



## Life stressors and personality traits in ischemic cerebral infarction

### ARTICLE INFO

#### Article Type:

Original Paper

#### Authors:

Mahsa Baghbani<sup>1\*</sup>

Marzie Abotorabi-Zarchi<sup>2\*</sup>

Reza Bidaki<sup>3</sup>

1. Department of Psychology, Faculty of Humanities, Yazd Branch, Islamic Azad University, Yazd, Iran.
2. Department of Neurology, School of Medicine, Shahid Sadoughi University of Medical Sciences, Yazd, Iran.
3. Department of Psychiatry, School of Medicine, Shahid Sadoughi University of Medical Sciences, Yazd, Iran.

#### \* Corresponding authors:

Mahsa Baghbani

Email: Mahsabaghbani1371@gmail.com

Marzie Abotorabi-Zarchi

Email: marzie.ab@gmail.com

### ABSTRACT

**Background:** Cerebral stroke, known as one of the most common causes of mortality and morbidity worldwide. The frequency of stroke is rising by ageing the population and placed a significant concern for public health. However, modifying risk factors contributing to stroke may decrease the burden of the disease. This study aimed to examine the association of life stressors and personality types with stroke.

**Method:** The participants were a convenient clinical sample of 100 patients with ischemic stroke and 100 individuals without stroke. The Paykel life event questionnaire and Friedman and Rosenman personality type questionnaire were used to evaluate life stressor and personality characteristics, respectively.

**Results:** Among the different types of stressor subgroups, mean prevalence score of total life stressors, psycho-social stressors, frustration-despair stressors and mental-physical stressors were significantly higher in patients ( $p=0.001$ ,  $p<0.001$ ,  $p=0.001$ , and  $p<0.001$  respectively). The prevalence of type A personality in stroke patients and control groups were 52 and 45 %, respectively ( $p = 0.322$ ). Severity scores of stressors were often higher in cerebral infarction patients with type A personality.

**Conclusion:** There is an association between higher psychological stressors and stroke, and people with type A personality in both groups experienced more stress than type B. It suggests that cerebral infarction patients with type A personality have a higher level of stress in response to life events which could be considered as a modifiable factor.

#### Keywords:

Personality type, Stressor, Brain, Stroke.

Copyright© 2020, TMU Press. This open-access article is published under the terms of the Creative Commons Attribution-NonCommercial 4.0 International License which permits Share (copy and redistribute the material in any medium or format) and Adapt (remix, transform, and build upon the material) under the Attribution-NonCommercial terms.

### Introduction

Cerebral infarction is the third most common cause of death and the most common cause of permanent disability in adults worldwide (1). It has been reported that each year, more than 5.5 million people die because of cerebral infarction globally. Two-third of these people are from developing countries (2, 3). In Iran, the incidence of cerebral stroke has been reported in the range of 23 to 103 per 100,000 persons per year (4). Also, the onset of stroke in Iran is almost a decade earlier than the other countries (5), which highlights the importance of this study for this country. One of the essential strategies for decreasing the burden of this disease is recognizing and modifying the risk factors (6).

Moreover, there are some reports about the association of particular personality types and some medical conditions such as heart stroke (7).

It has been widely recognized that Type A personality is a risk factor contributing to diseases (8).

There are different types of stress in daily life. Stressors can be positive (i.e. marriage or achievement) or negative (i.e. personal, occupational or social stresses) (9). People showing high-stress levels have a high tendency to show behaviors that can increase the possibility of disease and injury (7). Also, there is a hypothesis that acute and chronic physiological stress is associated with inflammation. For instance, the main stress hormones, such as norepinephrine and epinephrine, can activate nuclear factor kappa B (NF- $\kappa$ B) in macrophages, adipocytes and endothelial cells, and initiate inflammatory processes. The presence of this inflammatory condition in the wall of vessels, consider as a significant risk factor for

cardiovascular diseases (10).

Psychological factors such as anxiety, depression, lack of social support, occupational stresses (11-13) and type A personality (7) have an impact on the development of cardiovascular diseases. Furthermore, psychological stresses act as a trigger for cardiac infarction (14). However, their role in cerebral infarction is not elucidated well (15). Since cardiac infarction and cerebral infarction both have similar pathophysiology (16) and some risk factors (i.e. hypertension, diabetes, hyperlipidemia, smoking), it would be likely that personality types and stressors may also have a contributing role in cerebral infarctions.

