestyle in Kuwait may hinder the sustained regulation of energy balance through homeostatic and non-homeostatic pathways.[42]

Chronic respiratory diseases

Modifiable risk factors for chronic respiratory diseases

Chronic respiratory diseases represent the third leading cause of global death, with an estimated annual mortality of 3.6 million.[43] Among the umbrella of diseases, chronic obstructive pulmonary disease (COPD) and asthma are the primary contributors to the disease burden, accounting for an estimated 3.2 million and 0.4 million annual fatalities, respectively.[43] Research suggests that 73.3% of disability-adjusted life years (DALYs) linked to COPD morbidity can be attributed to modifiable risk factors.[43] Tobacco smoking and exposure to ambient particulate matter demonstrate a strong predictive influence on COPD DALYs. Factors such as household pollution and exposure to second-hand smoke further contribute to these outcomes, albeit to a lesser extent.[43]

In contrast, the influence of modifiable risk factors on asthma seems to be relatively minor, with tobacco smoking and exposure to occupational asthmagens collectively accounting for only 16.5% of asthma associated-DALYs.[43] The factors driving the escalating prevalence of asthma and the determinants of the condition remain poorly elucidated.[44] It is posited that chronic subclinical inflammation, potentially influenced by the accumulation of excessive adipose tissue and an altered gut microbiome, may underlie the pathogenesis of asthma and the co-occurrence of co-morbidities in affected individuals.[44,45] Therefore, further research on adiposity dysfunction is warranted. Despite the absence of direct evidence, the implementation of primary prevention strategies through lifestyle modifications, particularly increasing physical activity levels,[46,47] holds promise in the attenuation of chronic subclinical inflammation. This represents an innovative approach that may lead to a reduction in asthma exacerbations and an improvement of overall pulmonary health.[44]

Adherence of Kuwaiti citizens to modifiable risk factors for chronic respiratory diseases

Epidemiological data on the prevalence, morbidity, and mortality of COPD and asthma in Kuwait are notably scarce. The lack of empirical data suggests limited research on chronic respiratory diseases in the Gulf region, which may contribute to underdiagnosis and underestimated incidence rates. Nonetheless, available data indicate a prevalence of 7.1% for COPD and between 4.9% and 25.9% for asthma, respectively.[48,49]

Tobacco use, the foremost modifiable risk factor of COPD,[43] is elucidated under the lifestyle factors of Kuwaiti citizens in relationship to the modifiable risk factors of cancer. Regarding the exposure to ambient particular matter, a two-year assessment of air pollution in Kuwait demonstrates $PM_{2.5}$ matter levels almost four times higher than the proposed United States Ambient Air Quality Standard.[50] Further, a 10 $\mu g \cdot m^3$ reduction of $PM_{2.5}$ concentrations might avert 52 annual deaths, demonstrating the severity of air pollution in Kuwait.[51] Moreover, primary asthma prevention through lifestyle modifications holds promise for Kuwaiti citizens. In a recently conducted questionnaire, almost half of the respondents reported walking for less than 20 minutes daily.[52] In addition, 63.5% engaged in less than 20 minutes of other physical activities daily,[52] indicating a clear need for more physical activity to reduce asthma exacerbations and improve overall pulmonary health.[44]

Diabetes mellitus

Modifiable risk factors for diabetes mellitus

Diabetes mellitus is responsible for approximately 2 million deaths annually, making it the fourth leading cause of mortality among NCDs.[53] Type 2 diabetes mellitus (T2DM) accounts for nearly 95% of all diabetes cases, primarily driven by modifiable risk factors.[54,55] In contrast, Type 1 diabetes, which is an autoimmune disease, constitutes a much smaller portion of cases[53] and is less influenced by lifestyle changes. As such, this article focuses on T2DM due to its prevalence and the potential for prevention through lifestyle modifications.

