ISSN: 1343-4292
Volume 140, Issue 06, September, 2022

Perception of stroke warning signs and knowledge of potential risk factors among medical students in Tabuk University.

Hyder Mirghani[1*], Turki Moshabab Alqahtani[2], Talal Ahmad Alomrani[2], Eid Abdualazize Alaenzi[2], Abdulrahman Hussain Ghazwani[2], Yousef Ali Alaenzi[2], Ala'a Sulaiman M Almehmadi[2], Nawaf farag Alomrani[2]

Professor of Internal Medicine and Endocrine, Department of Internal Medicine, Faculty of Medicine, University of Tabuk, Saudi Arabia[1]
Medical students, Faculty of Medicine, University of Tabuk, Saudi Arabia[2]

Corresponding Author: 1*

ABSTRACT— Stroke is a common morbid disease with high mortality, knowledge about risk factors, management, and presentations might decrease its deleterious consequences. The current study aimed to assess Perception of stroke warning signs and knowledge of potential risk factors among medical students in Tabuk University. This is a cross-sectional study conducted among 251 medical students in Tabuk, University during the period from July 2022 to September 2022. A self-administered questionnaire based on demographic data, perception of stroke, and stroke risk factors. Was used, the action to be taken for potential stroke, the medications, and gender differences were collected. Knowledge was poor regarding the definition of with no difference between females and males stroke (65.9% versus 62.1%), P-value, 0.078, 90.4% of women vs. 88.8% of men knew that hypertension is a risk factor for stroke with a not significant statistical difference, P-value, 0.683, males knowledge regarding smoking as a risk factor was higher than females (93.1% versus 80.7%, P-value, 0.003), while only 65.9% of women and 57.8% of men knew diabetes as a risk factor, P-value, 0.115. The knowledge regarding the warning signs and symptoms of stroke was sub-optimal with no statistically significant difference between females and males, P-values <0.05. The knowledge of stroke was sub-optimal among medical students at Tabuk University, Saudi Arabia, especially regarding the knowledge of diabetes and obesity as risk factors for ischemic stroke. Females' knowledge was lower regarding smoking and increasing age as risk factors. The knowledge was lower among junior students as expected. Including stroke early in the curriculum is recommended.

KEYWORDS: Perception of stroke, warning signs, risk factors, medical students, Saudi Arabia.

1. INTRODUCTION

Stroke or cerebrovascular disease (CVD) is a medical condition that occurs when there isn't sufficient blood that circulates the body reaching the brain due to either blockade of the arteries by a clot or rupture of the vessels in the brain leading to hemorrhage and ischemia of the brain tissues For the brain to function accordingly it needs a regular continuous blood supply [1] Stroke carries a large burden both locally and globally Its the leading cause of disability and morbidity the third leading cause of death in the United States, more than 80000 affected annually with stroke [2], [3]. In Saudi Arabia, the research is not sufficient enough but a couple of studies have been conducted. According to data from the world health organization, stroke was the second largest cause of death in Saudi Arabia about 14.400 deaths in 2012 [4]. Stroke is being looked at as a rapidly growing problem and an important cause of illness and death in Saudi Arabia.

Therefore, it becomes one of the most important social and economic medical issues in the Kingdom [5]. There are two types of strokes, ischemic or hemorrhagic. Ischemic strokes account for about 80% of all strokes [6], [7]. When a vessel becomes occluded, a portion of functionally damaged, but structurally intact tissue surrounds the ischemic core [8]. This tissue is called the ischemic penumbra and since its salvage is linked to neurological improvement and recovery, it is a target for therapeutic interventions [9]. In hemorrhagic stroke, the hypertensive small-vessel disease is the most prevalent mechanism, which results in small lipohyalinotic aneurysms that burst [10], bout 5% of all strokes are subarachnoid hemorrhage which is classified as one of its types. rupture of saccular aneurysms inside the subarachnoid space is the most common cause of subarachnoid hemorrhage [11]. Risk factors are either Modifiable or non-modifiable. Modifiable risk factors are common such as hypertension, diabetes, smoking, atrial fibrillation, and TIAs. Because of atherosclerosis of extracranial and intracranial blood vessels, hyperlipidemia is a particularly major risk factor for strokes [12- 14]. Age, sex, race-ethnicity, and genetics are all non-modifiable risk factors for stroke. Stroke is an aging disease. The risk of stroke increases with age, with the risk doubling every decade after the age of 55 [15]. When compared to their white counterparts, blacks have double the risk of incident stroke and have a higher stroke-related mortality rate [16]. Age influences the link between sex and stroke risk. Women have the same or higher stroke risk as men at young ages, while the proportional risk is slightly higher for men as they get older [17]. For the past 20 years, CT has been the workhorse of stroke diagnosis; however, MRI is now just as helpful, if not more so, than CT [6]. If an MRI does not reveal a definite diagnosis, cerebral angiography is frequently recommended. Additional tests should include an echocardiogram and flexion and extension radiography of the cervical spine [18] for patients with acute stroke, Management in a stroke care unit, intravenous tissue plasminogen activator within 3 hours of stroke onset, or aspirin within 48 hours of stroke onset, and decompressive surgery for supratentorial malignant hemispheric cerebral infarction are proven interventions. Warfarin is a proven secondary preventive strategy for patients with atrial fibrillation [19]. Therefore, it becomes one of the most important social and economic medical issues in the Kingdom. Therefore, the current research assessed perception and knowledge, attitude toward stroke warning signs, and knowledge of potential risk factors among medical students at Tabuk University.