On this basis, a few investigations have recently been conducted for the recognition of new risk factors and triggers that may contribute to the disease, including psychological stresses. Although the findings of these researches are still limited, however, it has been realized that depression and significant events can increase the risk of stroke (17, 18). For example, it has been noticed that the year following an earthquake, the numbers of strokes was increased in the affected areas in comparison to the year before (19). Considering the gap in the current literature, the current study aims to examine the association of personality types and psychological stressors with cerebral ischemic stroke.

## Material and Methods

### Participants

The participants of this case-control study were a convenient sample of 100 cases diagnosed with cerebral infarction and 100 individuals without stroke as a control group. The study population sample was from the university-affiliated hospital, Shafa Hospital, Kerman, Southern of Iran. The sample recruited from all patients diagnosed with cerebral stroke during five months' period, including patients, was admitted to the hospital and referred to the clinic which less than three months have passed since the diagnosis of stroke.

The sample size was calculated using previous studies and the Cochran's formula. The control group was from a convenient sample of patients' caregivers and medical staffs. They were interviewed to exclude any considerable medical conditioning. Patients with the disturbance of consciousness or perception, dementia, memory loss, personality change due to cerebral stroke,

psychosis, speaking difficulties that could affect the person's responsivity to the questionnaire, and drug abuse were excluded.

### Tools

Demographic characteristics, such as age and gender, were asked.

*Paykel's stressful life events scale (1998)*: This questionnaire consisted of 65 life events and assessed the number and severity of stressful events experienced during the person's life (20). This 5-point Likert scale has had enough reliability and validity, which is used to assess the stress in patients with coronary artery heart disease (21). Its reliability coefficient 0.72 for the number of stressful events and 0.73 for the amount of stress (7).

This scale dichotomizes life events based on whether they are desirable or undesirable. The first half of the scale determine the valence of adverse events and the second half, determine the positive valence of the events (22). Generally, events grouped into ten categories, including work, finance, health, migration, bereavement, courtship, social, family and legal relationship and marital status, and additional information about a stressful situation and chronic or persisting problems (22).

*Friedman and Rosenman A, B personality test*: This test is used as a tool for personality type A classification (23). The questionnaire contains a series of 25 questions with answers yes (1 score) and no (0 score). The range of the scores is from 0 to 25. Scores more than 13 was considered as type A, and those with less than 13 were considered as type B (24, 25). The reliability of this test is reported in the range of 0.7-0.8 (24), and the validity of this questionnaire has been calculated as 0.91 (26). Type A behaviour personality pattern defined as "an action emotion complex can be observed in any individual aggressively involved in a chronic struggle to achieve more in less time" (23). People with type A personality are competitive, strict, time compulsive, impatient, aggressive and have lower self-acceptance. On the other hand, people with type B personality are calmer, have more care for the quality of life, are less ambitious and less impatient, and are more conservative (8, 27-29). The patients completed all questionnaires under the supervision of a clinician.

**Statistics**

The data were collected and analyzed using SPSS software (version 25, IBM Corporation, NY, USA) statistic software. According to normality tests ( $p < 0.05$  in Kolmogorov-Smirnov and Shapiro-Wilk), non-parametric tests (Mann-Whitney) used. Chi-Square test for nominal variables, Mann-Whitney for comparing continuous variables, and regression analysis to examine the association of personality type with stroke were used. P values  $\leq 0.05$  were considered statistically significant.

**Results**

The number of males in the case and control group was 62 (62%) and 58 (58%), respectively ( $p = 0.564$ ). There was no difference regarding age between the two study groups ( $p > 0.05$ ). The number of patients in the cases aged less than 30 years, between 30 and 40 years, and more than 40 years-old were 32 (32%), 45 (45%), and 23 (23%) respectively. Also, the number of patients in the control group aged less than 30 years, between 30 and 40 years, and more than 40 years were 17 (17%), 38 (38%), and 45 (45%) respectively.

Among the different types of stressor subgroups, mean prevalence score of total life stressors, psycho-social stressors, frustration-despair stressors and mental-physical stressors were significantly higher in patients ( $p = 0.001$ ,  $p < 0.001$ ,  $p = 0.001$ , and  $p < 0.001$  respectively). The mean prevalence score of Individual-familial and Occupational-educational stressors was also higher in the patients group but there was no statistically significant difference compared with the control group ( $p = 0.596$  and  $p = 0.190$  respectively) (Table 1), i.e. the occurrence of some life stressors has seen more in stroke patients than healthy subjects.

