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REVIEW ARTICLE

Dietary Sodium and Potassium Intakes and Salt Reduction Strategies: Systematic Review in Africa (2012-2022)

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Summary

Excessive salt/sodium (Sodium > 2 grams/day, equivalent to 5 g salt/day) and low potassium (less than 3.5 grams/day) intake increases the risk of heart attack and stroke. To fight against cardiovascular diseases, the nutritional strategy is to regulate the dietary intake of salt/sodium and potassium according to set standards.

Objective: This review aimed at documenting salt intake levels and the potential impact of salt reduction initiatives in Africa, based on studies published between January 2012 and April 2022.

Methods: These studies were obtained thanks to PubMed/MEDLINE electronic data, Google Scholar and specialized literature. The PRISMA guidelines were used to conduct the systematic review.

Results: The synthesis produced 583 articles of which 39 studies matched our inclusion criteria. Among these 39 studies, 24 (including 3 systematic reviews and one study) assessed the intake of salt/sodium and potassium from urine tests. Seven studies assessed the salt/sodium content in food and 7 other studies focused on the awareness, attitudes, beliefs and practices of populations with regard to salt intake. One study focused on modelling. Salt intake varied from one country to the other; all countries had an intake level beyond set standards (< 5g/d/p).

In Benin, for instance, the intake level was 4.4 g/24 h of sodium and 1.8 g/24 h of potassium. In Ghana, the estimated salt intake was 8.3 g/day and 6.8 g/day in South Africa. The salt content assessed in food also differed from one country to the other. In Nigeria, for instance, the sodium content was 1.36 g per 100 g of bread while it was 7.63 g (SD 3.12) per 100 g of bread in Tunisia. In Morocco, it was 8 to 9 g of salt for 100g of bread while it was 6 g in South Africa.

The awareness of salt/sodium intake and of food rich in potassium has increased over the last decade. In South Africa, for instance, it has been noticed an evolution of 38 % to 59.5 % ($p < 0.0001$) with people having improved upon their awareness further to mass sensitization campaigns. Some studies carried out both in South Africa and Ghana helped notice positive changes further to abiding by the salt-reduction bill, voted in July 2016. Most countries that have either benefited from the WHO (SAGE) support or adopted one of the national strategies in salt reduction like the South Africa's legislation, notably sensitization in Ghana and Nigeria, results proved to be encouraging.

Conclusion: This study reveals a significant decrease in salt intake in countries having adopted important strategies of salt reduction over this decade. However, these efforts must be maintained by the whole of of countries if we wish to meet worldwide 30% reduction objective in 2025.

Keywords

Food intake, Sodium, Potassium, Salt, Africa

Introduction

Non- Communicable Diseases (MNT) are generally chronic ones, with rather slow effects, they take much time to evolve and are generally not communicable from one person to the other [1]. These include essentially cardiovascular diseases, cancer, chronic lung affections and diabetes. They constitute the main mortality cause worldwide [2-4]. A high intake of salt /sodium (Sodium > 2 grams /day, equivalent to 5 g of salt/day) and a low intake of potassium (less than 3.5 grams/day) favour high blood pressure and increase the risk of heart attack

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and stroke [5-8]. According to the Global Burden of Disease (GBD) study carried out in 2017, a sodium-rich intake is pointed out as the main food risk causing death and years of disability (DALY) [9]. Worldwide, databases on sodium intake in the world show that the required standard is by far exceeded whereas potassium which is highly recommended is less consumed [5]. Indeed, a low intake of salt/sodium and a high intake of potassium results into a combined action in the THA decrease and the prevention of cardiovascular diseases [10-12]. In Africa, some studies on the salt intake among the population determined by the collection of urine in a day have proved that the average salt intake (ET) with African adults varied from 6.8 (2.2) g to 11,3 (5,4) g/day [13]. In Togo, despite the lack of data on sodium and potassium intake, the prevalence of high blood pressure (25-64 years: 19 % in 2014) [14] and the influence of cardiovascular diseases (MCV) on people's health [15,16] show that an assessment and a survey of salt and food intake and potassium is necessary for the prevention of MCV/MNT.

Considering the evidence which shows the link between a high intake in salt and cardiovascular diseases and other ones, world leaders committed themselves in 2011 during the UN General Assembly to prevent and control Non-Communicable Diseases (MNT), to reduce people's exposure to inadequate food intake and to reduce salt-intake of the population as a necessary step to alleviate the world burden due to MNT. In 2013, AMS adopted nine world voluntary objectives for preventing and controlling Non-Communicable Diseases (MNT) which include a relative reduction of 30% of salt intake by the 2025 horizon through world action plan for preventing and controlling Non-Communicable Diseases 2013-2020 [17]. Some studies were carried out on salt intake of the population namely those by the WHO on the world ageing population and the adult (WHO-SAGE).Such mass studies were carried out in six countries (China, Ghana, India, Mexico, Russia and South Africa) in three respective waves: wave 0 (2004), 1 (2007-2010) 2 (2014-2015) 3 (2018-2019) and a few reviews systematically were carried out in Sub-Saharan Africa [13,18,19]. With the recent systematic reviews carried out in Africa, we believe that other studies might have brought along new changes about the new salt intake rates. Hence, we deduce that: "Sodium intakes remain high and potassium intakes low in many African countries. Implementing optimal intake strategies for these nutrients is effective". To verify this hypothesis, we set as objective to document systematically all the studies concerning salt/ sodium and potassium intake in Africa and aimed at implementing the WHO recommendations about salt intake reduction. This will enable us to adjust strategies in fighting against cardiovascular diseases and to reduce mortality caused by non- communicable diseases [20,21].