2. Literature review

[20] conducted a cross-sectional study and found good knowledge regarding stroke risk factors among nursing students, another study published in Nigeria found that staff had more knowledge about stroke warning signs and risk factors than students. Importantly, hypertension was the most identified stroke risk factor [21]. A study conducted in Riyadh, Saudi Arabia found good knowledge regarding stroke risk factors. However, the knowledge regarding prevention was modest [22].

3. Subjects and Methods

This cross-sectional study was conducted among medical students at Tabuk University during the period from July 2022 to September 2022. All the students from the second through sixth class were invited and the first-year students were excluded from the study due to the difference in the curriculum. A self-administered electronic questionnaire was distributed, and the questionnaire was adapted from previous similar literature [1]. Simple randomization was applied to select the participants. No name, University number, or contact number was registered. All the data will be kept confidential and used by the researchers for research only. The sample size was calculated using the formula: https://www.calculator.net/sample-size-calculator.html?type=1&cl=95&ci=5&pp=50&ps=792&x=58&y=14 =259

A self-administered electronic questionnaire was distributed, and the questionnaire was adapted from a previous similar study. The questionnaire consists of three parts: Demographic data, perception of stroke,

and stroke risk factors. The risk factors for stroke include hypertension, dyslipidemia, obesity, family history, and a sedentary lifestyle. The symptoms of stroke including vision, speech, and weakness were collected. In addition, the cause (hemorrhage or thrombosis), the action to be taken for potential stroke, the medications, and gender differences were collected. The possibility of repeated stroke and if the participant joined a previous stroke awareness were reported.

3.1 Data analysis

All data that were obtained with the questionnaire were analyzed using the Statistical Package for the Social Sciences (SPSS) version 20. The chi-square test was used to test the distribution of categorical variables and the student's t-test for continuous variables. Statistical significance was accepted when P-value is less than 0.05.

3.2 Ethical consideration

Ethical clearance was obtained from the ethical committee, the University of Tabuk (approval number, UT-208-70-2022), and all the participants signed written consent.

4. Results

In the present study, the knowledge was poor regarding the definition of with no difference between females and males stroke (65.9% versus 62.1%), P-value, 0.078, 90.4% of women vs. 88.8% of men knew that hypertension is a risk factor for stroke with a not significant statistical difference, P-value, 0.683, males knowledge regarding smoking as a risk factor was higher than females (93.1% versus 80.7%, P-value, 0.003), while only 65.9% of women and 57.8% of men knew diabetes as a risk factor, P-value, 115. The knowledge regarding the warning signs and symptoms of stroke was sub-optimal with no statistically significant difference between females and males, for example only 74.8% and 69.8% knew that blurring of vision is a symptom of stroke, and 83.0% versus 80.2%, 73.3 versus 79.3%, were aware of the weakness of one side of the body and facial weakness as signs of stroke respectively, P-values, 0.342, and 0.169 respectively, and only 43% versus 37.9% were aware of dizziness as a warning symptom of stroke, P-value, 0.248. It is interesting to note that only 23% of females and 20.7% of males participated in a stroke campaign. Other differences between genders were depicted in table 1. In the present study, the knowledge about stroke increased progressively from first class (28.1%) to interns (100%) with a highly significant statistical difference, P-value<0.001, the same was observed regarding risk factors of stroke: Hypertension, 87.5% in the first and 95.2% in the interns, P-value, 0.020, smoking (81.3% versus 85.7%), this imply that the knowledge is increasing while progressing in the College. Table 2 showed the difference in knowledge according to the classes.