Numerous comprehensive studies carried out across diverse demographic cohorts have delineated several modifiable risk factors associated with T2DM.[54,55] Predominant among these variables are pre-diabetes, smoking, physical activity, fruit and vegetable intake, body mass index, hypertension, and sleep patterns.[54,55] Notably, unhealthy sleep patterns, defined as sleeping for less than six hours or more than eight hours per night, emerge as the most significant modifiable risk factor following pre-diabetes and hypertension in individuals aged 75 years and older.[55] This particular age group represents nearly half of the mortality cases related to T2DM.[53] Likewise, among younger age groups, unhealthy sleep patterns are classified as the most prominent lifestyle risk factor.[55]

Unhealthy sleep patterns may contribute to an increased risk of developing T2DM by amplifying the excitation of the sympathetic nerve and affecting the systems that regulate the immune system, leading to abnormal inflammatory responses.[55,56] The presence of concurrent health conditions represents a risk factor for sleep disturbances, which can further compound overall health outcomes, thereby establishing a reciprocal relationship.[56]

Adherence of Kuwaiti citizens to modifiable risk factors for diabetes mellitus

The modifiable risk factors pertaining to T2DM have been expounded upon in the preceding sections, barring the sleeping patterns of Kuwaiti citizens. Residents have exhibited poor sleeping habits,[57] which have been found to impact metabolic and inflammatory biomarkers,[58] thereby increasing the risk of developing T2DM.[55] Based on the Pittsburgh Sleep Quality Index (PSQI), it is found that 59.6% of individuals nationwide experience poor sleep quality.[57] Additionally, 57.6% of respondents report sleeping less than the recommended minimum of 6 hours per night.[57] Interestingly, overweight and obese individuals tend to report shorter sleep duration, longer sleep latency, and more sleep disturbances compared to those with a BMI of 18.5-24.9 $kg \cdot m^2$.[57] These findings present supplemental evidence of the intricate interrelation between poor sleep quality, overweight and obesity, and co-morbidities.[56,57]

Suboptimal PSQI scores may be associated with the habit of retiring to bed post-midnight and accumulating sleep deficits.[58] The latter is evaluated as having a notably longer mean sleep duration during weekends compared to weekdays. Empirical findings suggest a correlation between bedtime and the average duration of sleep within the Kuwaiti population, with individuals retiring to bed after midnight showing an average sleep duration of 4.67 ± 1.00 hours, while those retiring to bed before midnight exhibiting an average sleep duration of 7.47 ± 0.74 hours.[58] In addition, after-midnight sleepers accumulate a more substantial sleep deficit (4.47 ± 1.88 vs. 1.89 ± 2.21 hours).[58] Moreover, nocturnal habits and significant sleep deficits are linked to increased salivary levels of pro-inflammatory cytokines, which in turn contribute to a heightened risk of chronic subclinical inflammation.[55,56,58]

Sociocultural and environmental barriers to healthy living in Kuwait

Kuwait has experienced substantial urbanization and population growth in recent decades, primarily driven by economic expansion linked to its oil-dependent economy. These changes have precipitated a series of transformations, including a marked nutritional transition characterized by the increasing prevalence of Western fast-food chains and a shift toward more sedentary lifestyles.[26,52] The proliferation of Western dietary habits is facilitated by global supply chains, even though individual factors such as taste preferences[25,27] and health literacy[29] play a critical role in shaping consumption patterns, highlighting the complex interplay between global influences and individual choices.[10] From a bottom-up perspective, inadequate nutritional knowledge among the population is a pivotal contributor to unhealthy dietary behaviors.[30] Individuals must be equipped with an understanding of the nutritional value and health benefits of various foods, as well as the capacity to incorporate this knowledge into their daily diets, a competency likely mediated via education and personal motivation.[59]

Additionally, the sedentary lifestyle observed in Kuwait, as well as in neighboring Gulf countries, is shaped by region-specific factors, such as the prevalent use of domestic houseworkers, which is closely linked to the region's economic affluence.[60]

Moreover, Kuwait's hyper-arid and scorching climate, with record temperatures reaching 54°C and dusty conditions persisting for over one-third of the year,[50] significantly affects the behavioral patterns of its population.[57,61,62] These two environmental factors exhibit a reciprocal interaction with the lifestyle determinants of the citizens, causing a cascade of behavioral modifications. In a qualitative analysis pertaining to physical activity levels in Kuwait, researchers found that over 75% of respondents identified extreme heat as the primary barrier to regular physical exercise, a factor cited more frequently than a lack of time.[61] Many physical and social activities, including social gatherings, are rescheduled to the late evening to avoid heat exposure, which leads to delayed mealtimes and sleep patterns.[57,62] The National Nutrition Surveillance Data indicates that approximately 54% of adults in Kuwait consume an evening meal at 10 p.m. or later.[62] Late meals may contribute to disruptions in circadian rhythms and lead to a typical bedtime past midnight.[57] Consequently, the sequence of behaviors mediated by the climate, such as avoiding daytime heat,[50] reducing physical activity,[61] postponing social interactions and meals until late evening,[62] and delaying sleep,[57] creates a significant barrier to maintaining a healthy lifestyle, adversely affecting metabolic health and overall well-being.[44,55,56,58]