Competint interests

We do state that there are no conflicts of interests throughout the procedure of this general excerpt. To this end, the current study was carried out as a systematic review to identify, list, describe and summarize the main studies carried out about salt/sodium and potassium intake to assess the implementation level of recommendations in the fight against MCV/MNT. Our objective was to summarize the existing database on the salt intake levels in Africa. This step will enable us to identify the various strategies to fight against excessive salt/sodium and low potassium intake.

Methods

Research strategy

The PRISMA guidelines [22] were used in writing completely the systematic review. A documentary research was carried out in March and April 2022 thanks to PubMed/Medline database, Embase and Google Scholar and was updated in May 2022. It was completed by a specialized literature research using the same terminologies in Google, WHO's sites and by experts in nutrition and Non-Comunicable Diseases (MNT). These research strategies used for biometric database are considered as supplementary materials. A manual research of references was done based on the excerpts of articles from these very databases.

Admissibility and inadmissibility criteria

A study is complete if the following criteria are met: Complete publications available on line, both in English and French between January 2012 and April 2022, concerning the salt intake of the population, the salt levels in food, the awareness, the attitudes, the practices and the people's behavior. Modelling studies were also included. Duplicate publications, conference minutes and review articles were excluded.

Two examiners carried out the research, excerpted potential articles and deleted duplicate publications. Next, they independently examined the titles and summaries for eligibility. Entire passages were retrieved from all articles deemed to be potentially eligible, and these ones had been independently examined with disagreements which were solved by discussions.

Distorted assessement

To avoid methodological errors and analysis about collected data which could cause systematic consequences on the quality of this current literature review, distorted facts were highlighted to assess the quality level of the selected studies in compiling this systematic review. This is specifically about the confusion between a bad analysis or a controversial factor which has no link of cause with the study.

Data collection

Data collection took place by simultaneous documents reading by scholars. The collected data concern on one hand the authors, the years of studies, the publication date, the country of the study, the design of the study, the characteristics of the population and the summary of the results. The data collection was carried out by the leading author and revised by the second author.

Results analysis

A narrative synthesis of the results (descriptive approach) was undertaken due to the hybrid nature of the collected results in the studies.

Results

Results of the rechearch (data synthesis)