Severity scores of several stressor subgroups were significantly higher in patients compared to the control group such as total life stressors as well as individual-familial stressors, frustration-despair stressors, and mental-physical stressors ( $p < 0.05$ ) (Table 2). i.e. although some life stressors have seen more frequently in stroke patients, the severity of such stressors also is much higher in these patients in comparison with healthy subjects.

**Table 1.** Comparison of prevalence scores of stressors between patient and control groups

Type of stressors	Groups	Mean	SD*	Median	Mean Rank	P-value**
Total life	Patient	19.54	15.81	20.0	113.94	0.001
	Control	12.75	11.71	12.0	87.06	
Psycho-social	Patient	5.80	5.63	4.0	115.58	<0.001
	Control	2.87	3.31	2.0	85.42	
Individual-familial	Patient	4.11	4.10	2.0	102.65	0.596
	Control	4.11	4.31	4.0	98.35	
Occupational-educational	Patient	3.84	4.47	2.0	105.70	0.190
	Control	2.75	3.13	2.0	95.30	
Frustration-despair	Patient	2.12	2.34	1.0	113.34	0.001
	Control	1.16	1.63	0.0	87.66	
Mental-physical	Patient	2.57	3.10	1.0	123.24	<0.001
	Control	0.68	1.49	0.0	77.76	

\* Standard Deviation, \*\* Mann-Whitney U Test

**Table 2.** Comparison of severity scores of stressors between patient and control groups

Type of stressors	Groups	Mean	SD*	Median	Mean Rank	P-value**
Total life	Patient	36.2	24.08	27.5	113.21	0.002
	Control	25.5	19.29	23.0	87.79	
Psycho-social	Patient	7.59	8.15	6.5	104.11	0.370
	Control	5.61	5.45	4.5	96.89	
Individual-familial	Patient	9.79	6.66	10.0	108.52	0.049
	Control	7.83	6.68	6.0	92.48	
Occupational-educational	Patient	8.01	10.79	5.0	103.33	0.489
	Control	5.59	5.26	4.0	97.67	
Frustration-despair	Patient	5.50	4.85	5.0	118.92	<0.001
	Control	2.32	2.58	2.0	82.08	
Mental-physical	Patient	3.57	4.43	2.0	113.78	0.001
	Control	1.56	2.46	0.0	87.22	

\* Standard Deviation, \*\* Mann-Whitney U Test

**Table 3.** Comparison of frequency of personality types in the stroke group versus controls

Personality type	Patient N (%)	Control N (%)	P-value
Type A	52 (52)	45 (45)	0.322
Type B	48 (48)	55 (55)	
Total	100 (100)	100 (100)	

The frequency of personality types (A and B) demonstrated in Table 3. The prevalence of type A personality in stroke patients and control group were 52 and 45 %, respectively ( $p = 0.322$ ), which means that personality type is not associated with stroke susceptibility and may not consider as an independent risk factor for vascular events.

Table 4 shows the status of the severity of stressors regarding personality type and study group. In all stressor types, the differences were significant, except for the occupational-educational stressors, which mean rank of the stressor was not different in personality types and

study groups ( $p=0.185$ ). This means that the severity of stressors is different regarding personality types and vascular events, and severity scores of stressors were often higher in cerebral infarction patients with type A personality.

**Table 4.** Severity scores of stressors according to personality types in the stroke group and controls

Type of stressors		Mean rank		P-value*
		Type A	Type B	
Total life	Patient	131.11	93.82	<0.001
	Control	105.84	73.02	
Psycho-social	Patient	124.49	82.03	<0.001
	Control	110.59	85.68	
Individual-familial	Patient	123.72	92.05	0.001
	Control	107.81	79.94	
Occupational-educational	Patient	114.40	91.33	0.185
	Control	101.06	94.90	
Frustration-despair	Patient	127.67	109.44	<0.001
	Control	89.88	75.70	
Mental-physical	Patient	118.06	109.16	0.001
	Control	99.89	76.85	

\* Kruskal-Wallis test

**Table 5.** Correlation between severity score of stressor types and personality test scores according to study groups

Type of stressors		Personality test score	P-value*
		Correlation Coefficient	
Total life stressors	Patient	0.265	0.008
	Control	0.333	0.001
Psycho-social stressors	Patient	0.277	0.005
	Control	0.205	0.041
Individual-familial stressors	Patient	0.278	0.005
	Control	0.340	0.001
Occupational-educational stressors	Patient	0.047	0.645
	Control	0.054	0.592
Frustration-despair stressors	Patient	0.275	0.006
	Control	0.214	0.033
Mental-physical stressors	Patient	- 0.29	0.775
	Control	0.279	0.005

