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Review Article

Policies to Decrease Dietary Risk Factors in Populations: A Scoping Review of the Global Experiences

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ABSTRACT

Background and Objectives: World health organization has identified unhealthy eating behaviors as one of the modifiable behavioral risk factors. Since sugar, salt, saturated and total fats, and trans-fatty acids are consumed much more than recommended, substantial decreases in these components as dietary risk factors are urgently needed. The study reviewed evidence on possible dietary risk decrease strategies to describe prevention programs.

Materials and Methods: In this study, SCOPUS, Web of Knowledge (ISI), EMBASE, PubMed, Google/Google Scholar, ProQuest, and Cochrane databases were searched from inception through 16 November 2022 to find policies that decreased consumption of dietary risk factors. Two researchers independently screened, appraised, and extracted the retrieved papers. Due to heterogeneity, only descriptive analyses were carried out.

Results: Four studies were included in the review. Three studies focused on decreasing sodium/salt and one on decreasing trans-fatty acids in industrial foods. Studies used various indicators and methods to indicate their achievements. The overall results based on the selected indicators demonstrated the projects' relative success in decreasing risk factors of foods.

Conclusions: Despite achievements in decreasing dietary risk factors in industrial foods, there is still a long way to go. Since various indicators show various aspects of the achievements, sufficient considerations in preparing sensitive and specific indicators are warranted.

Keywords: Risk factors, Diet, Sodium, Sugar, Trans fatty acids

Introduction

Non-communicable diseases (NCDs) such as cardiovascular diseases (CVDs), diabetes, cancer, and chronic respiratory disease (CRD) are the leading causes of over 38 million deaths and account for 16 million premature deaths (more than 40% of NCD deaths) globally (1, 2). Almost 70% of all NCD deaths (28/38 million) and a majority of premature deaths (85%, 13.8/16 million) occur in low and middle-income countries (LMICs) (3, 4). Based on the World Health Organization (WHO) reports, NCDs account for 82% of mortalities in Iran and there are currently primary concerns for the Global NCD Action Plan and Sustainable Development Goals due to their high global prevalence (1). The WHO has identified the key four modifiable behavioral risk factors including tobacco and alcohol uses, physical inactivity, and unhealthy eating behaviors as priority areas for decreasing NCDs (4). The Global Burden of Disease Study 2019 ranked the nutrition-related risk factors of NCDs as the major causes of death in Eastern Mediterranean Regional Office (EMRO) countries (5). Several factors including economic development and its effects on traditional food practices (increased consumption of processed foods high in fat, salt, and sugar), alteration of cultural norms (increased uses of tobacco and alcohol), physical inactivity, and increases in sedentary lifestyles contribute to the rapid increases in the global burden of NCDs (6).

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Since one of the major goals of WHO is to globally decrease death from NCDs by 25% by 2025, establishing national and regional strategies for controlling these diseases as well as supporting research studies in this area is a key public health target (1). Recently, WHO has designed several approaches to enable countries to collect core data on major risk factors that drive the disease burden with a flexible structure to allow various countries to adapt it to their domestic situations (7). Dietary risk factors are still much higher than that recommended with increasing CVDs, hypertension, diabetes, metabolic syndrome and cancers (8). To achieve a healthy food atmosphere, strategies such as production of diversified foods, food safety, food-based dietary guidelines, and food labeling have been suggested (9). In a healthy food atmosphere manufacturers are motivated to produce foods that include healthier nutrition profiles which motivate them to decrease dietary risk factors in food products. Significantly, policy approaches linked to decreased salt intake (10, 11), sugar, saturated fats, and industrial trans fatty acids (TFAs) (12, 13) have been carried out. Thus, comprehensive integrated strategies for decreasing NCD dietary risk factors have not been provided. The current study reviewed global strategies to decrease dietary risk factors in industrial foods in various communities. The addressees including policymakers and researchers can achieve the best policy based on their local circumstances.

Materials and Methods

Study design

A scoping review was carried out to assess interventions for decreasing consumption of dietary risk factors in populations. The current scoping review used the Arksey and O'Malley five-step process including (1) establishing the study question; (2) identifying relevant studies; (3) selecting appropriate studies; (4) mapping data; and (5) arranging, summarizing, and communicating outcomes (14). Hence, we adhered to preferred reporting items for systematic reviews and meta-analyses (PRISMA) extension for scoping review checklist (15). A protocol was not prepared for the current scoping review.