The Figure 1 shows the chart of PRISMA (Preferred

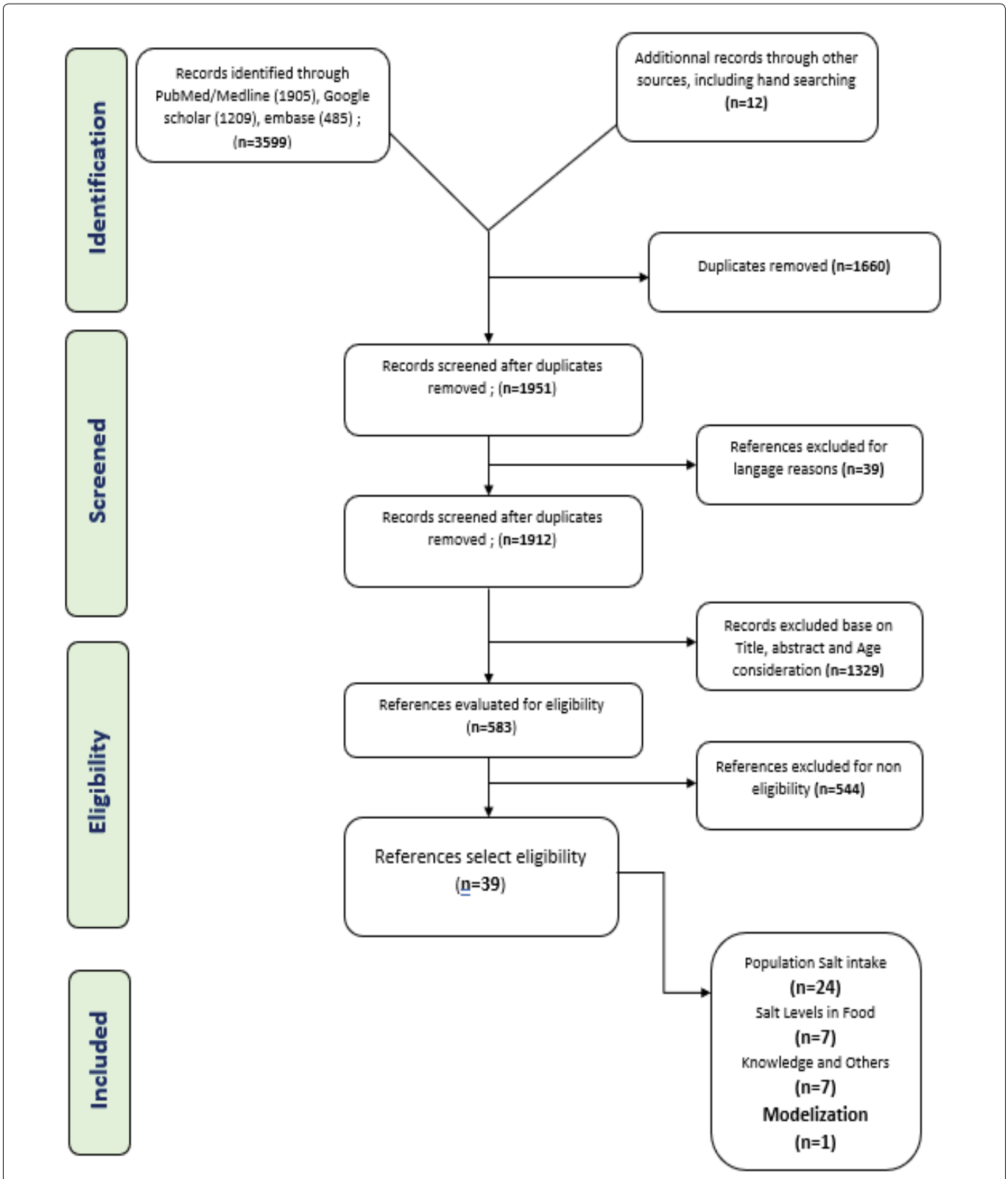

Figure 1: Monitoring and implementation of salt reduction initiatives in Africa: A systematic review.

Table 1: Classification of studies conducted in the 15 Africa contries.

Country name	Evaluation studies	Salt intake in the population	Salt levels in foods	Knowledge, attitudes and behaviour	Modelling studies
	Articles referencenumbers				
South Africa	[28,30]	[23,24,26,27,29,31,35]	[36]	[32-34]	[25]
Benin		[37,39]		[38]	
Cameroon		[40]			
Cape Verde		[41]			
Ethiopia		[42]			
Ghana	[30,44]	[26,43]			
Guinea				[38]	
Kenya				[38,45,46]	
Seychelles				[38]	
Malawi		[47]			
Morocco			[48,49]		
Mozambique		[50]	[52]	[38,51]	
Nigeria		[53,54]	[55,56]		
Uganda		[57]		[57]	
Tunisia			[58]		
SSA		[13,19,59]	[13]	[13]	

Reporting Items for Systematic Reviews and Meta-Analyses) of our research, which offers 1951 quotatio ones, after removing duplications. Among these ones, 1329 were removed from the database based on filtering of titles, summaries and age targets. The selection of a complete text of 583 articles of the remaining synthesis identified 39 studies that matched our inclusion criteria. Among the 39 studies, 25 (of which 3 systematic reviews and one study) assessed salt /sodium and potassium based on urine tests. Seven studies assessed the salt/ sodium content in food and 7 other studies focused on the awareness, the attitudes, the beliefs and the practices of the populations with regard to salt intake. One study focused on modelling. Seven studies assessed the salt/sodium content in food and 7 other studies focused on the awareness, the attitudes, the beliefs and the practices of populations with regard to salt intake. One study focused on modelling (Table 1).

Study characteristics

Fifteen African countries in all reported on 39 studies on salt and MCV/MTN. The studies included a range of study designs, including 25 cross-sectional studies, 11 case-control studies, 2 mass studies, and 01 modelling study (Table 2).

Salt intake of the population

Twenty-four studies carried out in 12 countries reported on salt intake. Of these studies, 24 estimated both potassium and sodium intake; only 29 only estimated sodium intake in order to assess the level of salt intake in relation to blood pressure. Although salt intake varies depending on countries, all had an intake beyond set standards (< 5g/d/p). Therefore, in Benin, for instance, 4.4 g/24 h of sodium and 1.8 g/24 h of potassium was reported [39]. In Ghana, the estimate of salt intake was 8.3 g/day and 6.8 g/day in South Africa [24,40].

Salt level in foods

Seven studies in 5 countries estimated salt level in food. The most consumed foods were selected for tests, namely the used bread. Salt levels differed according to countries. Therefore, in Nigeria the salt content was 1.36 g/ 100 g of bread while it was 7.63 g (ET 3.12)/ 100 g of bread in Tunisia. In Morocco, it was 8 to 9 g of salt/ 100g of bread while it was 6 g in South Africa.

Awareness, attitudes, beliefs andpratices

Similarly, seven studies carried out in 5 countries assessed the behavior of populations in relation to salt. They aimed at improving the populations awareness for a considerable reduction in the intake of food highly in sodium (Na) versus food rich in potassium. Some of these studies were able to assess consumers'awreness after mass sensitization campaigns. In South Africa, for instance, we observed an increase from 38% to 59.5% ($p < 0.0001$) of people having improved upon their awareness level after a mass sensitization campaign [34]. In Kenya, the STEPS survey showed that 89.5% reports on food intake was highly rich in sodium and foods intake was low in potassium [46].

Post-reduction strategy assessements

Three studies conducted in two countries, Ghana and South Africa, were able to assess the effects of salt intake

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Table 2: Summary and characteristics of the studies included in the systematic review.