Table 1. Perception of stroke warning signs and knowledge of potential risk factors among medical students in Tabuk University (difference between men and women)

			Female		Male		P value
Question		**Answer**	**N**	**%**	**N**	**%**	
What is the meaning of the stroke?		**Hemorrhagic**	3	2.2%	0	0.0%	0.078
		Thrombotic	21	15.6%	13	11.2%	
		Both	89	65.9%	72	62.1%	
		I don't know	22	16.3%	31	26.7%	
Which of the	**Hypertension**	**I don't know**	13	9.6%	13	11.2%	0.683
		Yes	122	90.4%	103	88.8%	

following is a risk factor for stroke?	**High Cholesterol**	**I don't know**	23	17.0%	15	12.9%	0.234
		Yes	112	83.0%	101	87.1%	
	Smoking	**I don't know**	26	19.3%	8	6.9%	0.003
		Yes	109	80.7%	108	93.1%	
	Increased age	**I don't know**	35	25.9%	18	15.5%	0.044
		Yes	100	74.1%	98	84.5%	
	Overweight	**I don't know**	44	32.6%	45	38.8%	0.186
		Yes	91	67.4%	71	61.2%	
	Diabetes	**I don't know**	46	34.1%	49	42.2%	0.115
		Yes	89	65.9%	67	57.8%	
	Hereditary family history	**I don't know**	67	49.6%	62	53.4%	0.317
		Yes	68	50.4%	54	46.6%	
	Lack of exercise	**I don't know**	71	52.6%	74	63.8%	0.048
		Yes	64	47.4%	42	36.2%	
Which of the following is a symptom or warning sign of the stroke?	**Problem with vision**	**I don't know**	34	25.2%	35	30.2%	0.229
		Yes	101	74.8%	81	69.8%	
	Slurred speech	**I don't know**	25	18.5%	20	17.2%	0.462
		Yes	110	81.5%	96	82.8%	
	Weakness on one side of the body	**I don't know**	23	17.0%	23	19.8%	0.342
		Yes	112	83.0%	93	80.2%	
	Sudden confusion	**I don't know**	42	31.1%	34	29.3%	0.432
		Yes	93	68.9%	82	70.7%	
	Facial weakness/fallen face	**I don't know**	36	26.7%	24	20.7%	0.169
		Yes	99	73.3%	92	79.3%	
	Severe headache	**I don't know**	61	45.2%	51	44.0%	0.474
		Yes	74	54.8%	65	56.0%	
	Numbness on one side of the body	**I don't know**	51	37.8%	54	46.6%	0.101
		Yes	84	62.2%	62	53.4%	
	Dizziness	**I don't know**	77	57.0%	72	62.1%	0.248
		Yes	58	43.0%	44	37.9%	
What is the action to be taken for the potential stroke?	**Call an ambulance**	**I don't know**	39	28.9%	48	41.4%	0.026
		Yes	96	71.1%	68	58.6%	
	Drive or have someone drive me to the hospital	**I don't know**	101	74.8%	85	73.3%	0.446
		Yes	34	25.2%	31	26.7%	
	Tell someone to contact GP	**I don't know**	100	74.1%	87	75.0%	0.492
		Yes	35	25.9%	29	25.0%	
	Take something (such as aspirin or head medication)?	**I don't know**	119	88.1%	106	91.4%	0.266
		Yes	16	11.9%	10	8.6%	
	Lie down, try to relax, and ignore it	**I don't know**	132	97.8%	113	97.4%	0.584
		Yes	3	2.2%	3	2.6%	
What are	**Thrombolysis**	**No**	60	44.4%	55	47.4%	0.365

ISSN: 1343-4292
Volume 140, Issue 06, September, 2022

the medications or other treatments that can be used for the stroke?		**Yes**	75	55.6%	61	52.6%	
	Heparin or warfarin	**No**	80	59.3%	73	62.9%	0.321
		Yes	55	40.7%	43	37.1%	
	Aspirin	**No**	84	62.2%	66	56.9%	0.233
		Yes	51	37.8%	50	43.1%	
	Blood pressure control	**No**	85	63.0%	82	70.7%	0.123
		Yes	50	37.0%	34	29.3%	
	Surgery	**No**	91	67.4%	91	78.4%	0.035
		Yes	44	32.6%	25	21.6%	
Who dies more in stroke (men or women)?		**Men**	62	45.9%	51	44.0%	0.081
		Women	23	17.0%	10	8.6%	
		No difference	50	37.0%	55	47.4%	
Have you been involved in stroke awareness campaigns?		**No**	104	77.0%	92	79.3%	0.390
		Yes	31	23.0%	24	20.7%	

Table 2. Perception of stroke warning signs and knowledge of potential risk factors among medical students in Tabuk University (according to class).