Data sources and evidence search strategy

In this review SCOPUS, Web of Knowledge (ISI), EMBASE, PubMed, Google/Google Scholar, ProQuest, and Cochrane databases were searched for relevant studies from inception through 19 November 2022. Search strategy of the highlighted databases has been presented in a supplementary table (Table S). Reference lists of the included full texts were reviewed for potential additional articles.

Study selection and inclusion criteria

Studies which assessed the strategies to decrease consumption of dietary risk factors in populations and contained quantitative outcomes were included. Full texts in English with no time limitations, trials, observational studies and natural experiments were included, as well. In the present study PRISMA flowchart was used to document the selection process (Figure 1) (16). Two reviewers (SA and MHS) carried out searches, extracted potential articles and removed duplicates. Two other investigators (MA and AD) independently assessed the titles and abstracts of all studies based on the inclusion and exclusion criteria to remove irrelevant studies. Full texts were retrieved for all articles seemed potentially eligible and screened independently by the investigators (MA and AD). Any discrepancies were resolved by the research team to reach a consensus.

Eligibility criteria

Table 1 summarizes the inclusion and exclusion criteria to assess the retrieved studies using participants, interventions, comparators, outcomes, and study design/setting approach (PICOS).

Quality assessment of the included studies

Quality of the included studies was assessed using Newcastle-Ottawa quality assessment scale (NOS) (17). This tool included three components of selection, comparability, and outcome. A study could be awarded a maximum of one star for each numbered item within the selection and outcome categories. A maximum of two stars could be received for comparability. The total score of this scale was nine stars and > 7 stars were described as high quality. One reviewer assessed data quality and the other one checked it. Disagreements were settled via discussion between the reviewers.

Data extraction and management

A purpose-adjusted individualized data extraction form with the consensus of the research team was developed. Information in data extraction form included three domains of 1) reference information: author and year; 2) characteristics of intervention: type of dietary risks, approach for dietary risk decreases, responsible/country, barrier(s), and enhancer(s) of the intervention; and 3) interpretation and assessment of the studies. Study characteristics can be accessed in Table 2. Further detailed data extraction of the outcome measures is present in Table 3.

Data synthesis

The quantitative analysis including meta-analysis and statistical pooling was not interested due to insufficient studies within similar outcome measures or interventions; therefore, evidence were summarized as narrative syntheses.

