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REVIEW

Knowledge, Prevention Practice and Associated Factors of Stroke Among Hypertensive and Diabetic Patients – A Systematic Review

Abreham Degu Melak[1]
Dawit Wondimsigegn[2]
Zemene Demelash Kifle[1]

[1]University of Gondar, College of Medicine and Health Science, School of Pharmacy, Department of Pharmacology, Gondar, Ethiopia; [2]University of Gondar, College of Medicine and Health Science, School of Pharmacy, Department of Pharmaceutics and Social Pharmacy, Gondar, Ethiopia

Introduction: Because of the inadequate level of public awareness of the disease, the incidence of stroke has been sharply rising. Eventually, due to the prehospital delay, many stroke cases could not be eligible for thrombolysis thereby poor rehabilitative outcome has been tremendously increased. Thus, this study aimed to review the level of knowledge, prevention practice, and associated factors of stroke among hypertensive and diabetic patients.

Methods: A systematic review of primarily published articles (2010–2020) related to knowledge and prevention practices of stroke was performed by searching online electronic databases like PubMed, Google Scholar, Refseek, Science direct, ResearchGate, and manual Google search by using the keywords and MeSH terms. Studies conducted on knowledge and prevention practices amongst hypertensive and/or diabetic patients were included.

Results: Out of 531 searched studies, 42 articles were identified to be reviewed. The reported overall knowledge of stroke was ranging from 4.4% to 79%. Knowledge to the signs/symptoms of stroke was 23.6% to 87%. However, 15% to 77% of subjects were also reported that they did not know any sign of stroke. The range of risk factor knowledge was 10.5% to 86.6%. The reported level of stroke prevention practice was 2.4% to 72% but physical activity and weight reduction practice were relatively low. Inadequate level of knowledge and prevention practice of stroke was related to elderly, female gender, uneducated, unmarried, rural residents, economically low, comorbidity and unemployed individuals.

Conclusion: The current finding revealed that the level of knowledge and prevention practice of stroke was inadequate. Hence, the finding highlights health educational programs should be planned as an important avenue to enhance stroke awareness among the high-risk populations.

Keywords: stroke, knowledge, warning sign, risk factor, prevention

Introduction

Despite global age-standardized mortality rates of stroke had shown a sharp decline from 1990 to 2016, its prevalence rate and burden have been still high.[1] Reports showed that 80·1 million prevalent cases, 5.5 million deaths, and 116·4 million DALYs of stroke in the world were recorded at the end of 2016. Its burden in developing countries especially Sub-Saharan Africans (SSA) is still high.[2,3]

Although stroke is considered as multi-factorial, it is majorly attributed to the contributing risk factors like uncontrolled hypertension (HTN), diabetes mellitus

Correspondence: Abreham Degu Melak
University of Gondar, College of Medicine and Health Science, School of Pharmacy, Department of Pharmacology, Gondar, Ethiopia
Email abrishdegu8@gmail.com

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(DM), dyslipidemia, heart disease, and other modifiable risk factors. The highest contributor is HTN which accounts for up to 75% of stroke cases.[4–8] Moreover DM contributes up to 30% incidence to stroke events.[1,9–13]

Therefore, prior awareness in these high-risk populations can have a very important implication to decrease the incidence of stroke emergencies. Creating awareness about stroke helps to promote early hospital presentation thereby reduces long-term complications of the disease. Due to the inability to know the disease condition 50–87% of patients presented to the hospital out of the window period of recombinant Tissue Plasminogen Activator (tPA). As a result, they could not be eligible to the American Heart Association and American Stroke Association (AHA/ASA) recommended treatment protocol.[14–16]

Poor recognition of warning signs of stroke often results in a delay in hospital presentation so that increases stroke-related morbidity and mortality. Extensive studies devoted to assessing the knowledge status of patients admitted on stroke and were reported as they had not had information on stroke disease and the way how to prevent it.[17–20] More than 70% of stroke patients did not know risk factors and 20–25% were smokers and alcoholics.[21]

Increasing awareness towards risk factors, warning signs, and prevention strategies of the stroke to the high-risk populations can imply a reduction of its incidence and pre-hospital care delay.[22–25]Therefore, this study aimed to review the level of knowledge, prevention practice, and associated factors towards stroke among hypertensive and diabetic populations.

Method

This systematic review was reported with the recommended protocols of Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA).[26]

Information Source and Search Strategy

A search strategy was developed to look at recent existing articles and adapted to search, PubMed, Google Scholar, ResearchGate, Refseek, Science direct, and Manual google search by using keywords, indexing terms (MeSH terms), and the combination of them. Keywords were, "Stroke", "Knowledge", "Awareness", "Risk Factor", "Warning Sign", "Primary Prevention", "Lifestyle", "Self-Care", "Hypertension", "Diabetic Mellitus". An advanced searching method by Boolean operators (AND & OR) was also used; "Stroke AND Awareness", Stroke AND Knowledge", "Stroke AND Awareness AND Hypertension OR Diabetic", "Stroke AND Prevention". Two reviewers independently reviewed the titles and abstracts of the articles identified by these searching databases. Finally, any article that appeared to meet the inclusion criteria was read in detail.

Inclusion and Exclusion Criteria

Primary studies published between 2010 and 2020 were included. The assessment questions used to test knowledge and practice could be open-ended, closed, or multiple choice. The way of delivering the questions could be through telephone, face-to-face, or postal surveys. We excluded articles that could not be accessed full text because of the limited data that could be extracted. Studies published other than English could be excluded due to the poor ability of reviewers in other languages. Non-empiric citations including editorials, letters, commentaries, and opinions were also excluded.