			First-year		Second year		Third year		Fourth-year		Fifth year		Sixth year		Intern	
		Answer	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**
is the meaning the stroke?		**Hemorrhagic**	0	0.0%	0	0.0%	2	5.1%	1	3.2%	0	0.0%	0	0.0%	0	0.0%
		Thrombotic	3	9.4%	2	4.7%	12	30.8%	3	9.7%	8	15.7%	6	17.6%	0	0.0%
		Both	9	28.1%	22	51.2%	16	41.0%	24	77.4%	41	80.4%	28	82.4%	21	100.0%
		I don't know	20	62.5%	19	44.2%	9	23.1%	3	9.7%	2	3.9%	0	0.0%	0	0.0%
	Hypertension	**I don't know**	4	12.5%	11	25.6%	3	7.7%	3	9.7%	3	5.9%	1	2.9%	1	4.8%
		Yes	28	87.5%	32	74.4%	36	92.3%	28	90.3%	48	94.1%	33	97.1%	20	95.2%
h e in r ?	**High Cholesterol**	**I don't know**	12	37.5%	10	23.3%	5	12.8%	2	6.5%	5	9.8%	2	5.9%	2	23.3%
		Yes	20	62.5%	33	76.7%	34	87.2%	29	93.5%	46	90.2%	32	94.1%	19	90.5%
	Smoking	**I don't know**	6	18.8%	4	9.3%	11	28.2%	5	16.1%	4	7.8%	1	2.9%	3	14.3%
		Yes	26	81.3%	39	90.7%	28	71.8%	26	83.9%	47	92.2%	33	97.1%	18	85.7%
	Increased age	**I don't know**	9	28.1%	9	20.9%	15	38.5%	5	16.1%	6	11.8%	6	17.6%	3	14.3%
		Yes	23	71.9%	34	79.1%	24	61.5%	26	83.9%	45	88.2%	28	82.4%	18	85.7%
	Overweig	**I don't**	19	59.4%	19	44.2	13	33.3	16	51.6	13	25.5	4	11.8%	5	23.8%

ht	**know**				%		%		%		%				
	Yes	13	40.6%	24	55.8 %	26	66.7 %	15	48.4 %	38	74.5 %	30	88.2%	16	76.2%
Diabetes	**I don't know**	19	59.4%	25	58.1 %	17	43.6 %	11	35.5 %	15	29.4 %	6	17.6%	2	9.5%
	Yes	13	40.6%	18	41.9 %	22	56.4 %	20	64.5 %	36	70.6 %	28	82.4%	19	90.5%
Hereditary family history	**I don't know**	29	90.6%	33	76.7 %	25	64.1 %	18	58.1 %	15	29.4 %	5	14.7%	4	19.0%
	Yes	3	9.4%	10	23.3 %	14	35.9 %	13	41.9 %	36	70.6 %	29	85.3%	17	81.0%
Lack of exercise	**I don't know**	28	87.5%	36	83.7 %	27	69.2 %	24	77.4 %	16	31.4 %	6	17.6%	8	38.1%
	Yes	4	12.5%	7	16.3 %	12	30.8 %	7	22.6 %	35	68.6 %	28	82.4%	13	61.9%
Problem with vision	**I don't know**	15	46.9%	14	32.6 %	15	38.5 %	11	35.5 %	7	13.7 %	3	8.8%	4	19.0%
	Yes	17	53.1%	29	67.4 %	24	61.5 %	20	64.5 %	44	86.3 %	31	91.2%	17	81.0%
Slurred speech	**I don't know**	12	37.5%	14	32.6 %	11	28.2 %	5	16.1 %	2	3.9%	1	2.9%	0	0.0%
	Yes	20	62.5%	29	67.4 %	28	71.8 %	26	83.9 %	49	96.1 %	33	97.1%	21	100.0%
Weakness on one side of the body	**I don't know**	9	28.1%	10	23.3 %	7	17.9 %	12	38.7 %	5	9.8%	2	5.9%	1	4.8%
	Yes	23	71.9%	33	76.7 %	32	82.1 %	19	61.3 %	46	90.2 %	32	94.1%	20	95.2%
Sudden confusion	**I don't know**	15	46.9%	12	27.9 %	13	33.3 %	12	38.7 %	11	21.6 %	6	17.6%	7	33.3%
	Yes	17	53.1%	31	72.1 %	26	66.7 %	19	61.3 %	40	78.4 %	28	82.4%	14	66.7%
Facial weakness/fallen face	**I don't know**	9	28.1%	11	25.6 %	14	35.9 %	10	32.3 %	8	15.7 %	8	23.5%	0	0.0%
	Yes	23	71.9%	32	74.4 %	25	64.1 %	21	67.7 %	43	84.3 %	26	76.5%	21	100.0%
Severe headache	**I don't know**	22	68.8%	22	51.2 %	24	61.5 %	17	54.8 %	13	25.5 %	12	35.3%	2	9.5%
	Yes	10	31.3%	21	48.8 %	15	38.5 %	14	45.2 %	38	74.5 %	22	64.7%	19	90.5%
Numbness on one side of the body	**I don't know**	25	78.1%	28	65.1 %	20	51.3 %	17	54.8 %	8	15.7 %	4	11.8%	3	14.3%
	Yes	7	21.9%	15	34.9 %	19	48.7 %	14	45.2 %	43	84.3 %	30	88.2%	18	85.7%
Dizziness	**I don't know**	27	84.4%	35	81.4 %	30	76.9 %	23	74.2 %	15	29.4 %	12	35.3%	7	33.3%
	Yes	5	15.6%	8	18.6 %	9	23.1 %	8	25.8 %	36	70.6 %	22	64.7%	14	66.7%
Call an	**I don't**	23	71.9%	24	55.8	17	43.6	8	25.8	10	19.6	5	14.7%	0	0.0%