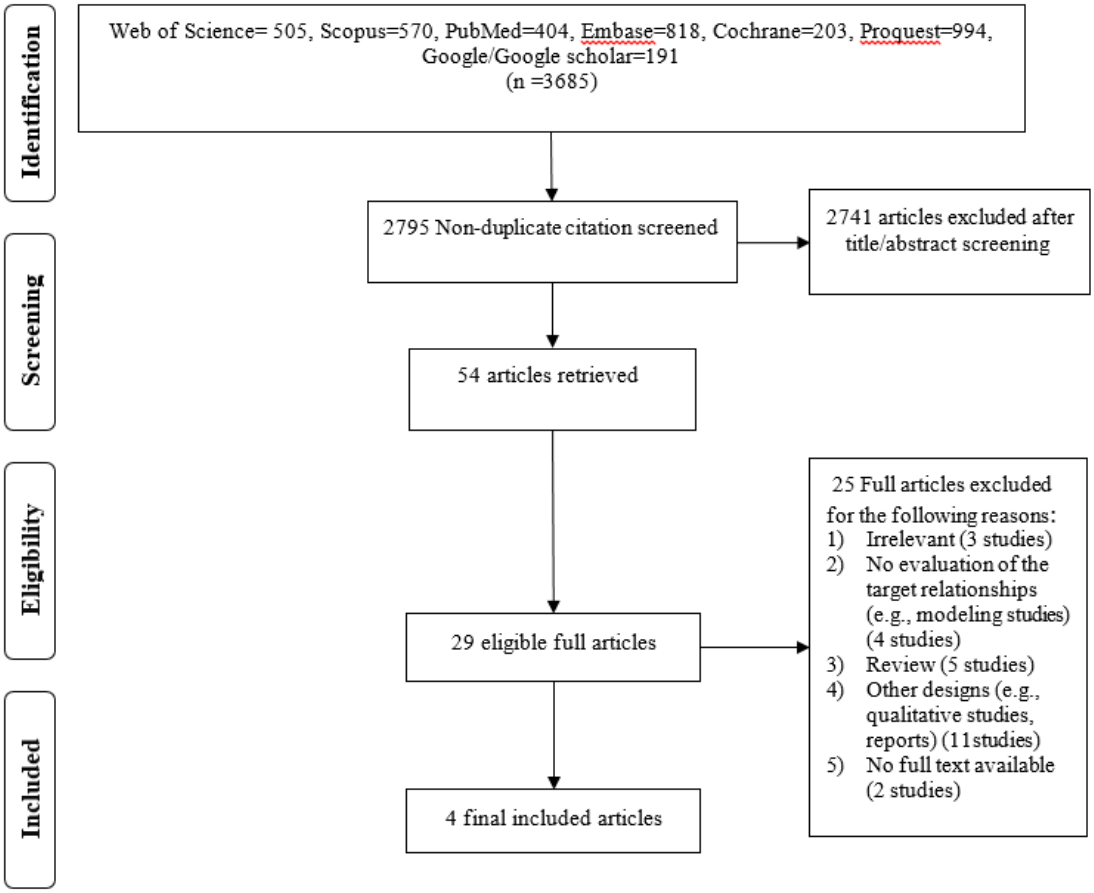

Figure 1. Flowchart for article selection

Table 1. Inclusion/exclusion criteria based on the PICOS

Participants	
Include	**Exclude**
Studies for all populations (all age groups) from different income countries (low/middle/and high income)	Studies on pregnant women, animals, and cells
Interventions	
Studies evaluate the strategies to reduce consumption of dietary risk factors by governmental policy or adopted in different settings, including food products reformulation, pricing/taxation strategies, food labeling policies, educational and incentives strategies	Studies evaluating the effect of a general or specific diet
Comparators	
all comparisons, including various interventions with or without control groups	-
Outcomes	
The primary outcome of interest was the reduction of dietary risk factors for NCDs, such as sugar, salt, saturated and total fat, and trans fatty acids. Secondary outcomes included changes in clinical/physiological indicators related to NCDs and behaviors associated with a healthy diet	Process evaluations reporting on implementing interventions/policies with no quantitative outcome data
Study design	
Trials, observational studies, and natural experiments	Modeling studies, systematic reviews, Commentary/opinion studies, and purely qualitative evaluations with no quantitative assessment, conference papers, books, thesis, and patents
Setting	
Different settings, including community, schools, kindergartens, workplaces, cafeterias, hospitals, child care centers, , canteens, and buffets	-

Results

Quality assessment

Quality of the studies were assessed based on the NOS scale. Studies were scored as poor/fair if they did not meet the desired criteria; for example, adequacy of follow-up and/or outcome assessment such as independent blind assessments.

Details of the included articles can be seen in Table 2. Of the reviewed articles, three focused on decreasing sodium and one on TFAs in processed/industrial foods. Canada, USA, and NZ targeted decreases in sodium in industrial foods and Brazil was the only country that assessed effectiveness of TFA decreases in processed foods. To decrease dietary risks in Canada, food industries worked with the government. However, National Salt Decrease Initiative, food industries, or the National Heart Foundation (NHF) was responsible in other countries. The major barriers for meeting goals of dietary risk decreases included low availability of salt-decreased foods, lack of information on sodium and serving size of the target foods, ambiguity of the fat terms that made consumers confused about TFA content of the food products, and high prices of healthier foods. Continuous efforts of the manufacturers to amend the nutritional values of their food products in addition to awareness of the customers were factors which facilitated the task.

Despite achievements in minimizing sodium and TFAs in food products, it seems that the countries are still at the beginning of the way to reach their goals and further efforts are needed to achieve positive effects of these measures in the communities. As shown in Table 3, various types of indicators have been reported in sodium minimizing approaches including ‘sodium or TFA content/density’, ‘sodium before and after reformulation’, ‘decrease of sodium/sodium difference’, ‘proportion of food products met definite benchmarks’, ‘proportion of food products exceeded benchmarks’, ‘changes in the sales-weighted mean (SWM) sodium densities’, and ‘quantities of the salt/sodium not added to the food products’. Although size of the effects varied within various projects, it could be understood that the ultimate effects were not satisfactory and the attempts slightly improved the status.