\* Spearman's rho

The correlation between the severity of stressors score and personality test score in the two groups has been shown in Table 5. The total life stressors in both groups showed a significant positive correlation with the personality test score ( $r=0.265$ ,  $p=0.008$  in patients and  $r=0.333$ ,  $p=0.001$  in controls), as well as the psycho-social stressors ( $r=0.277$ ,  $p=0.005$  vs  $r=0.205$ ,  $p=0.041$ ), individual-familial stressors ( $r=0.278$ ,  $p=0.005$  vs  $r=0.340$ ,  $p=0.001$ ) and the frustration-despair stressor ( $r=0.275$ ,  $p=0.006$  vs  $r=0.214$ ,  $p=0.033$ ). Additionally, no significant correlation was found

for occupational-educational stressors. Also, for mental-physical stressors, there was a positive and significant correlation only in the control group between stressor severity score and personality test score ( $p=0.005$ ), while no correlation was found in the patients ( $p=0.775$ ).

## Discussion

This case-control study aimed to evaluate the association between personality types, life stressors, and acute cerebral infarction in patients referred to or admitted in the Shafa hospital, Kerman, due to cerebral stroke. Previous studies demonstrated an association between personality type and some conditions, with particular attention to vascular-related diseases, such as ischemic heart disease, cerebral ischemia, and hypertension (30-40). It seems that stressful situations and respond to them may alter the predisposition to cerebrovascular diseases, regardless of other known risk factors.

Rosenmann et al. showed a strong association between ischemic heart disease and Type A personality in a prospective cohort conducted on 257 coronary heart disease (37). Hynes et al. found a similar association during the Framingham study (41). Jenkins et al. suggested that type A behaviour in known patients with CVD could predict further myocardial infarction (MI) attacks (42). Woods et al. showed a relationship between type A personality and types of headache (43). Woods and Burns showed that type A behavioural pattern implicated in illness and physical symptoms (43). They proposed that modifying these behavioural characteristics could be considered as a therapeutic target as well as a reduction in the risk of vascular events. A similar conclusion was reached in a study by Eysenk (44).

Previously, Kim et al. showed that aspects of personality types might correlate with diseases (45). They have shown the association between the tenseness dimension of type A personality pattern and the high risk of ischemic stroke. This finding was supported by Fernandez-Conception et al. study (46), which investigated the role of life events and stressful behavioural patterns in susceptibility to cerebral stroke. Type A personality is usually known with the presence of aggressiveness, ambition impatience, and hostility in this behavioural pattern, each of which accompanied by a high amount of physical and mental stress.

Furthermore, the association between significant life events and cardiovascular diseases was revealed in a study by Kornerup et al. (47). Also, Kotlega et al. argue that emotional stress is an underestimated risk factor for ischemic stroke and other neurological diseases (48). Shah et al. have shown the impact of psychosocial factors on atherosclerosis (49). They found that depression and anxiety were in association with subclinical atherosclerosis in men and stress as a risk factor in women, regardless of traditional risk factors.

However, the exact etiopathogenesis of cerebral ischemia is not well understood, but some contributing factors leading to increasing the risk of stroke was studied through many years. Among these, some underlying diseases may increase susceptibility to the stroke, over various mechanisms. In a study by Araki et al., concluded that low well-being status in elderly with diabetes mellitus could be considered as an independent risk factor for stroke (50).

In the present study, we observed that stressful life events have been seen more frequently in patients with cerebral stroke. The prevalence of some subtypes of stressors was significantly higher in patients with stroke, but the score of all stress subtypes studied was higher overall. A study by Gianturco et al. established an association between specific behavioral patterns and susceptibility to coronary events (32). They showed that the "pressure pattern" of behavior, which was accompanied by anger, ambitious and perfectionistic, was related to the higher frequency of cerebrovascular events (CVE). However, they could not answer the question that patients with this type of personality led to a combination of CVE, or patients with coronary artery disease (CAD) showed this personality type. Though, the presence of underlying CAD may have aggravated type A personality pattern. A study by May et al. suggested that psychologic stress is a predictive factor for only fatal cerebral stroke and not non-fatal strokes (51), but we showed that stressful life events were in association with the prevalence of cerebral infarction. Similar findings were concluded in several other studies regarding the prevalence of psychosocial stress in cardiovascular events (11, 12, 52, 53). However, the effect of stressful events may be different in various illnesses (54-56). In the present study, we could not find any association between occupational stress and

stroke, but Fransson et al. introduced the job strain as a risk factor for ischemic stroke (57) though the effect of social and economic factors is an essential determining factor in this regard (58). On the other hand, we found a relationship between frustration-despair stressor and risk of stroke, which was similar to findings of a study by Sheikhy et al. on patients with coronary artery disease (59).