ISSN: 1343-4292
Volume 140, Issue 06, September, 2022

	ambulance	know				%		%		%		%				
		Yes	9	28.1%	19	44.2 %	22	56.4 %	23	74.2 %	41	80.4 %	29	85.3%	21	100.0%
	Drive or have someone drive me to the hospital	I don't know	30	93.8%	39	90.7 %	32	82.1 %	26	83.9 %	32	62.7 %	18	52.9%	9	42.9%
		Yes	2	6.3%	4	9.3%	7	17.9 %	5	16.1 %	19	37.3 %	16	47.1%	12	57.1%
	Tell someone to contact GP	I don't know	28	87.5%	37	86.0 %	27	69.2 %	26	83.9 %	34	66.7 %	23	67.6%	12	57.1%
		Yes	4	12.5%	6	14.0 %	12	30.8 %	5	16.1 %	17	33.3 %	11	32.4%	9	42.9%
	Take something (such as aspirin or head medication)?	I don't know	32	100.0 %	42	97.7 %	35	89.7 %	25	80.6 %	39	76.5 %	33	97.1%	19	90.5%
		Yes	0	0.0%	1	2.3%	4	10.3 %	6	19.4 %	12	23.5 %	1	2.9%	2	9.5%
	Lie down, try to relax, and ignore it	I don't know	32	100.0 %	41	95.3 %	38	97.4 %	30	96.8 %	50	98.0 %	34	100.0 %	20	95.2%
		Yes	0	0.0%	2	4.7%	1	2.6%	1	3.2%	1	2.0%	0	0.0%	1	4.8%
	Thrombolysis	No	27	84.4%	32	74.4 %	26	66.7 %	17	54.8 %	6	11.8 %	6	17.6%	1	4.8%
		Yes	5	15.6%	11	25.6 %	13	33.3 %	14	45.2 %	45	88.2 %	28	82.4%	20	95.2%
	Heparin or warfarin	No	29	90.6%	35	81.4 %	31	79.5 %	18	58.1 %	24	47.1 %	12	35.3%	4	19.0%
		Yes	3	9.4%	8	18.6 %	8	20.5 %	13	41.9 %	27	52.9 %	22	64.7%	17	81.0%
	Aspirin	No	28	87.5%	33	76.7 %	30	76.9 %	20	64.5 %	19	37.3 %	15	44.1%	5	23.8%
		Yes	4	12.5%	10	23.3 %	9	23.1 %	11	35.5 %	32	62.7 %	19	55.9%	16	76.2%
	Blood pressure control	No	28	87.5%	36	83.7 %	32	82.1 %	24	77.4 %	29	56.9 %	15	44.1%	3	14.3%
		Yes	4	12.5%	7	16.3 %	7	17.9 %	7	22.6 %	22	43.1 %	19	55.9%	18	85.7%
	Surgery	No	29	90.6%	39	90.7 %	34	87.2 %	25	80.6 %	26	51.0 %	18	52.9%	11	52.4%
		Yes	3	9.4%	4	9.3%	5	12.8 %	6	19.4 %	25	49.0 %	16	47.1%	10	47.6%
	dies more in oke (men or women)?	Men	4	12.5%	15	34.9 %	13	33.3 %	15	48.4 %	32	62.7 %	22	64.7%	12	57.1%
		Women	2	6.3%	2	4.7%	6	15.4 %	5	16.1 %	10	19.6 %	7	20.6%	1	4.8%
		No	26	81.3%	26	60.5	20	51.3	11	35.5	9	17.6	5	14.7%	8	38.1%

	differenc e				%		%		%		%				
ve you been ved in stroke wareness mpaigns?	**No**	30	93.8%	39	90.7 %	34	87.2 %	24	77.4 %	34	66.7 %	27	79.4%	8	38.1%
	Yes	2	6.3%	4	9.3%	5	12.8 %	7	22.6 %	17	33.3 %	7	20.6%	1 3	61.9%