Study Selection and Quality Assessment

We used Endnote version 7 reference manager to remove duplicated articles as shown in Figure 1. The authors assessed the quality of each study independently. If any discrepancy happened, it was resolved through consensus discussions. The methodological quality of all the reviewed studies was checked by the National Institute of Health (NIH) Quality Assessment Tool for Observational Cohort and Cross-Sectional Studies before inclusion in the review.[27] The tool has 14 questions to be rated as Yes, No, Not applicable, and Not reported. Of course, it does not have a numerical scale, the general guidance provides to determine the overall quality of studies and to be grade as good, fair, and poor. Accordingly, studies answer more questions positively graded as Good (≥7) followed by Fair (5–6) and poor quality (≤4) as it was adapted from a previous study.[28]

Data Extraction and Synthesis

The authors looked at and screened the articles independently based on the inclusion/exclusion criteria. The following details were extracted from each study using an abstraction format prepared in Microsoft excel: author, year of publication, study area, study subjects, sample size, study design, sampling technique, general and/or overall knowledge of stroke, knowledge towards risk factors, knowledge towards the signs and symptoms of stroke, knowledge towards stroke prevention, lifestyle

practices of stroke prevention and associated factors related to knowledge and prevention practices.

After the raw data collected from the included articles, the results were synthesized into tables as per the objectives of the review. Finally, the studies included in the review were categorized under one or more of the following topics to be narratively synthesized; knowledge of general concepts of stroke, knowledge of risk factors of stroke, knowledge of stroke sign/symptoms, knowledge of the pre-stroke prevention, and lifestyle modification practice (LMP) of stroke prevention. It was impossible to express the result quantitatively in the form of meta-analysis since the reported data was insufficient.

Result

A total of 531 titles were identified in the searching databases. After duplicates and irrelevant articles were screened, 42 eligible studies were left to be reviewed for knowledge and prevention practice as shown in Figure 1.

Risk of Bias

High risk of bias can be expected in studies where the quality assessment element was not reported as per the standards. In the contrary studies that were rated as yes (reported) in the quality assessment questions considered as low risk of bias. As a result, more than 80% of the studies had clearly settled objectives,[17,29–69] specified

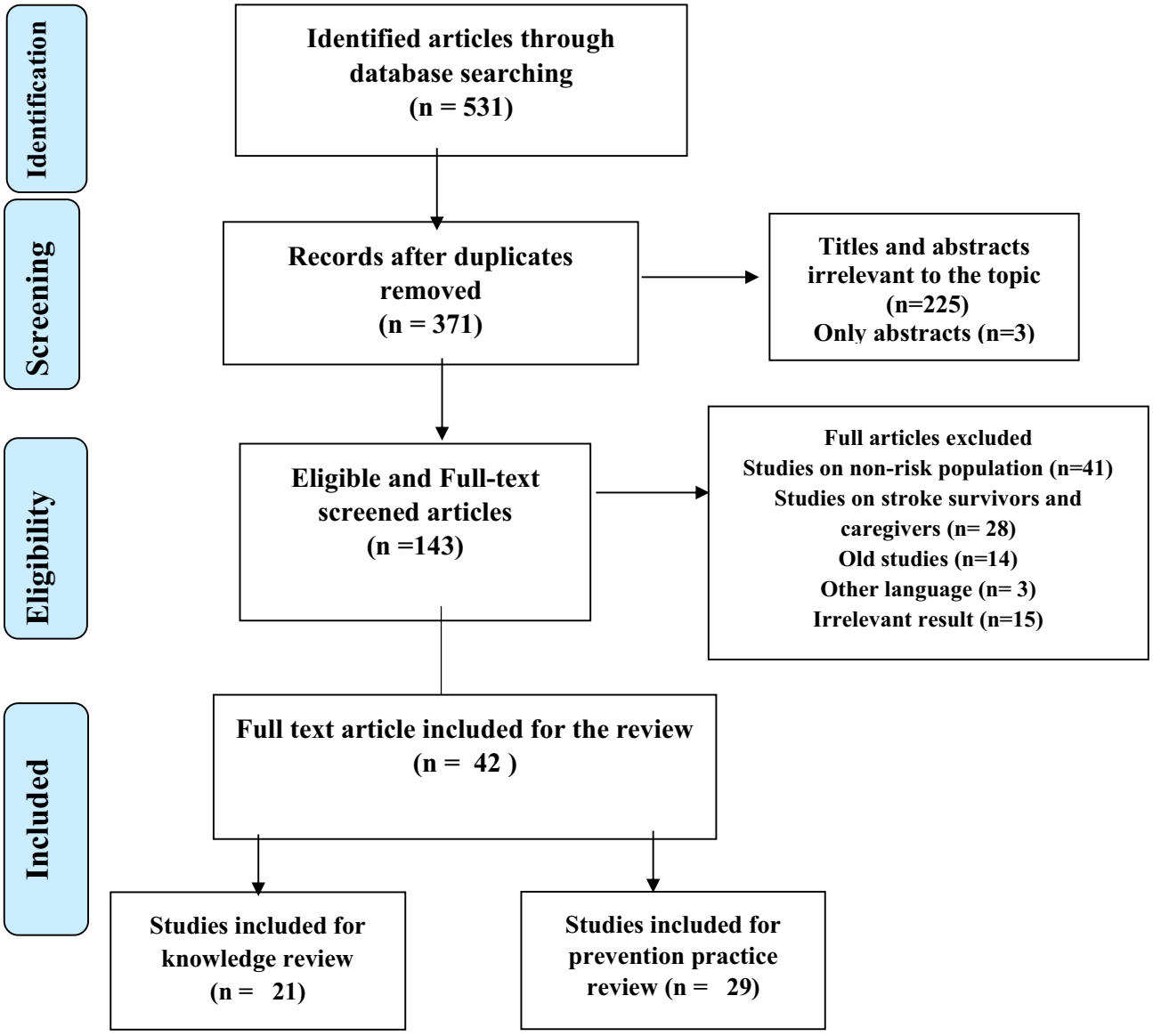

Figure 1 Flow chart of the article selection process.