Additionally, we found that besides the higher prevalence of life stressors in patients, the severity of such stressors is much higher in patients with stroke. These findings were consistent with a study conducted by Ghandehari et al., which evaluated the relationship between stress and cerebral stroke (60). Notably, Macko et al. demonstrated that recent psychologic stress might not consider as a risk factor for cerebral stroke (61).

What is still unclear is whether these stressful events are responsible for occurring the disease in these patients, or this pattern of personality is more prone to influenced by stressful life events and intensify these daily factors.

Although, we could not conclude that Type A of personality is more frequent in people with cerebral stroke compared to healthy subjects but this study showed that the majority of stressors severity of and personality type scores are correlated together in both study groups and generally severity scores of stressors were higher in cerebral infarction patients with type A personality.

However, some components of the behavioral pattern may play a central role in association with illness predisposition (62). Type Williams argued that global type A personality may not justify the CVD susceptibility, but some aspects of this behavioral pattern, such as hostility complex, may be associated with CAD, independently (63). Herein, Miller et al. suggested that hostility is associated with CVD and all-cause mortality (64). Several possible explanations were introduced in this regard, including metabolic syndrome (65) and systemic inflammation (66, 67), rather than behavioral mechanism (68).

In contrast, some studies could not find an emphasized relationship between personality and illnesses (69-71). Nakaya et al. did not find any association between personality and mortality from ischemic heart disease in a population-based cohort study on rural Japanese people (72).

Studies in this field have faced considerable limitations; first, types of personality are usually self-reported, which may have some bias and errors. Second, different scales of personality assessments have been used, leading to comparison difficulty across studies. Finally, some personal bias, the complexity of personalities, and social inhibitions may lead to inaccurate or even false reports on questionnaires.

Because stress and psychological factors could be controlled, further studies on personality types and life stressors are required to identify the extent of their effects. Such studies should exclude other risk factors to allow for these specific factors to be evaluated as independent risk factors contributing to the cerebral stroke. However, our results suggest that controlling life stresses could be a significant contributor to the prevention of cerebral stroke.

### Acknowledgement

The authors would like to express their gratitude to all the staff in the Shafa Hospital, Kerman, and the patients that cooperated in the execution of this study.

### Funding

This study was supported by a grant from Yazd Branch, Islamic Azad University.

### Declaration

Authors have no conflict of interest to declare.

### References

1. Ga D, Fisher m, macleod m, Davis Sm. Stroke Lancet. 2008;371(9624):1612-23.
2. Aminoff M, Greenberg D, Simon R. Clinical neurology: McGraw-Hill Education; 2015.
3. Haacke C, Althaus A, Spottke A, Siebert U, Back T, Dodel R. Long-term outcome after stroke: evaluating health-related quality of life using utility measurements. Stroke. 2006;37(1):193-8.
4. Hosseini AA, Sobhani-Rad D, Ghandehari K, Benamer HT. Frequency and clinical patterns of stroke in Iran-Systematic and critical review. BMC neurology. 2010;10(1):72.
5. Ghandehari K. Epidemiology of stroke in Iran. Galen Medical Journal. 2016;5(S1):3-9.
6. Hankey GJ. Potential new risk factors for ischemic stroke: what is their potential? Stroke. 2006;37(8):2181-8.
7. Khoosfi H, Monirpoor N, Birashk B, Peighambari MM. A comparative study of personality factors, stressful life events, and social support in coronary heart patients and non-patients. Contemporary Psychology, Biannual Journal of the Iranian Psychological Association. 2007;2(1):41-8.
8. Riska E. The rise and fall of Type A man. Social science & medicine. 2000;51(11):1665-74.
9. Gallagher M, Nelson RJ, Weiner IB. Handbook of psychology, Volume 3: Biological psychology: John Wiley & Sons, Inc; 2003.
10. Black PH. The inflammatory consequences of psychologic stress: relationship to insulin resistance, obesity, atherosclerosis and diabetes mellitus, type II. Medical hypotheses. 2006;67(4):879-91.
11. Rugulies R. Depression as a predictor for coronary heart disease: a review and meta-analysis. American journal of preventive medicine. 2002;23(1):51-61.
12. Rosengren A, Hawken S, Ôunpuu S, Sliwa K, Zubaid M, Almahmeed WA, et al. Association of psychosocial risk factors with risk of acute myocardial infarction in 11 119 cases and 13 648 controls from 52 countries (the INTERHEART study): case-control study. The Lancet. 2004;364(9438):953-62.
13. Gump BB, Matthews KA, Eberly LE, Chang Y-f. Depressive symptoms and mortality in men: results from the Multiple Risk Factor Intervention Trial. Stroke. 2005;36(1):98-102.
14. Strike PC, Perkins-Porras L, Whitehead DL, McEwan J, Steptoe A. Triggering of acute coronary syndromes by physical exertion and anger: clinical and sociodemographic characteristics. Heart. 2006;92(8):1035-40.
15. Elkind MS. Why now? Moving from stroke risk factors to stroke triggers. Current opinion in neurology. 2007;20(1):51-7.
16. Guiraud V, Amor MB, Mas J-L, Touzé E. Triggers of ischemic stroke: a systematic review. Stroke. 2010;41(11):2669-77.
17. Folkman S, Lazarus RS. Coping as a