Discussion

In the present study experiences of four countries in decreasing dietary risk factors including sodium and TFAs have been reviewed. The only approach for sodium decrease included decreasing the content of sodium in industrial foods; however, indicators for assessing the approach varied. The high salt intake handles almost one-third of hypertension contributing to at least 40% of all heart diseases and strokes (18) and 1,500 mg daily upper limit of sodium is recommended by the American Heart Association (AHA) for everyone (19). Strategies such as public education, regulating sodium levels in foods and food labeling have been suggested to decrease sodium intakes. Food labeling may motivate consumers to purchase healthier options. Nutrition fact tables are used to convey information on contents of sodium in food products (19, 20). The present review assessed sodium content according to the nutrition fact tables in two studies (20, 21). Although the fact tables were easy and applicable for measuring quantities of sodium in food products, data have led us to mistrust their accuracy (22). In one study, food manufacturers were encouraged to reformulate their products to comply with the expected program (23). Although highly consumed food products were targeted in the program, the program included insignificant effects on decreasing blood pressure of the population because of insufficient number of the products. To increase effectiveness of such a program, incentivizing food systems to promote healthier options is a priority.

It is well understood that the risk of CHD, morbidity, and all-cause mortality may be increased by TFAs (24, 25). To prevent non-communicable diseases, international health authorities of the WHO and the Pan American Health Organization (PAHO) have recommended that TFAs to be eliminated in industrial foods. Policy approaches such as limiting TFAs in all industrial foods and forbidding production of hydrogenated oils as the major source of TFAs and a combination of the two policies are feasible approaches that can remove TFAs from the food products (26). One article assessed TFA reduction in manufactured foods in Brazil. The TFA level was measured in the laboratory indicating significant progress in decreasing target food products. It is stated that an indicator is “a variable whose value changes from the baseline level at the time the program began to a new value after the program and its activities have made their impact felt.” (27). Since indicators are essential elements of monitoring and assessment frameworks, they should be selected correctly. Although there are guidelines for selecting good indicators, managers must decide what indicators should be selected to achieve their objectives (27).

Table 2. Details of the included articles

Author (year)	Country	Dietary risk	Approach for dietary risk reduction	Acceptable limit of the target dietary risk[a]	Responsible/ Country	Barrier(s) of the intervention	Enhancer (s) of the intervention	Interpretation	Evaluation of the study	Quality assessment of the study
Arcand, J. (2016)(18)	Canada	Sodium	Decreasing the sodium in industrial foods	2300 mg/day	Health Canada (government) worked with the food industry/ Canada	The restriction of salt-reduced foods, both industrial and restaurant, limited their availability for consumers.	Non-stop attempts of industries owners in reducing and monitoring of sodium reduction	Progress has been made in the reduction of the sodium in industrial food items. However, the food industry should do more to reduce sodium and follow the achievements continuously.	Since the study relied only on the data of sodium labeled on the industrial foods, there was a possibility that the sodium values were not real.	The article was not of high quality
Curtis,C(19) . J.(2016)	USA	Sodium	Decreasing sodium content in packaged foods	Halfway to the recommended limit of 2300 milligrams per day.	National Salt Reduction Initiative/USA	All private label products and some branded products lacked the data of sodium and serving size	A combination of categorizing target foods prior to the study and continuous monitoring encouraged the food industry to reduce the content of sodium in the target foods in the USA.	Although industry progress was not promising, the setting of the national target and the partnership of the health organizations proved to be practical.	Data of food sales in the USA was not complete for all industrial foods Interpretability for private sector and some branded products was limited because of the data loss of sodium and serving size. Some categories had small sample sizes and dominancy of a few products in the categories reduced power. The source of the nutritional information was labels of Nutrition Facts which may differ from actual information. The change in the overall sample was not analyzed in all food categories.	The article was not of high quality
Dias, FSL. (2018)(20)	Brazil	TFA (trans fatty acids)	Decreasing TFA in processed foods	Less than 0.2 g per portion	Food industry/ Brazil	-Lack of standardization of fat terms did not inform consumers whether or not the food product has TFA, and it was confusing.	- TFA content was decreased in numerous foods by the industry. - More consumer knowledge in choosing healthier options	Despite significant progress in decreasing the TFA of processed foods in Brazil. Some foods especially fast foods and some types of biscuits need to be decreased even more.	An exclusion criterium for the survey was metabolic diseases or any medication which could change lipids of plasma; however, no blood sample was reported to be taken from the participants.	The article was not of high quality
Young, L.(2002)(21)	New Zealand	Sodium	Decreasing sodium content in industrial foods through reformulation or formulation of the food products.	Sodium content of 450 mg per 100 g or less of Bread; 400 mg of sodium per 100 g or less of Breakfast cereals; 400 mg of sodium per 100 g or less of Margarine and reduced fat spreads	NHF**/New Zealand	The healthier options may be more expensive.	- The manufacturers were motivated to amend the nutritional quality of foods. -NHF had been viewed as a credible, independent organization by the industry.	The impact of the program on the population's blood pressure was not detectible. To improve the effectiveness of Pick the Tick program, the market share and volume of the approved products and including a wide range of products and applying various strategies are needed.	The calculation of not added salt was based on average sodium level which was an estimate not the true. It was assumed that all sold foods were consumed. Information of food service sector was excluded which in turn underestimated the volume of product sold by almost 10%.	The article was not of high quality