Authors and year of publication	Location (Study leader)	Type of study	Nature of intervention/ strategy	Target(s) of interventions	Duration of interventions	Impact of interventions	Prevalencemea-suredbefore interven-tion	Prevalence after interventions	Proportion of reduction	References
WHO's supported interventions on salt intake reduction in the sub-Saharan Africa region, Juin 2015 (Revue systématique)	ASS	Revue des interventions soutenues par l'OMS de 2005 à 2014	Résumé des différentes stratégies d'intervention de réduction sel	Personnes âgées de 25 ans et plus	10 ans	**En cours…**	> 10g/j (Exemples de Afrique du Sud et Ile Maurice : 7,9g/j)	**NA**	**NA**	[59]
Sodium and potassium intake in South Africa : an evaluation of 24-hour urine collections in a white, black, and Indian population Novembre 2016	South Africa	Étude d'observation (Cas Témoins)	Estimation des niveaux de consommation Na/K	692	Août à Décembre 2015	Necessité me mise en œuvre de la législation	(Na et K) 122,9 et 33,5 mmol/j Sel: 7,2g/j	**NA**	**NA**	[23]
Salt and potassium intake among adult Ghanaians: WHO-SAGE Ghana Wave 3; Septembre 2020	Ghana (Wave3)	Étude transversale de Juin 2018 à Juin 2019 où Chine, Ghana, Inde, Russie, Mexique et ADS	Estimation des niveaux de consommation Na/K	839 Personnes âgées de 18 ans et plus	1an	Le rapport sodium/ potassium avait un impact plus important que le sel sur la TA	8,3 g/jour K< 90 mmol/j	**NA**	**NA**	[43]
WHO SAGE Wave 2 Salt \& Tobacco, Ware, Lisa J and Charlton, K and Schutte, Aletta E and Cockeran, M and Naidoo, Nirmala et Kowal, Paul; Juillet 2017	South Africa (Wave2)	Transversale de Août en Septembre 2015. 6pays (Afrique du Sud, Ghana, Inde, Russie et Mexique Chine)	Estimer les apports alimentaires Na/K et TA (Législation)	2971 Personnes âgées de 18 ans et plus	Août à Décembre 2015	Le rapport Na/K avait un impact plus important que le sel sur la tension artérielle liée à l'âge	6,8 g/jour K: 35 mmol/j	**NA**	**NA**	[24]

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Mizéhoun-Adissoda C, Houinato D, Houehanou C, Chianea T, Dalmay F, Bigot A, Aboyans V, Preux PM, Bovet P, Desport JC. Dietary sodium and potassium intakes: Data from urban and rural areas. Nutrition. 2017Jan;33:35-41. doi: 10.1016/j.nut.2016.08.007. Epub 2016 Sep 7. PMID: 27908548.	Benin	Transversale, rétrospective de Novembre 2012 à Septembre 2013 réalisée sur 420 patients réparties en milieu rural et urbain	Le but de cette étude était d'estimer les apports alimentaires en sodium et en potassium sur la base de collectes d'urine de 24 heures	420 individus (âgés de 25 à 64 ans)	1 an	Necessité de mettre en place une intervention de réduction d'apports en sodium et d'augmentation du potassium	4,4 g/24 h de sodium et 1,8 g/24 h de potassium	**NA**	**NA**	[37]
Electronic Document Format (ISO) BERTRAM, Y et al. Reducing the sodium content of high-Saltfoods: effect on cardiovascular diseases in South Africa. 2012	South Africa	Étude de modélisation	1ère étude de prédiction (l'effet potentiel d'une politique de réduction du sel sur la santé en Afrique du Sud)	18 ans et plus	NA	Diminution prédictive de consommation de sodium	8,1 g	0,85 g/ personne/jour.	ND	[ ]
Leveraging ongoing research to evaluate the health impacts of South Africa's salt reduction strategy: a prospective nested cohort within the WHO-SAGE multi country, longitudinal study, Novembre 2016	South Africaand Ghana (Waves 2)	Étude comparative Cas et Témoins	Législation de réduction du sel en Afrique du Sud et non législation au Ghana	1200 de chaque pays âgé de 18 ans et plus	1 an (2014-2015)	Effets bénéfiques de la législation à étendre dans les autres pays d'Afrique	5,8-13,8 g de sel/jour (Ghana et Afrique du Sud) (Campagne) **Japon** : H, 14 g à 11 g F : 12g	(Campagne) **Japon** : Homme : 11 g Femme : 10 g	2 à 3g/j (Japon) 10% (Royaume Uni)	[26]
Monitoring and implementation of salt reduction initiatives in Africa: A Systématic review? 8 août 2020	SSA	Revue systématique	Evaluation des niveaux de consommation en sel, Stratégies de réduction	Populations	**Nov. 2018 à Nov. 2019** janvier 2009 et novembre 2019 (Période de la RS)	Non encore disponibles	Niveaux d'apports de sel et décès liés aux MCV	ND	ND	[13]

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Alves D, Santos Z, Amado M, et al. Low potassium and high sodium intakes: a double health threat to Cape Verdeans. *BMC Public Health*. 2018 ;18(1):995. [PMC free article] [PubMed] [Google Scholar], 9 août 2018	Cape Verde	**Étude transversale** Dans le cadre du projet UPHI-STAT : Urbanisme et inégalités de santé – passer de la macro à la micro statistique	Evaluation des niveaux de consommation du sodium et du potassium alimentaires en milieu intraurbain	559 de 18 ans et plus	Janvier et octobre 2014	Estimation des niveaux de consommation de Na et K et orientations sur les actions correctrices	L'apport médian (intervalle) de sodium chez les adultes capverdiens âgés de ≥ 18 ans était de 3707,4 mg/j (IQR : 2308,6-5219,7 mg/j) K: 2924.2mg/j (2208.9–3726.2)	**ND**	**ND**	[41]
Urinary sodium excretion and determinates among adults in Ethiopian: Findings from National STEPS Survey;2017	Ethiopia	Étude transversale	Estimation de la consommation du sel	6761 de 15-69 ans	Avril à Juin 2015	Ras	8,3 (IC à 95 % 8,2-8,4)	**ND**	**ND**	[42]
A lowered salt intake does not compromise iodine status in Cape Town, South Africa, where salt iodization is mandatory, Avril 2013	South Africa	Étude transversale	Estimation de la consommation du sel	262 de 20 à 65 ans au Cap, Afrique du Sud	1an	Une grande partie du sel alimentaire provient de sources non iodées, vraisemblablement ajoutées aux aliments transformés	Blancs (9,5 g/j) Mixte (8,5 g/j) et Noirs (7,8 g/j)	**ND**	**ND**	[27]
Dietary sodium intake in urban and rural Malawi, and directions for future interventions, Septembre 2018	Malawi (Karonga and Lilongwe)	Étude transversale	Estimation de la consommation du sel	1027 de 18 ans et plus	Mai 2013 à février 2015	ND	6,8 g en milieu rural et de 7,1 g en milieu urbain	**ND**	**ND**	[47]
Urinary Sodium and Potassium Excretion and Dietary Sources of Sodium in Maputo, Mozambique, Août 2017	Mozambique	Etude comparative Cas et Témoins	Estimation de la consommation du sel	100 de 25 à 64 ans	Octobre 2012 et mai 2013	ND	10,6 (4,6) g	**ND**	**ND**	[50]
Modèles d'excrétion de sodium et de potassium et de la pression artérielle dans la diaspora africaine, Mai 2011	Nigeria	Etude comparative Cas et Témoins	Estimation des niveaux de Na et K et relation avec HTA	2 704 personnes du Nigéria, de la Jamaïque et des États-Unis	1an	ND	Sodium moyen 145,5 (63,1) mmol	**ND**	**ND**	[21]