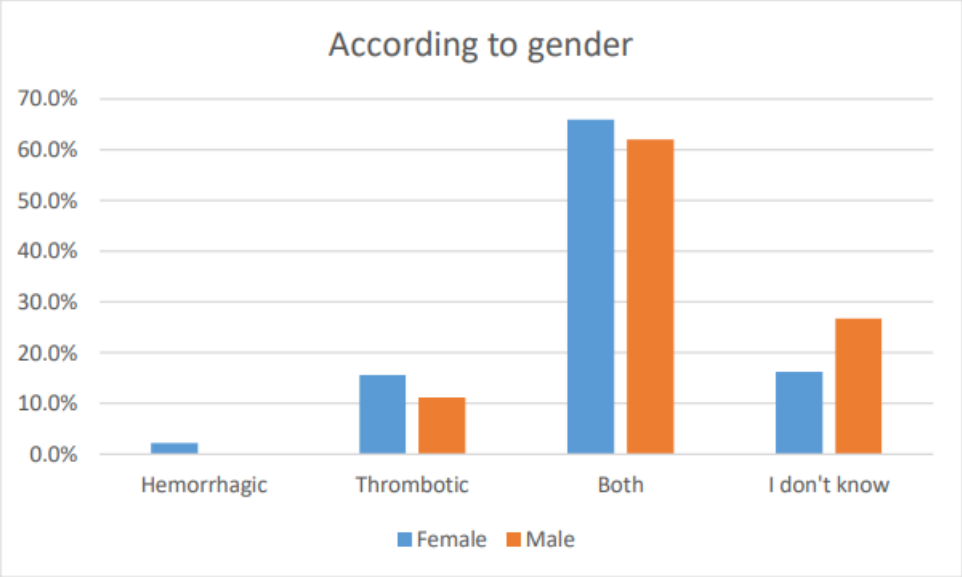

Figure 1. Definition of stroke.

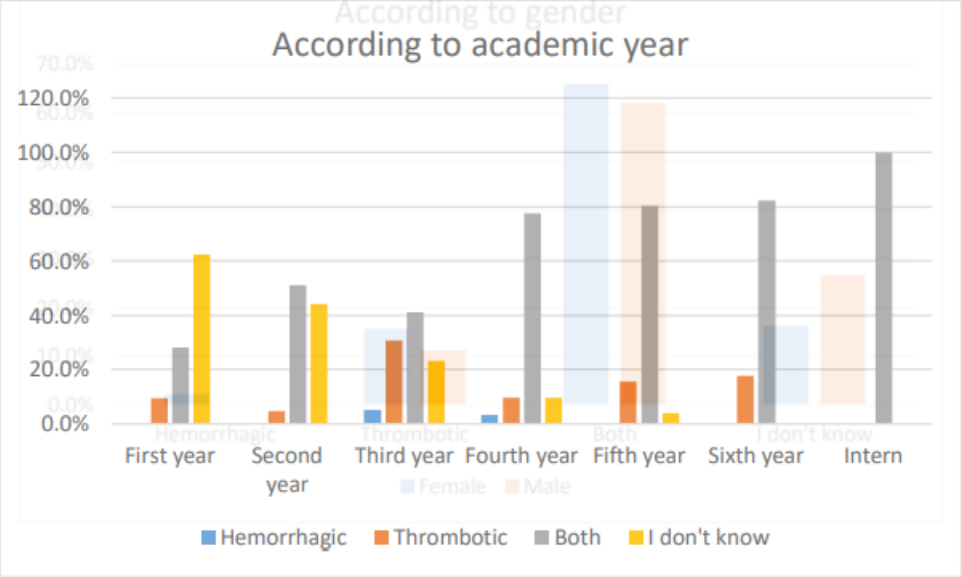

Figure 2. What is the meaning of the stroke?

5. Discussion

In the present study, the most commonly identified stroke risk factor was hypertension followed by high serum cholesterol, similar to [23] who conducted a study among students in Nepal and concluded similar findings. Pradhan and colleagues found smoking and oily food were cited more by males as risk factors in line with the current findings. A study conducted in Indonesia found no impact of gender on knowledge about stroke risk factors in contrast to the current findings [24]. The knowledge about smoking is expected