- mediator of emotion. *Journal of personality and social psychology*. 1988;54(3):466.
18. Simons LA, McCallum J, Friedlander Y, Simons J. Risk factors for ischemic stroke: Dubbo Study of the elderly. *Stroke*. 1998;29(7):1341-6.
  19. Sokejima S, Nakatani Y, Kario K, Kayaba K, Minowa M, Kagamimori S. Seismic intensity and risk of cerebrovascular stroke: 1995 Hanshin-Awaji earthquake. *Prehosp Disaster Med*. 2004;19(4):297-306.
  20. Paykel ES, Prusoff BA, Uhlenhuth EH. Scaling of Life Events. *Archives of General Psychiatry*. 1971;25(4):340-7.
  21. Bayazi MH, Rastegari Y. Relationship of Type 2 behavior pattern, hardiness, and stress with coronary heart disease. *Psychological Research*. 2005.
  22. Paykel E. The interview for recent life events. *Psychological medicine*. 1997;27(2):301-10.
  23. Friedman M, Rosenman R. *Type A Behavior and Your Heart*, New York: Alfred A. Knop; 1974.
  24. Mazaheri S, Zarabian MK, Samadi MJ. Assessment of Personality Types and Locus of Control in Multiple Sclerosis Patients. 2008.
  25. Shaygannejad V, Dehnavi SR, Ashtari F, Karimi S, Dehghani L, Meamar R, et al. Study of type A and B behavior patterns in patients with multiple sclerosis in an Iranian population. 2013;4(Suppl 2):S279.
  26. AZAD ME, QOLAMI FM. The relationship between geographical areas, personality, socio-economical status and demographical factors with job stress. 2011.
  27. Fretwell CE, Lewis CC, Hannay M. Myers-Briggs type indicator, A/B personality types, and locus of control: where do they intersect? *American Journal of Management*. 2013;13(3):57-66.
  28. Mellam AC, editor *Socio-demographic markers on Type A behaviour*. International Congress Series; 2002: Elsevier.
  29. Joshi VV. *Stress: From burnout to balance*: Sage; 2005.
  30. Adler R, MacRitchie K, Engel GL. Psychologic processes and ischemic stroke (Occlusive cerebrovascular disease): I. Observations on 32 Men with 35 strokes. *Psychosomatic medicine*. 1971;33(1):1-30.
  31. Gentry W, Jenkins C, Kaplan B, Heyman A, Breslin M, Gianturco D. The A behavior pattern and ischemic cerebrovascular disease. *Heart & lung: the journal of critical care*. 1979;8(6):1113-6.
  32. Gianturco D, Breslin M, Heyman A, Gentry W, Jenkins C, Kaplan B. Personality Patterns and Life Stress in Ischemic Cerebrovascular Disease: 1. Psychiatric Findings. *Stroke*. 1974;5(4):453-60.
  33. Jenkins CD. Psychologic and social precursors of coronary disease. *New England Journal of Medicine*. 1971;284(5):244-55.
  34. Eysenck HJ. Personality, cancer and cardiovascular disease: A causal analysis. *Personality and individual differences*. 1985;6(5):535-56.
  35. Nabi H, Consoli SM, Chastang J-F, Chiron M, Lafont S, Lagarde E. Type A behavior pattern, risky driving behaviors, and serious road traffic accidents: a prospective study of the GAZEL cohort. *American journal of epidemiology*. 2005;161(9):864-70.
  36. Al Asadi J. Type A behaviour pattern: is it a risk factor for hypertension? 2010.
  37. Rosenman RH, Brand RJ, Jenkins CD, Friedman M, Straus R, Wurm M. Coronary heart disease in the Western Collaborative Group Study: Final follow-up experience of 8 1/2 years. *Jama*. 1975;233(8):872-7.
  38. Kornitzer M, Kittel F, De Backer G, Dramaix M. The Belgian Heart Disease Prevention Project: type" A" behavior pattern and the prevalence of coronary heart disease. *Psychosomatic Medicine*. 1981.
  39. Steca P, D'Addario M, Magrin ME, Miglioretti M, Monzani D, Pancani L, et al. A type A and type D combined personality typology in essential hypertension and acute coronary syndrome patients: Associations with demographic, psychological, clinical, and lifestyle indicators. *PLoS one*. 2016;11(9):e0161840.