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Effect of South Africa's interim mandatory salt reduction programme on urinary sodium excretion and Blood pressure, Juin 2021	South Africa	Etude d'évaluation	Évaluation de la stratégie de législation sur la réduction du Sel	1299 (W2) 1189 (W3)	Août-décembre 2015 (W2) juin 2018-juin 2019(W3)	Réduction de 1,16 g de sel par jour entre 2015 et 2018/ début 2019	7,8 (4,2, 9,5) g de sel/ jour 5,8 (4,0 ; 8,5) g/jour (50+)	**7,7 (4,1, 9,2) g de sel/jour 6,0 (4,0 ; 8,6) g/jour (50+)**	**1,16 g/jour (P = 0,028)**	[28]
How will South Africa's mandatory salt reduction policy affect its salt iodisation programme? A cross-sectional analysis from the WHO-SAGE Wave 2 Salt & Tobacco study, 2018	South Africa	Etude transversale (observation)	Estimer les apports en sel et vérifer si le faible apport était associé à la carence d'iode	2887 de 18 ans et plus	5 mois	Association du faile apport en sel (<5g) à la carence en iode	Na : 6,3 g/jour Iode UIC : 130 µg/L (IQR = 58–202)	**ND**	NA	[29]
Salt-reduction strategies may compromise salt iodization programs: Learnings from South Africa and Ghana, Avril 2021	South Africa& Ghana	Etude comparative Cas et Témoins	Evaluer l'effet de la législation dans la réduction de consommation du sel	Ghana =495 SA = 707 18 ans et plus	9 mois août 2018-avril 2019	Necessité de la législation	Afrique du Sud 8,2 g/jour	Afrique du Sud Sel 5,6 (p:0,0001) et UIE médian = 100,2 µg/L Ghana Sel 10,7g/j (P:0,0001) UIE 182,4 µg/L	2,6	[30]
Apports en sel en Afrique subsaharienne : revue systématique et méta-régression, 2016	SSA	Revue systémtique	Evaluer le niveau d'apport en sodium	Enfants et adultes	ND	Efforts de réduction de 30% de consommation de sel	Environ 10g/j	**NA**	**NA**	[19]
Un programme communautaire pour réduire la consommation de sel et la tension artérielle au Ghana, Jan 2006	Ghana	Etude comparative Cas et Témoins	Effets de sen-sibilisation communau-taire dans la réduction du Sel au Ghana	Populations	6 mois	2,54 mmHg [-1,45 à 6,54]) et diastolique (3,95 mmHg [0,78 à 7,11], p = 0,015)	Avant : 50 mmol d'UNa par jour, p < 0,001)	47,46 mmold'Una	2,54 mmHg [-1,45 à 6,54]) et diastolique (3,95 [0,78 à 7,11], p = 0,015)	
Knowledge and behaviors regarding salt intake in Mozambique. Eur J Clin Nutr.2018, 2018	Mozam-bique	CAP	Des. Conn. sur la consommation du sel	15 à 64 ans (n = 3116)	ND	Nécessité d'une campagne de réduction	NA	NA	NA	[51]