Self-management recommendations

Preventive health screening and behavioural change

The previous discussion of modifiable risk factors for non-communicable diseases (NCDs) emphasizes chronic subclinical inflammation as a prevalent biological risk factor.[12,16,18,44,55,56,58] Chronic subclinical systemic inflammation (CSSI) is quantified as a two- to threefold elevation in circulating pro-inflammatory cytokines, which might act as biomarkers reflecting existing lifestyle behaviors.[46,58] Key predictive markers of CSSI include C-reactive protein (CRP), interleukin-6 (IL-6), and tumor necrosis factor-alpha (TNF-α).[13,46] Additionally, fasting plasma glucose testing can diagnose pre-diabetes (5.6-7.0 $mmol \cdot L^{-1}$) and Type 2 diabetes mellitus (≥7.0 $mmol \cdot L^{-1}$), both of which are associated with increased NCD risk.[15,54,55]

While these diagnostic biomarkers highlight the need for lifestyle interventions to reduce NCD risk, they do not indicate a direct causal relationship with specific modifiable risk factors. For instance, CSSI can be triggered by insufficient physical activity[46] and poor sleeping habits.[58] Moreover, diagnosis alone is often insufficient to initiate sustained behavioral change.[64] Evidence indicates that despite a Type 2 diabetes mellitus diagnosis, long-term lifestyle changes, such as increasing physical activity and improving dietary habits, remain suboptimal, with only modest improvements observed 2–4 years post-diagnosis.[64] This supports the need for comprehensive behavioral interventions that extend beyond diagnosis to prevent and manage NCDs effectively, yet this data could serve as the first trigger for behavioral change.

Although a detailed exploration of behavioral change frameworks is beyond the scope of this review, the seven-stage model of behavioral change, ranging from unawareness to the maintenance phase, where behavior becomes habitual, is a crucial roadmap for understanding the process of sustainable health behavior change.[65]

Healthy lifestyle recommendations

Table 2 summarizes the healthy lifestyle recommendations, practical considerations, and health benefits of adopting healthy lifestyle practices for the populace of Kuwait. Of particular importance is the adherence to a modest hypo-caloric Mediterranean diet, which effectively mitigates various risk factors associated with NCDs.[12,15,19,20,24,32,44,54,55,66] This dietary pattern incorporates staples of the Mediterranean region and can be integrated into existing cultural practices. Examples include consuming fresh salads as an appetizer and encouraging increased fruit intake by placing a fruit bowl in a commonly accommodated household area.[65,66]

Table 2: Recommendations healthy lifestyle habits for Kuwaiti citizens.

Recommendations	Practical considerations	Health benefits
Nutrition		
(i) Adherence to a modest hypo-caloric Mediterranean dietary pattern characterised by a low	(i) Consuming lentil soup and a fresh salad that includes nuts and legumes, dressed with extra-virgin	(i) Reduced chronic subclinical systemic inflammation.[35]