study populations,[17,29–35,37,39–53,55,56,58,60–64,66–69] inclusion/exclusion criteria,[17,29–35,37,40,42–51,53–57,59,61–69] adjusted confounders,[17,29–69] defined dependent variables,[17,29,30,32–44,46–51,53,55–58,63–69] and independent variables.[17,29–31,33,34,36,37,39–44,46–49,51–60,63–65,69] Whereas ≥50% participation rate,[29–31,33–35,37,39–42,44,46,48,50–53,55,56,61–63,65,68,69] justified sample size determination,[29–32,34,37–40,42–44,46–52,55–57,60,61,63,65,66,68,69] and less 20% lost follow up/response rate,[17,29–31,34–36,39,47,49–51,56,66,68] were clearly stated in 61.9%, 69% and 35.7% of studies, respectively. Other questions were not applicable for our reviewed studies. Finally, after critically appraised near to 62%, 31% and 7% of studies were found in good, fair, and poor quality, respectively.

Characteristics of Studies

The reviewed 42 articles comprised a total of 10,063 sampled participants obtained from 20 different world countries; 20 Asian, 16 African, 3 European, 2 North American, and 1 South American study. Twenty-two studies (52.4%) were done among hypertensive patients, ten studies (23.8%) among diabetic patients, and ten (23.8%) of the studies were done among hypertensive and diabetic patients. The mean age of participants was 55.1±5.7 years per study. The sex proportion of the subjects was 53±14.5% of males and 49.1±12% of females. The search results revealed that most of these articles were institutionally based and were designed as a cross-sectional study. However, their randomization technique was a probabilistic and non-probabilistic method as mentioned in Table 1.

Overall Knowledge Towards Stroke

Overall knowledge can be operationalized as knowing pick general concepts obtained from inquiries regarding the definition, cause, organs affected, and preventions of stroke. Of the reviewed studies, seven studies reported the calculated overall good knowledge of respondents towards stroke. As good awareness was shown in Ghana (79.18%),[33] low awareness in Iraq (4.4%),[32] Nigeria (16.9%),[53] and Ethiopia (18.3%)[29] were reported. The participants' scope of knowledge that stroke affects the brain was also reported in six studies ranged from 21.6%,[29] to 87.4%.[34] With a comparative cross-sectional study aimed to assess the knowledge difference of native and migrant diabetic patients towards stroke in Germany and Turkey, only 50% of the native and 25% migrant diabetic cases responded exactly that the brain is the affected organ with stroke.[65] The participants' overall knowledge can be seen in Table 2.

Knowledge Towards Warning Signs of Stroke

Seventeen studies have been employed to knowledge towards warning signs of a stroke. Out of these, eight articles revealed the computed prevalence of overall good level of knowledge of warning signs of stroke ranged from 23.6%[53] to 87%;[34] half of them were below 50%. The ability to name the signs/symptoms of stroke markedly varied between the studies. The signs of stroke sudden half body paralysis/weakness, sudden trouble speaking, sudden severe headache, and sudden double vision were reported by more than 65% of the studies. From these, 70–85% of studies reported low knowledge (<50%) of sudden double vision and severe headache as the signs of a stroke. Besides these, though few studies were reporting, there was low awareness detected to numbness, imbalance movement, memory loss, and dizziness. Unfortunately, eight studies depicted that 15–77% of the respondents did not know any sign of stroke as shown in Table 3.

Knowledge Towards Risk Factors of Stroke

Based on studies that stated on risk factor awareness, 10.5%[32] to 86.6%[34] overall good levels of risk factor knowledge were reported. But only two studies were reporting more than 50%.[34,43] Despite it was not adequate, just more than half of the studies reported whether their respective subjects had better knowledge of HTN as the risk of stroke. The majority of studies reported a low level of knowledge to hypercholesterolemia, DM, past stroke history, cigarette smoking, obesity, physical inactivity, bad diet, alcohol intake, family history, elderly, and heart disease. Studies inquired on stress as a risk of stroke and revealed up to 96% of knowledge. However, the review found 2.3–77% of the HTN and DM patients that did not know any risk factors of stroke as shown in Table 4.