because the Saudi community is preserving and females' knowledge about smoking is lower. Previous studies conducted among the public identified hypertension as the most common stroke risk factor in line with our findings [25], [26]. [25] respondents identify smoking as a risk factor in 87.8% in line with the present findings. Weakness on one side of the body was the most commonly encountered symptom in line with [27], and slurring of speech was reported in 81.5% in contrast to a study published in Saudi Arabia [28] who reported slurring of speech in only 18.8% of responders. Importantly, only two-thirds of participants knew that diabetes and overweight are risk factors for stroke, and urgent interventional programs are needed to raise awareness about diabetes and obesity complications. Diabetes and obesity are common in Saudi Arabia, nearly one-third of the population were suffering from diabetes [28]. In the present study, 71.1% will call the ambulance, however, the same percentage will take the patients to the hospital by themselves or call another one to do so, the findings are in line with previous literature [29]. more effort is obviously needed regarding this important matter as time is crucial for the management of ischemic stroke if thrombolytic therapy is planned [30]. The knowledge regarding stroke medications is modest and better than another study published in Nepal [23]. Given the above and the fact that only 20% of the current sample have participated in the stroke campaign, it is recommended to implement measures to increase the student's awareness about stroke, including stroke early in the curriculum is of great importance to reduce the ischemic stroke complications by knowledge about risk factors, symptoms, and calling the ambulance as early as possible.

The study limitations: The current study limitations were the reliance on a self-administered questionnaire and the small size of the study sample. Being a single-center study is another limitation.

6. Conclusion

The knowledge regarding stroke risk factors, symptoms and signs, and prevention of stroke was sub-optimal among medical students at Tabuk University, Saudi Arabia, especially regarding the knowledge of diabetes and obesity as risk factors for ischemic stroke. Females' knowledge was lower regarding smoking and increasing age as risk factors. The knowledge was lower among junior students as expected. Including stroke early in the curriculum is recommended.

7. References

[1] Almalki, S., Habeeb, F. A. A., Alaboud, N., Habeb, H., Alhamoud, A. I. A., & Abdulmajeed, M. Perception of stroke warning signs and knowledge of potential risk factors among medical students in King Faisal University. International Journal of Medicine in Developing Countries. 2020;4(9):1421–1427. https://doi.org/10.24911/IJMDC.51-1594510449

[2] Tsao CW, Aday AW, Almarzooq ZI, Alonso A, Beaton AZ, Bittencourt MS, et al. Heart Disease and Stroke Statistics-2022 Update: A Report From the American Heart Association. Circulation. 2022 Feb 22;145(8):e153-e639. doi: 10.1161/CIR.0000000000001052.

[3] Mozaffarian D, Benjamin EJ, Go AS, Arnett DK, Blaha MJ, Cushman M, et al. Executive summary: heart disease and stroke statistics-2015 update a report from the American Heart Association. Circulation. 2015;131(4):434–41. https://doi.org/10.1161/CIR.000000000000015

[4] Robert AA, Zamzami MM. Stroke in Saudi Arabia: a review of the recent literature. Pan Afr Med J. 2014 Jan 15;17:14. doi: 10.11604/pamj.2014.17.14.3015.

[5] Al-Jadid MS, Robert AA. Determinants of length of stay in an inpatient stroke rehabilitation unit in

Saudi Arabia. Saudi Med J. 2010;31(2):189-92.

[6] Fiebach JB, Schellinger PD, Jansen O, et al. CT and diff usion-weighted MR imaging in randomized order: diff usion-weighted imaging results in higher accuracy and lower interrater variability in the diagnosis of hyperacute ischemic stroke. Stroke 2002; 33: 2206–10.

[7] Thrift AG, Dewey HM, Macdonell RA, McNeil JJ, Donnan GA. Incidence of the major stroke subtypes: initial fi ndings from the North East Melbourne stroke incidence study (NEMESIS). Stroke 2001; 32: 1732–38

[8] Fisher M, Garcia JH. Evolving stroke and the ischemic penumbra. Neurology 1996; 47: 884–88.

[9] Don nan G, Baron J, Davis S, Sharp F. The ischemic penumbra: overview, defi nition, and criteria. In: Donnan G, Baron J, Davis S, Sharp F, eds. The ischemic penumbra: pathophysiology, imaging and therapy. New York: Informa Healthcare, 2007: 7–20.

[10] Auer RN, Sutherland GR. Primary intracerebral hemorrhage: pathophysiology. Can J Neurol Sci 2005; 32: S3–12.

[11] Van Gijn J, Rinkel GJ. Subarachnoid haemorrhage: diagnosis, causes and management. Brain 2001; 124: 249–78.

[12] Tirschwell DL, Smith NL, Heckbert SR, Lemaitre RN, Longstreth WT Jr, Psaty BM. Association of cholesterol with stroke risk varies in stroke subtypes and patient subgroups. Neurology. 2004;63:1868–1875

[13] Whisnant JP. Modeling of risk factors for ischemic stroke. The Willis lecture. Stroke 1997; 28: 1840–44.