intake of red meats, refined carbohydrates, sugar-sweetened beverages, and dairy products.[66] (ii) A high consumption of whole grains, fruits, vegetables, nuts, and legumes is recommended.[66] (iii) Additional guidelines include avoiding all processed meats, consuming one cup of coffee daily, drinking one to three cups of green tea daily, incorporating pure chocolate in moderation, and using extra-virgin olive oil as the primary fat source.[66]	olive oil, serves as a nutritious appetizer. This combination is rich in antioxidants, fiber, and other bioactive compounds.[65] The low caloric density of these foods is likely to reduce total caloric intake during dinner, resulting in an anti-inflammatory modest hypo-caloric diet.[35,66] (ii) Other recommendations include having fresh fruits and snacks (e.g., nuts) in visible places,[66] and purchasing informational nutritional resources (e.g., books).	(ii) Mitigated the primary modifiable risk factors of cardio-metabolic death in Kuwait.[24] (ii) The informational resources,[30] combined with the visibility of healthy snacks,[65] increase awareness and the probability of consuming them.
Physical activity (i) Complying with an active lifestyle by striving for a minimum of 25 minutes of physical activity, such as walking, every day.[67]	(i) Utilizing public, air-conditioned facilities such as shopping malls to augment daily step count[61,68] and limit heat exposure.[61] (ii) Daily step count could be quantified with a consumer-based wearable activity tracker (e.g., Fitbit).[69]	(i) Reduced chronic subclinical inflammation.[46] (ii) Increased motivation through activity tracking.[69]
Sleeping habits (i) Cultivating sleep consistency—which means having a routine or regularity of sleep schedules that minimizes day-to-day variability in sleep parameters, such as bedtimes and sleep duration.[70] (ii) The midpoint of sleep should be before 3 a.m.[70]	(i) Retiring to bed before midnight.[58] (ii) Incorporating sleep hygiene practices, which could include stress management techniques, meditation, or guided breathing.[71]	(i) Reduced chronic subclinical inflammation.[58] (ii) Decreased sleep latency and improved sleep quality.[71] (iii) Reduced Type 2 diabetes mellitus risk.[55]
Tobacco consumption (i) Refrain from exposure to second-hand and thirdhand smoke.[12] (ii) Ceasing the use of all tobacco-containing products.[72]	(i) Adhering to a household smoking ban to preclude second-hand and thirdhand smoke exposure.[40] (ii) Utilizing nicotine replacement therapy (e.g., nicotine inhalator) for an increased odds rate of quitting.[72]	(i) Potential reduction in the risk of cancer-related mortality by as much as 28%.[32] (ii) Significant decrease in the likelihood of developing chronic obstructive pulmonary disease.[43]

When utilizing physical activity as a (preventive) medicine to mitigate NCD risk, it is recommended to engage in at least 25 minutes of aerobic activity daily.[46,54,55,67] This can be achieved through a single session or smaller movement intervals throughout the day.[67] It is anticipated that most of the accumulated physical activity minutes will be attributed to walking. That said, the prevailing public perception of an optimal daily step count needs more empirical support.[68] Instead, contemporary research reveals a dose-response relationship, indicating that an increased accumulation of steps throughout the day is associated with a more substantial reduction in all-cause mortality risk.[68] When a practical and feasible objective is desired for motivational purposes, 8,000 steps per day may be considered as it is linked to a 48% reduction in all-cause mortality risk.[68] It must, however, be underlined that lower step counts still yield health benefits, and surpassing the specified goal is associated with even more significant health benefits.[68] Moreover, utilizing a consumer-based wearable activity tracker is a prudent investment. It is associated with higher daily step counts, increased daily energy expenditure, and elevated moderate to vigorous physical activity levels compared to control groups not using wearable trackers.[69] On average, individuals using a device accumulate an additional 475 steps per day,[69] potentially reducing all-cause mortality risk by almost 6%.[68]

In the context of sleep, adherence to a pre-midnight bedtime and consistent sleep patterns emerge as pivotal determinants, alongside a minimum sleep duration of six hours per night.[58,70] These factors serve to reinforce the regularity of the circadian rhythm, a crucial element in the amelioration of chronic subclinical inflammation.[70] Integrating meditation and stress management techniques may reduce sleep onset latency, enhance sleep quality,[72] and potentially facilitate adherence to an earlier bedtime.

Finally, it is imperative to mitigate the risk of NCDs by abstaining from second-hand and thirdhand smoke inhalation and ceasing the use of tobacco-containing products.[32-43] Enforcing a household smoking prohibition is instrumental in shielding non-smokers from exposure.[40] For individuals who want to quit smoking, nicotine replacement therapy (e.g., nicotine inhalator) seems to be a valuable instrument for facilitating the likelihood of quitting.[72]

Conclusion

We have identified several modifiable risk factors for NCDs and assessed the adherence of Kuwaiti citizens to these risk factors. We also identified plausible sociocultural and environmental barriers in Kuwait to health-promoting behaviors. Based on the reviewed literature, we recommend a modest hypo-caloric Mediterranean diet, regular physical activity, consistent sleep routines, and strict avoidance of tobacco smoke as pivotal approaches to managing NCD risk in the Kuwaiti population.

Even though our review focuses on Kuwait, comparable trends of rising NCD rates and sociocultural and environmental constraints are likely present across other GCC member states. Therefore, our healthy lifestyle recommendations might be of regional relevance. Future research and targeted public health initiatives will be essential to promote these lifestyle modifications and address shared challenges across the region.

Disclosure

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