Knowledge Towards the Prevention of Stroke

Even though few studies were enrolled in the knowledge of stroke prevention, a single study reported the overall calculated level of stroke prevention knowledge (90.8%).[34] Two authors reported 82–85% of subjects

Table 1 Characteristics of Reviewed Studies

Study, Year of Publication	Country	Disease Condition	Sample Size	Mean Age (Years)	Male (%)	Female (%)	Data Collection	Method & Sampling
Abate et al, 2019[29]	Ethiopia	HTN	278	54.40	47.80	52.20	Y	Cross sectional, SRS
Aboutorabi Zarchi et al, 2019[30]	Iran	DM	281	54.04	29.60	70.40	O, MCQ	Cross-sectional
Al-Beladi et al, 2016[31]	Saudi Arabia	DM & HTN	166	-	42.20	57.80	O&C	Cross-sectional, Consecutive Sampling
Amen, 2016[32]	Iraq	HTN	114	58.40	58.8	45.70	C	Cross-sectional Purposive sampling
Ampiah et al, 2018[33]	Ghana	DM & HTN	208	57.30	41.30	58.70	C	Cross-sectional, Convenient S
Arisegi et al, 2018[34]	Nigeria	DM & HTN	239	48.21	34.3	65.7		Cross-sectional, SRS
Chukwuocha, 2018[38]	Nigeria	DM	91	59	33	67	O	Cross-sectional
Dar et al, 2019[39]	Pakistan	HTN	384	51.4	52.90	47.10	Y	Cross-sectional, consecutive S
Ehidiamen et al, 2018[43]	Nigeria	HTN	144	58.50	53.50	46.50	O	Cross-sectional, consecutive S
Mersal et al, 2020[50]	Saudi Arabia	HTN	203	41.83	51.20	48.80	C	Cross-sectional,
Oparah, 2017[53]	Nigeria	DM & HTN	148	54.30	45.90	54.10	O	Cross-sectional,
Poongothai et al, 2017[54]	India	HTN	50	48.7	72.00	28		Observational
Venkatesh et al, 2016[61]	India	HTN	105	47.50	66.70	33.5	C	Cross-sectional, consecutive S
Vincent et al, 2015[62]	Nigeria	DM & HTN	200	47.50	66.70	33.30	O	Cross-sectional, consecutive S
Wahab et al, 2015[63]	Nigeria	DM & HTN	314	56.40	47.10	52.90		Cross-sectional, consecutive S
Weltermann et al, 2013[65]	Germany	DM	218	-	50.40	49.50	O	Cross-sectional
Konduru et al, 2017[47]	India	DM	100	-	64.00	36.00		Prospective and observational
Chimberengwa et al, 2019[69]	Zimbabwe	HTN	304	59.00	34.60	65.40		Cross-sectional
Okonta et al, 2014[52]	South Africa	DM	217	-	-	-		Cross-sectional
Tesema et al, 2016 [60]	Ethiopia	HTN	130	-	57.70	42.30	O&C	Cross-sectional
Buda et al, 2017[37]	Ethiopia	HTN	205	53.90	48.8	51.2		Cross-sectional
Durai et al, 2015[42]	India	HTN	100	51	100	NP		Cross-sectional
Mutyambizi et al, 2020[68]	South Africa	DM	396	-	39.24	60.76	MCQ	Cross-sectional
Rashidi et al, 2018[57]	Iran	HTN	110	57.97	47.3	52.7	MCQ	Cross-sectional
Faiz et al. 2018[44]	Norway	DM & HTN	173	68	63.6	36.4	O	Prospective cross sectional
Sheeba et al, 2017[59]	India	DM	100	-	75	25		Cross-sectional, Convenient S
Dinesh et al, 2016[40]	India	DM	400	-	62.25	38.75	C	Cross-sectional, Random
Bollampally et al, 2016[66]	India	HTN	160	-	47.5	52.5	O	Prospective, observational

(*Continued*)

Table 1 (Continued).

Study, Year of Publication	Country	Disease Condition	Sample Size	Mean Age (Years)	Male (%)	Female (%)	Data Collection	Method & Sampling
Warren-Findlow et al, 2011[64]	Carolina	HTN	188	53	28.70	71.3		Cross-sectional
Rajan et al, 2019[55]	India	HTN	200	56.6	40.5	59.5	MCQ	Cross-sectional, Convenient S
Kisokanth et al 2018[46]	Sri Lanka	HTN	424	60.4	41	59	MCQ	Cross-sectional, SRS
Obirikorang et al, 2018[51]	Ghana	HTN	300	63.6	62	38	Y	Cross-sectional, Simple Random
Bakhsh et al, 2017[36]	Saudi Arabia	HTN	211	51.8	60.2	39.8	Y	Cross-sectional,
Rajasekharan et al, 2015[56]	India	DM	290	47.9	60	40	MCQ	Cross-sectional, Convenient S
Metias et al, 2017[67]	Canada	DM & HTN	791	-	-	-		Prospective Survey
Bacha et al 2019[35]	Ethiopia	HTN	385	57.6	54.5	48.3		Cross-sectional, SRS
Duque et al, 2018[41]	Portugal	HTN	163	-	-	-	O&C	Cross-sectional, Simple Random
N IK and B VR, 2015[48]	India	DM & HTN	100	59	73	27	O	Retrospective cross sectional
Parappilly et al, 2019[17]	Colombia	DM & HTN	100	66.6	60	4	MCQ	Cross-sectional, Convenient S
Kaddumukasa et al, 2017[45]	Uganda	HTN	440	54	-	-		Cross-sectional,
Lai et al, 2015[49]	Taiwan	DM	597	51.28	-	-		Retrospective, SRS
Selcuk Ozkan et al, 2019[58]	Turk	HTN	336	53.2	39	61		Cross-sectional, consecutive S

Abbreviations: C, closed ended; O, open ended; MCQ, multiple choice questions; Y, yes/no questions; SRS, systematic random sampling; S, sampling; DM, diabetes mellitus; HTN, hypertension; Np, not participated.