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Food Consumption, Knowledge, Attitudes, and Practices Related to Salt in Urban Areas in Five Sub-SaharienAfrican. Countries, 2018	Benin ;Guinea ;Kenya ;mozam-bique; Sey-chelles	CAP Etude d'observation au Bénin ; Guinée ;Kenya ; mozambicain ; Les Seychelles	Décrire et comparer les CAP des adultes liés au sel dans les zones urbaines de cinq pays d'Afrique subsaharienne	588 de 25 à 65 ans		Nécessité d'une campagne de réduction	NA	NA	NA	[38]
Urinary sodium excretion and its association with Blood pressure in Nigeria : A nationwide population Survey, Oct. 2020	Nigeria	Etude d'observation (transversale)	Estimation du Na et K urinaires (ponctuelles)	2503	Mars 2017 à avril 2018 (1an)	Nécessité d'une stratégie de réduction de consommation du sel	Na 99,3mmol/j (105,0) K : 16,3 (13,1)	NA	NA	[54]
Suivi de l'apport en sel de la population sud-africaine : urine ponctuelle vs urine de 24h,Fév. 2018	Afrique du Sud	Etude d'observation (transversale)	Comparaison entre les différentes méthodes d'estimation de l'excrétion de Na/K	681 [blancs (n 259), noirs (n 315) et indiens (n 107)]	ND	Intelsat meilleur	Intelsat :Na : 161 mg/j /j, IC à 95 %-4038, 4360	NA	NA	[20]
Knowledge, attitudes and perception on dietary salt reduction of two communities in Grahamstown, South Africa, Mars 2017	South Africa	CAP	CAP	100	Aout 2015 à Jan 2016 (6 mois)	Necessitité	NA	NA	NA	[32]
Liking, salt taste perception and use of table salt when consuming reduced-salt chicken stews in light of South Africa's new salt regulations, Jan 2016	South Africa	Etude d'observation (transversale)	impact de la réduction du sel sur le goût	432	6 mois	Possibilité de réduire l'apport en sodium sans perception des	NA	NA	NA	[33]
Evaluation of a Mass-Media Campaign to Increase the Awareness of the Need to Reduce Discretionary Salt Use in the South African Population, Nov 2017	South Africa	Etude d'observation (transversale)	Connaissance, Attitudes et Croyances	550	ND	Améliorer la connaissance des bénéficiaires	38 %	59,5 %	38 % à 59,5 %,p < 0,0001)	[34]

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Influence de la consommation de sodium et des connaissances associées sur l'hypertension post-AVC en Ouganda, Septembre 2016	Ouganda	Etude d'observation (transversale) cas témoins	Estimation du Na urinaires et Sel et CAP	350	Janvier 2014 et août 2015	Nécessité de stratégies éducatives qui incluent les préférences alimentaires en sel pour contrôle de PA	≥ 8,5 g/j	ND	NA	[57]
Estimation of Daily Sodium and Potassium Excretion Using Spot Urine and 24-Hour Urine Samples in a Black Population (Benin), Juillet 2016	Benin	Etude d'observation (transversale) cas témoins	Estimation de Na et K urinaires	354 âgés de 25 à 64 ans	6 mois	Evaluation des méthodes de concordances des urines ponctuelles avec les urines de 24h	Urines ponctuelles : Nacl/Kcl: 10,2 ± 4,9 g/24 h et de 2,9 ± 1,4 g/24 h Estimés 24h: Nacl/Kcl: 10,7 ± 7,0 g/24 h et de 3,9 ± 2,1 g/24 h	ND	NA	[39]
Prediction of 24-hour sodium excretion from spot urine samples in South African.Adults :acomparaison of four equations, Jan 2020	South Africa	Etude d'observation (transversale)	Évaluer systématiquement la validité de quatre équations existantes d'estimation du Na urinaire	438	Août à Décembre 2015	Intelsatsous estimé, les autres sur estimé, utilisation de Kawasaki et Tanaka pas recommandé	6,7 g de sel/jour	ND	NA	[35]
Association of urinary sodium excretion with Blood pressure and Risk factors Associate with hypertension among Cameroonian pygmées and bantus : a cross-sectional study, Mars 2018	Cameroun	Etude d'observation (transversale) cas témoins	Association de Na et TA. programmes de prévention communautaires rentables	300	Novembre 2013 à avril 2014	Association du Na à la TA chez les Bantou que les Pygmées	Pygmées /Bantous : (46,9 ± 32,4 vs 121,5 ± 61,0 mmol/l, p < 0,0001)	ND	NA	[40]
DiteryRisk factors for non-communicable diseases in Kenya: findings of the STEPS survey, 2015	Kenya (STEPS)	Etude d'observation (transversale) issue de STEPS	CAP	4484 de 18 à 69 ans	avril à juin 2015	Nécessité d'agir pour la réduction	18,3 % (IC à 95 % 17,2 %, 19,5 %)	ND	NA	[45]
Individual and household level factors associated with presence of multiple non-communicable diseasesRisk factors in Kenyan adults, Nov. 2018	Kenya (STEPS)	Etude d'observation (transversale) issue de STEPS	CAP	4066 de 18 à 69 an	avril à juin 2016	Necessité des interventions efficaces et multisectorielles pour lutter contre MNT	89,5 % de Na Consommation de fruits et légumes faibles	ND	NA	[46]