[14] Yusuf S, Hawken S, Ounpuu S, et al. Eff ect of potentially modifi able risk factors associated with myocardial infarction in 52 countries (the INTERHEART study): case-control study. Lancet 2004; 364: 937–52

[15] Roger VL, Go AS, Lloyd-Jones DM, et al; American Heart Association Statistics Committee and Stroke Statistics Subcommittee. Executive summary: heart disease and stroke statistics–2012 update: a report from the American Heart Association. Circulation. 2012;125:188–197. doi: 10.1161/CIR.0b013e3182456d46.

[16] Boehme, A. K., Esenwa, C., & Elkind, M. S. Stroke Risk Factors, Genetics, and Prevention. Circulation research, 2017; 120(3), 472–495. https://doi.org/10.1161/CIRCRESAHA.116.308398

[17] Kapral MK, Fang J, Hill MD, Silver F, Richards J, Jaigobin C, Cheung AM; Investigators of the Registry of the Canadian Stroke Network. Sex differences in stroke care and outcomes: results from the Registry of the Canadian Stroke Network. Stroke. 2005;36:809–814. doi: 10.1161/01. STR.0000157662.09551.e5.

[18] Reeves MJ, Hogan J, Rafferty A P. Knowledge of stroke risk factors and warning signs among Michigan adults. Neurology, 2020; 59(10), 1547–1552.

https://doi.org/10.1212/01.wnl.0000031796.52748.a5

[19] Donnan G A, Fisher M, Macleo M, Davis S M. Stroke. Lancet (London, England), 2008; 371(9624), 1612–1623. https://doi.org/10.1016/S0140-6736(08)60694-7

[20] Kankaya H, Yesilbalkan OU. Awareness of risk factors and warning signs of stroke among nursing students: Results from questionnaire. Niger J Clin Pract. 2021 May;24(5):729-734. doi: 10.4103/njcp.njcp_181_19.

[21] Obembe AO, Olaogun MO, Bamikole AA, Komolafe MA, Odetunde MO. Awareness of risk factors and warning signs of stroke in a Nigeria university. J Stroke Cerebrovasc Dis. 2014 Apr;23(4):749-58. doi: 10.1016/j.jstrokecerebrovasdis.2013.06.036.

[22] Abutaima MKT, Almaghrabi A, Alhazzaa R, Alaydaa A, Alshuraymi A, Alzahim M, Ashour S, Alayed M, Alshamrani M, Khalifa AFM. Level of awareness regarding stroke among Riyadh population. J Family Med Prim Care. 2021 Jan;10(1):538-541. doi: 10.4103/jfmpc.jfmpc_1304_20.

[23] Pradhan RR, Jha A, Bhandari S, Ojha S, Karn R. Knowledge, attitude, and practice of stroke and thrombolysis among students preparing for undergraduate medical entrance examination in Kathmandu, Nepal. Health Sci Rep. 2021 Apr 5;4(2):e268. doi: 10.1002/hsr2.268.

[24] Rachmawati D, Ningsih DK, Andarini S. Factors affecting the knowledge about stroke risks and early symptoms in emergency department east java-Indonesia. Malang Neurol J. 2020;6(1):9-11.

[25] Haghighi AB, Karimi AA, Amiri A, Ghaffarpasand F. Knowledge and attitude towards stroke risk factors, warning symptoms and treatment in an Iranian population. Med Princ Pract. 2010;19(6):468-472.

[26] 14. Yadav PK, Simerleen S, Kumar V, Joshua A, Krishnan S, Kumar SP. Survey of knowledge and awareness about cerebro-vascular stroke, its risk factors, warning signs and immediate treatment among mangalore urban population-a cross-sectional study. Age. 2013;40(105):39

[27] Alreshidi FM, Alrashidi AS, Alshammari FNM, et al. Knowledge, attitude and practicetowards stroke risk factors and warning symptoms in Saudi Arabia, 2017. Egypt J Hosp Med. 2017;69(3):2082-2087

[28] Al Dawish MA, Robert AA, Braham R, Al Hayek AA, Al Saeed A, Ahmed RA, Al Sabaan FS. Diabetes Mellitus in Saudi Arabia: A Review of the Recent Literature. Curr Diabetes Rev. 2016;12(4):359-368. doi: 10.2174/1573399811666150724095130.

[29] Sowtali SN, Yusoff DM, Harith S, Mohamed M. Comparison of knowledge, attitude and practice on stroke knowledge in Malaysia and other nations: a review of literature. Intern Med J. 2017;24(2):168-173.

[30] Fang J, Yan W, Jiang G-X, Li W, Cheng Q. Time interval between stroke onset and hospital arrival in acute ischemic stroke patients in Shanghai, China. Clin Neurol Neurosurg. 2011;113(2):85-88.