Table 2 Overall Knowledge of HTN and DM Patients Towards Stroke

Study	Country	Disease Condition	Overall Good Knowledge of Stroke (%)	Know Stroke Affects Brain (%)
Abate A[29]	Ethiopia	HTN	18.30 [a]	21.6
Ehidiamen[43]	Nigeria	HTN	NR	56.3
Dar[39]	Pakistan	HTN	NR	76
Weltermann[65]	Germany	DM	39.4 [a]	50- Native 25 -Migrant
Oparah[53]	Nigeria	DM & HTN	16.9	NR
Arisegi[34]	Nigeria	DM & HTN	70.3	87.4
Amen[32]	Iraq	HTN	4.4	NR
Ampiah[33]	Ghana	DM & HTN	79.16[b]	68.30
Venkatesh[61]	India	HTN	66.7	NR

Notes: Associated factors: [a]age <61 years, educated, urban residents, high income, [b]married, employed, educated, NR-not reported.
Abbreviations: DM, diabetes mellitus; HTN, hypertension.

Table 3 Knowledge Towards Warning Signs of Stroke

Study	Good Knowledge (%)	Did not Know any Sign (%)	Trouble Speaking (%)	One body Paralysis (%)	Double Vision (%)	Numbness (%)	Headache (%)	Dizziness (%)	Memory Loss (%)	Loss of Balance (%)
Abate A[29]	–	77.3	–	35.9	–	–	–	–	–	–
Aboutorabi[30]	–	–	77.9	87.2	54.4	–	56.8	–	85.1	88.6
Al-Beladi[31]	48.2 [c]	-	36.1	43.4	22.9	35.5	22.9	-	-	33.1
Amen[32]	24.6 [a c]	34.2	28.9	29.8	23	-	23.7	-	-	20.20
Ampiah[33]	75 d e	-	75.5	70.2	48.5	69	66	59.6	-	-
Arisegi[34]	87 [a c d]	-	83.3	85.5	41	-	86.2		59.6	81.2
Dar, N[39]	-	26.2	67	-	28.6	66.9	32.8	34.6	22.4	-
Ehidiamen[43]	54.9 [abc]	45.1	28.5	36.1	0	-	0	-	0	-
Mersal[50]	-	-	41.40	51.2	42.4	34	46	45.8	-	42.8
Oparah[53]	23.6	-	-	-	-	-	-	-	-	-
Venkatesh[61]	-	-	-	72.4	-	-	45.7	-	-	-
Vincent[62]	-	15	-	-	-	-	-	-	-	-
Weltermann[65]	53	24.3	25.2	-	9.2	-		-	-	-
Duque[41]	-	23.3		96.3	93.6	-	87.7	91.4	-	-
Faiz, K[44]	43.5	33.8	50.3	60.7	6.4	-	3.5	4.6	4.6	3.5
Selcuk[58]			69	30	32	22	3.5	48	37	-
Lai, Y[49]	-	-	63.5	67.1	31.5	-	10.4	26.1	-	-

Notes: Associated factors: [a]age <50, [b]male, [b]*female, [c]higher education, [d]employed, [e]marital status/married.

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Table 4 Knowledge Towards Risk Factors of Stroke

Study	Good Knowledge to RF (%)	Did not Know any RF (%)	HTN (%)	DM (%)	Dyslipidemia (%)	Alcohol Use (%)	Physical Incivility (%)	Bad Diet (%)	Past Hx of Stroke (%)	Obesity (%)	CAD (%)	Family Hx (%)	Stress (%)	Smoking (%)	Elderly Age (%)
Abate [29]	14	77	3.6	–	–	18.7	21.6	–	–	20.1	–	–	–	–	–
Al-Beladi[31]	38 [c]	-	57.8	59.6	-	-	-	-	-	-	-	15.1	36.1	52.4	37.3
Wahab[63]	[acdfg]	52	34.7	7.3	-	4.5	-	0.6	-	1.9	0.6	-	12.7	3.8	-
Chukwuocha[38]	-	36.3	55	80	-	-	-	-	-	-	-	-	-	1	-
Aboutorabi[30]	-	-	93	71.5	85.1	64.1	22.1	88.6	87.9	79.4	69.8	39.6	82.2	78.6	62.3
Venkatesh[61]	-	-	80	-	-	-	-	-	-	-	-	18.6			
Weltermann[65]	-	-	27.5	21.6	4.5	14.7	-				4.1			29.8	
Poongothai[54]	-	-	76	64	24	32	-		24	16	16	12		32.	
Dar[39]	19.5	2.3	93.4	45.3	37.7	-	-		-	-	-	-	-	30.4	
Arisegi[34]	86.6 [c]	-	92	76.2	85.7	72.8	80.8	85.7		85	63.2	54.8		71	42.3
Oparah[53]	49.3 [c]	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mersal A[50]	-	-	56.7	43	48.8	34	47.3		37.9	39.9				48.3	
Vincent[62]		15	80	61.5	3	-	5		0.5	22	1	0.5		11	24
Amen[32]	10.5[abce]	25	-	-		42.1	17.5	43		39.5				39.5	39.5
Ampiah[33]	-	-	87	77	76	79	74	71				42.3	76	69.7	35
Ehidiamen[43]	56.9[abc]	-	35.4	22.2	-	9.7	-	-	-	-	-	-	41	15.9	-
Duque[41]		14	98.7	85.1	99.3	95.7	95.7		98.2	96.9		74.9	95.7	96.9	
Faiz, K[44]	14.4	68.1	21.4	8.7	10	11.6	7.5	8.4		12.1	7.5	6.9		26.6	
Parappilly[17]			31	10											
Metias[67]			49	12.4	27.4	4.7	16.5			20.7		10.1	13.7	43.7	3.7
Selcuk[58]			89	7			19		3	26			23	45	12

Notes: Associated factors: [a]age <55, b-male, [b]*female, [c]education, [d]urban, [e]longer duration of disease, [f]took health education previously, [g]family history of stroke.
Abbreviations: CAD, coronary artery disease; DM, diabetes mellitus; HTN, hypertension; Hx, history; RF, risk factor.