[a]Acceptable based on the target of the study
**NHF: The National Heart Foundation of New Zealand

Table 3. Details of the indicators used for monitoring and evaluating the projects included in the review

Author (year)	No	Indicator(s) of dietary risk reduction	Type of indicator	Nominator	De-nominator	Definition	Size of the of effect	Data Source	Reporting Period	Expected limit [a]
Arcand, J. (2016)	1	Sodium content in foods	Outcome	-	-	Mg sodium/100 g of the food product based on the Nutrition Facts table	-In 16.2% of food categories sodium was reduced -Sodium increase in 1.9% of food categories	University of Toronto Food Label Information Program (FLIP) database	Once	25%–30% overall sodium reduction by 2016
		Reduction of sodium in food categories	Process	-	-	Classification of the food categories guided by Health Canada's document "guidance for the Food Industry on Reducing Sodium in Processed Foods"	-In 81.9% of food categories sodium was not changed.			
		The proportion meeting Health Canada's sodium reduction benchmarks	Process	Number of foods meeting Health Canada's sodium benchmark targets in 2010 and 2013	The number of all studied packaged food products	The proportion of foods that met at least one of the benchmark targets	- Slight increase in the proportion of foods that met at least one of the benchmark targets, from 51.4% of products in 2010 to 58.2% in 2013			
			Process	Number of foods meeting Health Canada's sodium benchmark, phase 1 from 2010 and 2013	The number of all studied packaged food products	The proportion of foods that met phase 1 benchmarks	Most categories made a positive change toward meeting the phase 1, 2, and 3 benchmark targets, increasing from 11.5% to 12.6%, 11.3% to 12%, and 28.6% to 33.6%, respectively from 2010 to 2013.			
			Process	Number of foods meeting Health Canada's sodium benchmark, phase 2 from 2010 and 2013	The number of all studied packaged food products	The proportion of foods that met phase 2 benchmarks				
				Number of foods meeting Health Canada's sodium benchmark, phase 3 from 2010 and 2013	The number of all studied packaged food products	The proportion of foods that met phase 3 benchmarks				