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Salt content of some fast foods in Casablanca, Morocco : Pilot study Contenu en sel d'aliments provenant de la restauration rapide à Casablanca, Maroc : étude pilote, Fév. 2018	Maroc	Etude d'observation (transversale)	Evaluation de teneur en sel des aliments	38 fastfoods	2 mars et le 30 mai 2014	Consommation en sel plus élevé (réduire les portions)	Variation de 0,25 g/100 g (0,62 g de sel/100 g) dans les sandwichs à la viande hachée à 0,44 g/100 g (1,1 g de sel/100 g)	ND	NA	[48]
Composition en chlorure de sodium du pain blanc commercial au Maroc, décembre 2017	Maroc	Etude d'observation (transversale)	Evaluation de teneur en sel des aliments	80 boulangeries	February-April 2011	Consommation en sel plus élevé (réduire les portions)	17,42 ± 1,28 g/kg, soit de 8 à 9 g de sel	ND	NA	[49]
Sodium content of bread from bakeries and traditional markets in Maputo, Mozambique, Mars 2015	Mozam-bique	Etude d'observation (transversale)	Evaluation de teneur en sel des aliments (estimation de la teneur en Na du pain blanc	17 boulangeries	41061	(88 %) ne respectaient pas la réglementation en Afrique du Sud (≤ 380 mg/100 g),	450,3 mg/100 g (254,9-638,3 mg/100 g)	ND	NA	[52]
Mineral composition of commonly consumed local foods in Nigeria, Juillet 2016	Nigeria	Etude d'observation (transversale)	Evaluation de teneur en sel des aliments (estimation de la teneur en Na)	25 plats	ND	Consommation élevé (réduire les portions)	Na et K : 5,0 ± 0,20 à 17,4 ± 0,42 mg/100 g	ND	NA	[55]
Salt (sodium chloride) content of retail samples of Nigerian white bread: implications for the daily salt intake of normotensive and hypertensive adults, Fév 2013	Nigeria	Etude d'observation (transversale)	Evaluation de teneur en sel des aliments (estimation de la teneur en Na)	100 pains	ND	Nécessité de réduire le Na dans les aliments (Pain)	Sel était de 1,36 g pour 100 g	ND	NA	[56]
Assessment of salt concentration in bread commonly consumed in the Eastern Mediterranean Region, 5 avril 2018	Tunisia	Etude d'observation (transversale)	Evaluation de teneur en sel des aliments (estimation de la teneur en Na dans le pain)	105 pains	Novembre to 15 Décembre 2013	Nécessité de réduire le Na dans les aliments (Pain)	La teneur moyenne en sel et en sodium du pain pour tous les pays était de 7,63 (ET 3,12) et 3,0 (ET 1,23) g/kg	ND	NA	[58]
Sodium content of foodstuffs Included in the sodium reduction regulation of South Africa, Oct. 2017	Afrique du Sud	Etude d'observation (transversale)	Evaluation de teneur en sel des aliments	13 catégories d'aliments	Mars à Mai 2016	Nécessité de réduire le Na dans les aliments (Pain)	Na moyenne : 2,40 ± 0,14 mg	ND	NA	[36]

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Légende

Light green	Assessment of salt consumption from urine analysis
Lemon yellow	Assessment of salt/Na content in food
White	Other studies (Knowledge, systematic reviews, STEPS etc.)
Sky bkue	Changes achieved after intervention (Legislation). Na/Salt data available before and after
Darkblue	Modelling study

Syntax :

PubMed*:* In accordance with our study question, we established a search equation that was used in the different databases and in the following steps:

Etape 1: "("population salt intake"[Title/Abstract]) OR (population salt intake [MeSH Terms])", ""population salt intake"[Title/Abstract]",82,12:35:04;

Etape 2: "("salt levels" [Title/Abstract]) OR (salt levels [MeSH Terms])", ""salt levels"[Title/Abstract]",494,12:46:57;

Etape 3: "("in food"[Title/Abstract]) OR (in food [MeSH Terms])", ""in food"[Title/Abstract] OR (("injuries"[MeSH Subheading] OR "injuries"[All Fields] OR "in"[All Fields]) AND "food"[MeSH Terms])", "52,733",12:48:09;

Etape 4: "(("salt levels"[Title/Abstract]) OR (salt levels [MeSH Terms])) AND (("in food"[Title/Abstract]) OR (in food [MeSH Terms]))", ""salt levels"[Title/Abstract] AND ("in food"[Title/Abstract] OR (("injuries"[MeSH Subheading] OR "injuries"[All Fields] OR "in"[All Fields]) AND "food"[MeSH Terms]))",10,12:49:06;

Etape 5 : "(("population salt intake"[Title/Abstract]) OR (population salt intake[MeSH Terms])) AND ((("salt levels"[Title/Abstract]) OR (salt levels[MeSH Terms])) AND (("in food"[Title/Abstract]) OR (in food[MeSH Terms])))",,, ""population salt intake"[Title/Abstract] AND ("salt levels"[Title/Abstract] AND ("in food"[Title/Abstract] OR (("injuries"[MeSH Subheading] OR "injuries"[All Fields] OR "in"[All Fields]) AND "food"[MeSH Terms])))",1,12:49:41.

Medline : "Population salt intake" [MeSH Terms], [Title/Abstract] OR "salt levels in foods"[Title/Abstract].

Google Scholar: Population salt intake and/or salt levels in foods;

Google : estimated consumption of salt/sodium and potassium in Africa; salt content of food in Africa from 2012 to 2022.

reduction interventions in order to considerably reduce morbidity and mortality due to MCV/MNT. In Ghana, for instance, after a community awareness campaign on salt reduction, urinary sodium excretion increased from 50 mmol/d/person ($p < 0.001$) to 47.46 mmol ($p < 0.001$) [44]. In South Africa, in the mass study (Waves 2 and 3) a significant difference of 1.16 g/day/person ($p = 0.028$) was observed further to the implementation of the legislation voted in June 2016 [28].

Discussion

This review aimed at identifying studies carried out in Africa in relation to salt/sodium and potassium linked to cardiovascular diseases and/or non- communicable diseases. Considering these results, four types of studies were identified, namely salt assessment studies with total and/or occasional urine test methods or 24-hour recall methods; studies assessing the sodium/potassium levels in the most-consumed food by the population; public perception of the links between sodium/potassium intake and cardiovascular diseases (particularly high blood pressure) and the studies carried out aimed at reducing excessive sodium intake and increasing potassium intake.

Salt/sodium and potassium intake

Broadly speaking and regardless of the type of study (cross-sectional, case or mass study), it was observed that salt/sodium intake was excessive and low in potassium between 2012 and 2022 despite the commitment of the countries since 2013 [13,19,59,60]. In compliance with the WHO's guidelines, it is important to quantify current salt intake levels of the population. This is particularly important in sub-Saharan Africa where the epidemiological transition is likely to lead to dietary changes and a high increase in the MNT prevalence.