40. Sahoo S, Padhy SK, Padhee B, Singla N, Sarkar S. Role of Personality in Cardiovascular diseases: An issue which needs to be focused too! *Indian heart journal*. 2018.
41. Haynes S, Feinleib M, Kannel WB. The relationship of psychosocial factors to coronary heart disease in the Framingham Study. III. Eight-year incidence of coronary heart disease. *American Journal of Epidemiology*. 1980;111(1):37-58.
42. Jenkins CD, Rosenman RH, Zyzanski SJ. Prediction of clinical coronary heart disease by a test for the coronary-prone behavior pattern. *New England Journal of Medicine*. 1974;290(23):1271-5.
43. Woods PJ, Morgan BT, Day BW, Jefferson T, Harris C. Findings on a relationship between Type A behavior and headaches. *Journal of behavioral medicine*. 1984;7(3):277-86.
44. Eysenck HJ. Personality as a risk factor in coronary heart disease. *European Journal of Personality*. 1991;5(2):81-92.
45. Kim JS, Yoon SS, Lee SI, Yoo HJ, Kim CY, Choi-Kwon S, et al. Type A behavior and stroke: high tenseness dimension may be a risk factor for cerebral infarction. *European neurology*. 1998;39(3):168-73.
46. Fernandez-Concepcion O, Verdecie-Feria O, Chavez-Rodriguez L, Alvarez-Gonzalez M, Fiallo-Sanchez M. Type A behaviour and life events as risk factors for cerebral infarct. *Revista de neurologia*. 2002;34(7):622-7.
47. Kornerup H, Osler M, Boysen G, Barefoot J, Schnohr P, Prescott E. Major life events increase the risk of stroke but not of myocardial infarction: results from the Copenhagen City Heart Study. *European Journal of Cardiovascular Prevention & Rehabilitation*. 2010;17(1):113-8.
48. Kotłęga D, Gołąb-Janowska M, Masztalewicz M, Cieciewicz S, Nowacki P. The emotional stress and risk of ischemic stroke. *Neurologia i neurochirurgia polska*. 2016;50(4):265-70.
49. Shah BM, Shah S, Kandula NR, Gadgil MD, Kanaya AM. Psychosocial factors associated with subclinical atherosclerosis in south Asians: the MASALA study. *Journal of immigrant and minority health*. 2016;18(6):1317-27.
50. Araki A, Murotani Y, Kamimiya F, Ito H. Low well-being is an independent predictor for stroke in elderly patients with diabetes mellitus. *Journal of the American Geriatrics Society*. 2004;52(2):205-10.
51. May M, McCarron P, Stansfeld S, Ben-Shlomo Y, Gallacher J, Yarnell J, et al. Does psychological distress predict the risk of ischemic stroke and transient ischemic attack? The Caerphilly Study. *Stroke*. 2002;33(1):7-12.
52. HEYDARI PA, GHARAKHANI M, Mahjoub H. A comparative study of stressful life events and stress coping strategies in coronary heart disease patients and non-patients. 2010.
53. Fredrickson B, Loftus GR, Lutz C, Nolen-Hoeksema S. Atkinson and Hilgard's Introduction to Psychology: Cengage Learning; 2014.
54. Tsutsumi A, Kayaba K, Kario K, Ishikawa S. Prospective study on occupational stress and risk of stroke. *Archives of Internal Medicine*. 2009;169(1):56-61.
55. Egido JA, Castillo O, Roig B, Sanz I, Herrero MR, Garay MT, et al. Is psychophysical stress a risk factor for stroke? A case-control study. *J Neurol Neurosurg Psychiatry*. 2012;83(11):1104-11.
56. Addo J, Ayerbe L, Mohan KM, Crichton S, Sheldenkar A, Chen R, et al. Socioeconomic status and stroke: an updated review. *Stroke*. 2012;43(4):1186-91.
57. Fransson EI, Nyberg ST, Heikkilä K, Alfredsson L, Bjorner JB, Borritz M, et al. Job strain and the risk of stroke: an individual-participant data meta-analysis. *Stroke*. 2015;46(2):557-9.
58. Camelo LV, Giatti L, Chor D, Griep RH, Bensenor IM, Santos IS, et al. Associations of life course socioeconomic position and job stress with carotid intima-media thickness. The Brazilian Longitudinal Study of Adult Health (ELSA-Brasil). *Social Science &*