Table 5 Knowledge Towards the Prevention of Stroke

Study	Good Knowledge of Prevention (%)	Know Stroke is Preventable (%)	Avoid Alcohol (%)	Avoid Fat Intake (%)	Smoking Cessation (%)	Physical Activity (%)	Weight Reduction (%)	Vegetable Use (%)
Venkatesh[61]	–	–	9.5	45.7	5.7	42.8	5.7	37.1
Dar[39]	–	85.4	–	40.4	85.2	49	–	76
Arisegi[34]	90.8 [a]	–	77.8	88.7	78.6	88.3	87.9	87
Parappilly[17]	–	–	–	57	–	51	–	52
Ampiah[33]	–	82	–	–	–	–	–	–

Notes: Associated factors: [a]educational and employment status.

were knowing whether a stroke is preventable.[33,39] Furthermore, four studies investigated and reported regular physical exercise (49–88%), avoiding fat intake (40–89%), and frequent use of vegetables (37–87%).[17,34,39,61] Likewise, three studies reported whether subjects had know-how of smoking cessation (6–85%) as prevention of stroke.[34,39,61] Avoiding alcohol use and weight reduction were also revealed by studies as shown in Table 5.

Prevention Practices Towards Stroke

One of the prevention strategies of stroke emergency is pre-stroke LMP which is supported by many pieces of evidence.[70] In this review, we extracted data from primary studies that were done related to LMP. In doing so, 29 studies were reviewed to generalize the trends of stroke prevention practices.

As a result, seven studies reported 2.4% (South Africa)[52] to 72% (Ghana)[51] prevalence of good LMP among the respondents. But only three studies were reporting more than 50% good practice.[51,59,61] When asked what actions have you ever practice to maintain their body and to prevent the incidence of stroke, the majority of the studies reported sub-optimal practice; nineteen studies reported for smoking cessation (>50%), fourteen studies for avoiding alcohol (60–90%), nine studies for avoiding added salt (57–95%), five studies for vegetable use (60–100%), four studies for regular home/facility BP or blood glucose (BG) checking (57–77%), three studies for reducing fat intake (59–95%). However, the practice of regular physical exercise was too low. Similarly, weight reduction practice was low as shown in Table 6.

Discussion

To the reviewer's knowledge, this systematic review has been the first paper synthesized regarding knowledge and prevention practices of stroke amongst hypertensive and diabetic patients. To undergo the review, the results of 42 existing articles were collected. The reported results were variable in between the studies. This might be due to the difference in the time course of the conducted studies and/or the variability in the socioeconomic status of the study population/study setting/. Irrespective of this, the overall results of the review show that the prevalent level of knowledge and LMP towards stroke was limited. Almost 40–80% of subjects were not aware of what a stroke is and the organ to be affected.[29,43,65] Obviously, individuals with HTN and/or DM are at greater risk of suffering stroke.[8,71] Hence, it is expected to be familiar with stroke and its warning signs.

The present review depicted that there was low awareness of the clinical signs and symptoms of a stroke.[32,53] In contrast, two studies showed better knowledge of the signs/symptoms of a stroke.[33,34] Even if suboptimal knowledge was found in other signs/symptoms, more than 50% of respondents did not know the exact double vision and severe headache as symptoms of a stroke in the majority of the reviewed studies. Severe headache,[72] and double vision/diplopia are major clinical presentations that should be identified as warning symptoms of a stroke.[5,73,74] So far, the reviewed studies reported 15–77% of patients with no knowledge of any of the mentioned warning signs of stroke as shown in Table 3.

It is important to note that left to unaware these vulnerable groups to the warning signs will come up with complicated medical situations up on attacked with stroke events. This is because not identifying the early warning signs leads to a prehospital delayed. The main reason for stroke victims too late hospital presentation was considered as their inability to recognize the symptoms of stroke, waiting for the sign to abate by itself, and eventually lack of awareness of the advantages that could be obtained from early treatment of thrombolysis.[14–16] On the contrary, having previous information to this able to increased patient's early hospital arrival by