Furthermore, resources for treating salt-associated diseases may not meet the expectations of the population in such a way that preventive strategies, like salt reductions are important to avoid associated morbidity and mortality [61-63]. To identify populations among which sodium intake is high and to assess progress regarding the WHO's sodium reduction target, it is necessary to know the sodium intake in Africa. Therefore, thirty-two studies carried out in our document conducted in 12 countries namely South Africa, Benin, Cameroon, Cape Verde, Ethiopia, Ghana, Malawi, Morocco, Mozambique, Nigeria, Uganda and Tunisia reported on the salt intake. Among these studies, 24 assessed both potassium and sodium intake; sodium intake solely from urine tests in twenty-nine. Although salt intake varied from one country to the other, all had an intake beyond set standards (< 5 g/d/p).

In our systematic review, at the beginning of the decade, Benin had an estimate of 4.4 g/24 h of sodium and 1.8 g/24 h of potassium [39]. In Ghana, the salt intake was 8.3 g/day. In South Africa, in a 2013 study, it was 9.5 g/d, 8.5 and 7.8 g/d in white, mixed and black populations respectively [24,40]. All these observations similar to previous studies carried out on the salt intake levels within populations [64,65] showed to which extent it was important to set in place-integrated strategies to reduce salt/sodium intake.

Studies on dietary salt/sodium and potassium levels are hard to carry out since they require both resources and appropriate technologies. Beside, the dietary issue remains a challenge in a context whereby the choice of food is individual and varies according to the consumers' tastes [66]. Seven studies were able to assess the sodium level in the staple food. The average salt and sodium level in bread in Tunisia (Maghreb) was 7.63 (ET 3.12) and 3.0 (ET 1.23) g/kg while in Nigeria (West Africa) it was 5.0 ± 0.20 mg/100 g bread. These variations could be explained by the differences in food choices and habits of individuals.

Seven studies assessed the awareness, habits and behavior of populations with regard to the salt/sodium intake. Even if the populations are more sensitized about the harmful effects of excessive salt, the rigor in the choice of food low in sodium and high in potassium remains insufficient. Three studies were able to show an improvement of awareness about salt intake. They have demonstrated the need for awareness campaigns as additional strategies in the fight against excessive salt/sodium intake.

Reduction strategies

The evaluation of the effects of the legislation in South Africa was done in two studies. Another evaluation study focused on the implementation of awareness campaigns in Ghana [28,30,44]. These studies yielded fruits because positive changes were observed thereafter. However, it should be pointed out that efforts are yet to be made if the objective of reducing salt intake in the world by 30% by the year 2025 is still maintained. Still, we were able to notice that the WHO supported only a few African countries notably South Africa and Ghana to carry out large mass studies for the assessment of salt intake level and monitoring over time, particularly the SAGE (Study on Global AGEing and Adult Health). This may explain the low availability of data on the continent because the other countries handicapped by the costs related to these studies were less committed. It is important to encourage all African countries to make data available through operational research studies for a better action.

Therefore, in the light of the results of our research study, only high impact sensitization campaigns such as the adoption and implementation of legislation in South Africa and major mass campaigns yielded minor successes because despite the obtained changes, the results are beyond the set standards intake recommended by the WHO. It is difficult for us to assess salt reduction efforts in other countries since there were no sensitization campaigns or post-sensitization campaigns evaluation. Nevertheless, efforts are to be encouraged as more and more countries are taking measures to reduce salt intake. However, additional measures are essential to reduce the health consequences associated with excessive salt intake, particularly in low- and middle-income countries where the risk of death from high blood pressure is higher, more than double that in high-income countries [66]. Likewise, the WHO encourages the use of tools such as SHAKE to technically assist countries in their fight [67,68]. These tools integrate multidimensional actions extended to other health partners targeting consumers, industry and government in addition to an efficient leadership and political commitment [69].

Strengths and Weaknesses

The strengths of this systematic review lie in the almost exhaustive search of studies carried out throughout the African continent. They were identified both in Sub-Saharan Africa and in the Maghreb countries. This study was able to appreciate the trends observed at the beginning and at the end of the decade (2012-2022) with regard to the levels of salt/sodium and potassium intake and this through the different methods which were the assessment of urinary sodium/potassium through spots and/or total urine, dietary sodium/potassium level and the awareness, attitudes, beliefs and practices of food consumers. Some also appreciated the perception of taste based on the variability of salt in food. Two reviewers reviewed the study extraction methodology. This confers more certainty to the various studies carried out. Unfortunately, this review was unable to obtain enough intervention studies to conduct the meta-analysis. No single strategy can be dependent on the reduction results observed in these studies. It will therefore be important to be cautious in the different conclusions made in these studies.

Conclusion

This review highlights the value of updating and monitoring studies on the assessment of salt/sodium and potassium intake levels in each country in order to assess the level of achievement of the global goals by 2025. Reducing salt intake is underway but remains a challenge for all countries in the African region due to the nutritional shift that the continent is initiating. In addition, the disease burden associated with high salt intake is also increasing in Africa and might strain public health systems that are not strong enough. The sensitization campaigns supported by the WHO, although limited in scope, are to be encouraged in other countries in order to optimize salt reduction efforts and to encourage the intake of foods rich in potassium, protective factors against cardiovascular diseases/non-communicable diseases.

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Nothing to report.

Conflict of Interest

No conflict of interest to declare.

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