Author (year)	No	Indicator(s) of dietary risk reduction	Type of indicator	Nominator	De-nominator	Definition	Size of the of effect	Data Source	Reporting Period	Expected limit [a]
				Number of foods exceeding Health Canada's sodium benchmark targets in 2010 and 2013	The number of all studied packaged food products					
		The proportion exceeding maximum benchmark levels	Output			The proportion of foods that exceeded Health Canada's maximum benchmark level	The proportion of foods that exceeded Health Canada's maximum benchmark level reduced from 25.2% in 2010 to 20.8% in 2013			
Curtis C. J.(2016)	2	-Mean sodium density in packaged foods	Outcome	-	-	Mg sodium/100 g of the food product based on the Nutrition Facts table	-By 2014, 26% of categories met 2012 targets and 3% met 2014 targets. -The sales-weighted mean sodium density decreased significantly in abouthalf of all food categories from 2009 to 2014,.	The NSRI (National Salt Reduction Initiative) Packaged Food Database	Once	Sodium reduction in packaged foods by 25% over 5 years.
		-Food, categories meeting 2012 and 2014 NSRI* targets in percentage;	Output	Number of food categories meeting 2012 and 2014 NSRI targets	All 54 studied food categories					Reduction in SWM sodium density by 25%. Absolute and relative changes in SWM sodium density from 2009 to 2014 was calculated
		-Percentage of food products meeting 2012 and 2014 NSRI targets;	Output	Number of food products meeting 2012 and 2014 NSRI targets -	All studied food products -		-A 6.8%reduction in sales-weighted mean sodium density			absolute and relative changes in un-weighted mean sodium density from 2009 to 2014
		-Food category and meta category-specific changes in the sales-weighted mean (SWM) sodium densities	Process	-	-					
		-Overall change in SWM sodium density.	Output							

Author (year)	No	Indicator(s) of dietary risk reduction	Type of indicator	Nominator	De-nominator	Definition	Size of the of effect	Data Source	Reporting Period	Expected limit [a]
Dias, FSL. (2018)	3	-Levels of TFA among target manufactured foods	Outcome	-	-	Trans fatty acid (TFA) content (g/100 g) (presented by mean and SD) of 42 samples	TFA content varied between 0.00 and 0.86 g/100 g of processed foods with exception of one sample (12.92 g/100 g)	Results of a survey carried out in 2014–2015 in Rio de Janeiro	Once	Less than or equal to 0.2 g/portion
Young, L.(2002)	4	The amount of salt not added to food products	Outcome	--	--	Reformulation: The volume of product was multiplied by the difference between salt content before and after reformulation. Formulation: The difference between the average sodium level of food products without the Tick in the category and the actual sodium level of food product with the tick was used.	The program encouraged food companies to exclude 33 tons of salt through reformulation and formulation of the food products.	July 1998 to June 1999	Once	Decline in mean daily salt intake by 80-100 mmol(5-9 g).
		Sodium before reformulation (mg/100 g)	Input	--	--					
		Sodium after reformulation (mg/100 g)	Output	--	--					
		Sodium difference (mg/100 g)	Process	--	--					
		Sodium difference (%)	Process	Sodium difference (mg/100 g)	Sodium before reformulation					
		Volume of product sold (kg)	Process	--	--					
		Sodium not added to food (kg)	Outcome	--	--					

[a]Expected based on the recommendations.
*NSRI: The National Salt Reduction Initiative.

Although the ultimate aim in the three studies of sodium decrease was similar, indicators used for assessing effectiveness of the projects varied. According to Arcand and Cutris study process and output indicators provided information on the weighted average sales of sodium density in addition to the number of target food groups which provided a clearer interpretation of the project's success. In Dias study only one indicator was used for assessing a project which aimed to decrease TFAs. Result interpretation was possibly different if multiple indicators were selected which could detect other aspects of the project. As shown in Table 3, the major outcome indicator in Young's study was the quantity of not added salt to food products. Based on the study although salt was reported as the outcome indicator of interest, sodium was measured in practice then converted to salt to fulfill the aim of the project. Although the current study searched all the relevant databases, number of eligible studies was not sufficient to discuss deeper about more aspects of the projects of interest. Therefore, if more studies were available, further accurate comprehensive assessments of policies on dietary risk decreases were possible.

Conclusions

Despite achievements in minimizing dietary risk factors in food products, it seems that countries are still at the beginning of the way and much more efforts are needed to gain effects of these measures in the communities. Since no judgments about the effectiveness are possible by accurate indicators, sufficient considerations in this regard are highly recommended.

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Authors' contribution

AD contributed to conceptualization, articles screening, drafted the original paper, and reviewed & edited the manuscript. MA contributed to conceptualization, articles screening, and data extraction, drafted the original manuscript, and reviewed & edited the manuscript. MF contributed to data extraction and interpretation and revised the manuscript critically. SA & MH contributed to the conception and design of the study and acquisition of data. All authors gave final approval of the version to be submitted.

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