Table 6 Prevention Practice Towards Stroke

Study	Good Practice %	Medication Adherence %	Check BP/ BG Regularly%	Avoid Alcohol%	Avoid Fat Intake %	Not Add Salt %	Smoking Cessation %	Physical Activity %	Weight Reduction %	Vegetable Use (%)
Venkatesh[61]	62.9	79	–	10.5	75.2		71.4	52.4	–	62.9
Dar, N.Z[39]	–	45.1	38	–	40.4	–	85.2	49	–	76
Mersal A[50]	–	–	–	–	–	–	43.3	55.2	–	–
Arisegi[34]	– bd	66.5	9.2	75.7	39.7	58.6	85.4	-	36.8	41.8
Amen[32]	-	-	-	91.2	-	-	49.1	-	-	-
Konduru[47]	-	-	27	-	-	-	-	28	-	-
Chimberengwa[69]	a b	-	-	75	-	41.1	88.2	-	-	73.7
Metias[67]		-	-	-	-	-	56.4	-	-	-
Okonta[52]	2.4	-	-	-	-	-	-	8.3	2.3	
Tesema[60]	-	-	-	-	-	94.6	98.5	14	-	-
Buda[37]	27.3 b e	-	-	87.9	-	57.5	91.2	16.1	41.9	-
Durai[42]	-	-	-	72	-	75	89	89	-	3
Mutyambizi[68]	a b c	67	-	-	-	-	85	9	-	-
Rashidi[57]	-	-	57.3	-	59	76.35	-	37.25	-	-
Sheeba[59]	63	88	63	-	-	-	-	46	57	-
Dinesh[40]	-	48	65.25	-	-	-	46.75	20.5	-	-
Bollampally[66]	41.25	64.35	-	81	-	61.25	95.7	16.25	-	-
Warren-Findlow[64]		58		65.4		22.3	75	52.1	30.3	-
Rajan[55]	-	84	77	-	-	72	-	9	-	-
Kisokanth[46]	-	-	47.2	-	-	-	-	-	-	95
Obirikorang[51]	72 b f	-	-	84.3	-	92.7	98	-		99.4
Bakhsh[36]	-	46.7	19.8	-	-	79.3	31.2	57.3	60	-

Rajasekharan[56]	-	60.50	-	63.1	93.8	-	70.3	43.4	-	26.20
Bacha[35]	39.5	-	-	83	-	-	96.4	-	-	-
Duque[41]		-	-	91.4	-	-	77.3	-	-	-
N IK. and B V[48]		-	-	-	-	-	74.6	-	-	-
Faiz[44]		-	-	73	-	-	76	-	-	-
Kaddumukasa[45]		-	-	93.5	-	-	95.7	-	-	-
Lai[49]		-		68	-	-	68.68	-	-	-

Notes: Associated factors: [a]male gender, [b]education, [c]urbane residency, [d]employed, [e]income.

10-fold thereby enhanced thrombolysis eligibility.[75] Therefore, creating awareness of the sign and treatment of stroke has a paramount advantage to enhance the need for a rapid medical call.[74–76]

Years ago, many countries were launching an effective Face Arm Speech Time (FAST) campaign that can have a positive implication to increase public awareness to the warning signs of stroke and thereby to promote immediate response; it aimed to raise the need for rapid medical call whenever anyone manifest early warning signs and symptoms of stroke, ie, facial deviation, arm weakness, and speech disturbance. Their intention was not only to these signs of stroke but as far as possible to familiarize people even to other signs and symptoms of a stroke. Because the clinical manifestations may not be always similar in all individuals.[74,77–81] Therefore, this review also suggests such educational strategies should be reconsidered and planned in the future.

Stroke awareness is necessary not only to the clinical signs and symptoms but also to the risk factors and prevention as well. The ultimate objective of conducting population awareness is to increase the trend of abstaining from those contributing lifestyle risk factors. However, almost all the reviewed studies stated that the HTN and/or DM patients' level of recognition to the potential relation of stroke and risk factors has been low so that they were recommending educational programs/campaigns to be held as an important concern of the national health policies.[29–31,38,39,43,50,53,54,65]

Since stroke is multi-factorial, people especially risky individuals should be conscious enough to measure their level of exposure and to be away from those risk factors. Risk factor knowledge begins with the identification of the current own medical conditions. Surprisingly, 64.6% to 94.6% of the hypertensive[29,43] and more than 78% of the diabetic patients[65] were found that they did not know whether their own medical condition is the cause of a stroke as shown in Table 4.

By far the most cited risk factor of stroke in the majority of the reviewed studies was HTN.[30,31,34,38,39,41,50,54,58,61,62] Though HTN is the major, it is not the only risk of stroke; other risk factors should be identified well. Some studies reported that more than 50% of the respective respondents with no knowledge to at least one risk factor of stroke.[29,44,63] Of course, being hypertensive and/or hyperglycemic contributes to stroke events by itself; their effect is much accelerated whenever other modifiable lifestyle factors (ie, smoking, excessive alcohol use, physical inactivity/sedentary life,

obesity, high cholesterol, and habit of diet) are poorly managed.[70,82–85] However, the result of this review revealed that more than 85% of the sampled participants did not consider the above-listed behavioral factors as the risk of stroke.[38,44,62,63,65,86]

Interestingly, stress that was highlighted in many of the reviewed studies; 12.7%[63] to 96%[41] of the subjects consider it exactly as the risk of stroke. Noticeably, stressful life events increase 2–3 times to the emergence of stroke by increasing excessive sympathomimetic activity and other different postulated mechanisms.[87–90] So, people at risk of stroke should identify and be away from any psychologically stressful situations. The review also found a low level of knowledge of the non-modifiable risk factors as if a stroke is highly associated with older age, family, and previous history of stroke.[31–34,44,50,54,58,62] Therefore, it should be of great concern to healthcare providers that so many patients do not understand the cause of stroke and have a limited understanding of basic stroke prevention methods.