- Medicine. 2015;141:91-9.
59. Shiekhy S, Issazadegan A, Banehasmishishevan M, Mahmoodi H, Amani Saribagloo J. A comparative study of personality factors, life orientation and hope level in coronary heart patients and normal subjects. *Journal of Urmia Nursing And Midwifery Faculty*. 2013;11(2):0-.
  60. Ghandehari K, Behdani F, Izadi Mood Z, Davarri Edalatpanah M, Asaadi S, Kiadarbandsari E, et al. Assessment of Relationship between Stress and Stroke. *SSU\_Journals*. 2015;23(6):606-12.
  61. Macko RF, Ameriso SF, Barndt R, Clough W, Weiner JM, Fisher M. Precipitants of brain infarction: roles of preceding infection/inflammation and recent psychological stress. *Stroke*. 1996;27(11):1999-2004.
  62. Gremigni P. Hostility as a risk factor for coronary heart disease. *Psychological Factors and Cardiovascular Disorders: The Role of Psychiatric Pathology and Maladaptive Personality Features*. 2008:261-76.
  63. Williams Jr RB. Refining the type A hypothesis: emergence of the hostility complex. *The American journal of cardiology*. 1987;60(18):J27-J32.
  64. Miller TQ, Markides KS, Chiriboga DA, Ray LA. A test of the psychosocial vulnerability and health behavior models of hostility: Results from an 11-year follow-up study of Mexican Americans. *Psychosomatic medicine*. 1995;57(6):572-81.
  65. Niaura R, Banks SM, Ward KD, Stoney CM, Spiro III A, Aldwin CM, et al. Hostility and the metabolic syndrome in older males: the normative aging study. *Psychosomatic medicine*. 2000;62(1):7-16.
  66. Piché M-È, Lemieux S, Weisnagel SJ, Corneau L, Nadeau A, Bergeron J. Relation of high-sensitivity C-reactive protein, interleukin-6, tumor necrosis factor-alpha, and fibrinogen to abdominal adipose tissue, blood pressure, and cholesterol and triglyceride levels in healthy postmenopausal women. *The American journal of cardiology*. 2005;96(1):92-7.
  67. Elovainio M, Merjonen P, Pulkki-Råback L, Kivimäki M, Jokela M, Mattson N, et al. Hostility, metabolic syndrome, inflammation and cardiac control in young adults: The Young Finns Study. *Biological psychology*. 2011;87(2):234-40.
  68. Pulkki L, Kivimäki M, Elovainio M, Viikari J, Keltikangas-Järvinen L. Contribution of socioeconomic status to the association between hostility and cardiovascular risk behaviors: a prospective cohort study. *American Journal of Epidemiology*. 2003;158(8):736-42.
  69. Myrtek M. Meta-analyses of prospective studies on coronary heart disease, type A personality, and hostility. *International journal of cardiology*. 2001;79(2-3):245-51.
  70. Dimsdale JE, Gilbert J, Hutter Jr AM, Hackett TP, Block PC. Predicting cardiac morbidity based on risk factors and coronary angiographic findings. *The American journal of cardiology*. 1981;47(1):73-6.
  71. Hemingway H, Marmot M. Evidence based cardiology: psychosocial factors in the aetiology and prognosis of coronary heart disease: systematic review of prospective cohort studies. *BMJ: British Medical Journal*. 1999;318(7196):1460.
  72. Nakaya N, Tsubono Y, Hosokawa T, Hozawa A, Kuriyama S, Fukudo S, et al. Personality and mortality from ischemic heart disease and stroke. *Clinical and Experimental Hypertension*. 2005;27(2-3):297-305.