Another important finding worth of highlighted in this review was LMP as the primary prevention (PP) of stroke. Though stroke is preventable primarily by avoiding or reducing the contributing risk factors,[70] the result of this review shows that more than 60% of the vulnerable individuals did not strive to prevent stroke and other cardiovascular complications.[35,37,52,61,66] Take for example smoking; the pattern of smoking habit contributes 2–4 times the likelihood of developing stroke as compared to non-smokers.[91,92] Nonetheless, with this review, 50–70% of subjects were found to be smokers with a double burden to their medical condition in some studies.[32,36,40,50] This could amplify the rate of stroke in risky individuals unless immediate action is taken.[84,85]

Although its detailed biological mechanism is not clearly stated, evidence suggests physical activity (3–5 days/week) to reduce the likelihood of a stroke event.[93–95] Unfortunately, subjects of the review level of engagement to practice regular physical exercise were found to be low. More than 70% of papers stated <50% of the respondents were striving to do regular physical exercise as shown in Table 6. Sedentary life has been the leading cause of mortality in the world; it increases 20–30% risk of all causes of death. Hence, WHO proposed in raising awareness of physical activity and to be a key component in the prevention of non-communicable diseases including stroke.[96]

Moreover, weight reduction was reported as a poor practice by many reviewed studies.[34,37,52,64] Overweight and obesity are important public health problems associated with many serious medical conditions including stroke. Recent American College of Cardiology and American Heart Association (ACC/AHA) guidelines recommend weight reduction as PP of stroke and other cardiovascular complications.[97] Alternatively, a cohort study also suggests that not only weight gain but also weight loss more than 5% should be emphasized to the increased incidence rate of Transient ischemic attack (TIA).[98] Therefore, weight management to be optimal to prevent a stroke rate.

The trend of alcohol reduction practice was good in most studies but a single study in India showed too low (10.5%).[61] This worldwide prevalent practice has been established as a risk factor for stroke disease principally hemorrhagic stroke since alcohol affects the coagulation pathway and cerebral vessel integrity.[99] In fact, excessive alcohol use is a risk factor of stroke events, low to moderate alcohol intake has advantages to reduce the incidence of ischemic stroke.[99–101] Regardless of this controversy alcohol is not that much recommended to be used especially in risky individuals.

Another point of discussion was medication adherence, which was reported 45–90% adherence to the prescribed antidiabetic and hypertensive medications as shown in Table 6. Even if they did not feel any problem, 55–77% of them were regularly checking their BP and/or BG either in-home or health facilities as was reported by the reviewed studies.[40,55,57,59] This is good practice that should be advocated more for early prevention of HTN and DM-associated emergence of stroke. Because the most plausible reasons for stroke events have been uncontrolled BP and BG.[1,4,9]

So far, dietary conditions, ie, fat, salt, and vegetable use should have to be emphasized for PP of stroke as if there has been a suboptimal practice in few reviewed studies.[102] Evidence showed that bad nutritional formula is considered as the risk of stroke, especially in high-risk populations. Early prevention of stroke and other cardiovascular complications starts from adjusting the day-to-day dietary conditions. For example, habiting the Mediterranean diet, high in olive oil, whole grains, fruits, vegetables, and legumes, and low in cholesterol/saturated fat is advised as prevention of stroke.[103–105] Habiting these diets can reduce the stroke rate by up to 40% or more in high-risk patients.[104] Hence, awareness to apply diet-based stroke prevention is necessary to these populations.

Finally, significantly associated sociodemographic factors of stroke knowledge and practice were systematically reviewed. As a result, educational level,[29,31,32,34,43,53,63] urban residency,[29,33,63] employment,[33,34] age <60

years,[29,32,34,63,65] monthly income[29] and marital status[30] were statistically associated with good level of stroke knowledge. Moreover, male gender in Nigeria[43] and female in Iraqi[32] was found to be strongly associated sole predictor variable of stroke knowledge. Similarly, LMP was affected with these independent sociodemographic factors; male gender,[10,35] higher educational level,[34,35,37,51,69] urban residency,[35] income,[37] employment[34] and marital status.[51] Meanwhile, the elderly and comorbidity were the preventive factors of good stroke prevention practice.[37] The main highlighted reason for the high level of knowledge and practice to these subgroups was due to the sufficient and easy accessibility of the different information sources to them.

Limitation

Despite this review has strong parts like critically apprizing and compiling the results of the published articles systematically, some other limitations that we could not avoid may be here. The limitations might be obtained from the reviewed studies; some data were not complete; their data collection questioneers were not similar in studies that could reduce the generalizability of this review. Additionally, all the reviewed articles were published in journal cites; unpublished studies could not be accessed. So far, to show the result quantitatively, the pooled estimated value was not attempted to be calculated because of diverse outcomes and the insufficient data reported in the studies.

Conclusion

It is clear from the above discussion that knowledge and prevention practice of stroke amongst hypertensive and diabetic patients has been low. The reported level of knowledge in high-risk populations towards the general concepts, warning signs, risk factors, and prevention methods of stroke was very low. There is also suboptimal lifestyle modification practice to prevent stroke. Especially the trend of regular physical activity and weight reduction practice was relatively low. This inadequate knowledge and prevention practice were associated with elderly, educationally low, economically poor, rural residents, unmarried, unemployed, and comorbid populations. Finally, the review highlights the importance of increasing public awareness about stroke symptoms, risk factors, and prevention strategies as well.

Abbreviations

ACC/AHA, American College of Cardiology and American Heart Association; AHA/ASA, American Heart Association and American Stroke Association; BG, Blood Glucose; DALYS, Disability-Adjusted Life Years; DM, Diabetes Mellitus; HTN, Hypertension; LMP, Lifestyle Modification Practice; NIH, National Institute of Health; PP, Primary Prevention; SSA, Sub-Saharan African; TIA, Transient Ischemic Attack; tPA, Tissue Plasminogen Activator; WHO, World Health Organization.

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