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# Apathy subtypes in acute stroke: validation of the Russian self-rated Dimensional Apathy Scale

Mansur Kutlubaev[1*], Albina Akhmetova[2] and Ratko Radakovic[3,4]

## Abstract

**Background** Apathy is a syndrome that can occur in a third of stroke patients. It can be measured by the Dimensional Apathy Scale (DAS), not yet utilized in acute stroke or translated to Russian.

**Aim** To explore apathy subtypes in acute stroke while validating the self-rated Russian DAS.

**Methods** Acute stroke patients (10 days post-stroke) and controls completed the Russian self-rated DAS, a depression measure, cognitive screen, and functional and stroke severity measures. Russian DAS psychometrics and apathy subtype relationships were explored.

**Results** Eighty-seven acute stroke patients and 50 controls were recruited. The Russian DAS internal consistency reliability was good (Alpha = 0.70). Depression was not significantly correlated with emotional apathy, but was significantly positively correlated with initiation and executive apathy, with no functional and stroke severity relationships observed. 34.6% of acute stroke patients displayed apathy, with Executive apathy as the most common, followed by Initiation apathy. Initiation apathy was significantly negatively correlated with cognitive functioning, with cognitively impaired patients having significantly higher Initiation apathy ($p < 0.01$). Executive apathy was higher in those with higher depression severity ($p < 0.001$).

**Conclusions** The Russian DAS is a psychometrically robust multidimensional measure for assessment in acute stroke with emergent preliminary apathy profiles observed, associated with cognitive functioning and depression.

**Keywords** Apathy, Stroke, Cognitive impairment, Depression, Dimensional Apathy Scale

## Introduction

Apathy can be defined as a lack of motivation towards goal-directed behaviors [1–3]. It is a common, but often overlooked sequel of stroke, with recent large-scale meta-analysis revealing that one-third of stroke patients present with apathy [4]. This is suggested to occur due to damage to goal-directed behavior frontal-subcortical neuroanatomical structures and pathways [2, 3, 5]. Apathy has been shown to predict worse outcomes after stroke [5], with research suggesting that early apathy post-stroke can impact longer term outcomes [6, 7]. Notably, more recent research has suggested that apathy has more negative impacts post-stroke compared to depression [8] and may impact community reintegration, social inclusion, and participation [9, 10]. However, apathy can overlap with depression [11, 12], with a meta-analysis study suggesting that in combination, both impact engagement with instrumental activities of daily living (IADLs) [13]. IADLs are key to rehabilitation and reintegration with everyday activities and are affected in

*Correspondence:
Mansur Kutlubaev
mansur.kutlubaev@yahoo.com
[1] Bashkir State Medical University, Ufa, Russian Federation
[2] Republican Clinical Hospital named after G.G. Kuvatova, Ufa, Russian Federation
[3] University of East Anglia, Norwich, UK
[4] University of Edinburgh, Edinburgh, UK

terms of complex tasks such as financial management, in stroke and a variety of other neurological conditions, e.g. [14, 15]. Further, apathy has been found to associate with cognitive impairment both cross-sectionally and longitudinally [16–18].

Apathy as a multidimensional syndrome is composed of different dimensions or subtypes with different demotivational characteristics [1–3]. These subtypes can be classified as executive apathy (lack of motivation for planning, organization, and attention), emotional apathy (emotional flatness, blunting, indifference, or neutrality), and initiation apathy (lack of motivation for self-generation of thoughts and/or actions) [19]. These can be assessed using the Dimensional Apathy Scale (DAS) [20], which has been translated to a number of languages, e.g., [21–23] and applied to neurodegenerative as well as neurological conditions, including stroke [11, 24–26]. Previous research has found that executive and initiation apathy are more prevalent in stroke survivors several years after stroke [11, 27] and have been applied at a case level to explore neuropsychological characteristics of apathy subtypes in stroke [28]. However, there is no research exploring the apathy subtype and associated motivational difficulties in acute stages post-stroke. Research has suggested that the presence of apathy in acute stages of stroke can negatively impact engagement with services [5]. Furthermore, a Russian translation of the DAS is not yet available, and subtypes of apathy have not yet been explored at acute stages of stroke.

The aim of this study was to explore apathy profiles in acute stroke patients while determining the reliability and validity of the Russian version of the self-rated DAS.

## Methods

### Participants

Acute stroke patients were recruited from academic hospitals in Ufa (Russia) between September 2020 and June 2021. The inclusion criteria were: individuals experiencing an ischemic stroke, preserved consciousness (Glasgow Coma Scale score < 11), and hospitalization within the first day after the development of the stroke. The control group included sex- and age-matched individuals with no history of stroke. Exclusion criteria for both groups were comorbid major psychiatric, medical, or other neurological diseases, including dementia. All patients admitted to these hospitals with acute stroke who met the inclusion criteria were invited to participate in the study. After informed consent, demographic and clinical data were obtained.

### Procedure and measures

Stroke patients were tested in the acute stage (day 10 ± 1 after stroke) at the Hospital. Controls were recruited from hospital staff and caregivers. Participants underwent a brief clinical interview aimed at identifying potential exclusion criteria. Demographic data were available for all participants.

Stroke severity was measured by the National Institutes of Health Stroke Scale (NIHSS) [29], which is a 13-item scale across different motor, sensory, and cognitive domains. Scores range from 0 to 42, with a higher score indicative of higher stroke severity. Functional disability was assessed using the modified Rankin Scale (mRs) [30] and the Rivermead Mobility Index (RMI) [31]. The mRs is a single-item global stroke disability outcome measure ranging from 0 to 6, with higher scores indicating more disability. The RMI is a functional mobility measure composed of 15 items, answered dichotomously, with a summed score ranging from 0 to 15, with higher scores indicative of worse mobility. Cognitive functioning was assessed using the Montreal Cognitive Assessment (MoCA) [32], which assesses various cognitive domains (e.g., memory, language, executive functioning, visuospatial functioning) with a score ranging from 0 to 30. Lower scores indicate worse cognitive functioning. The MoCA has a stroke-specific cutoff (< 22), which was available [33]. Depression was assessed using the Beck Depression Inventory (BDI) [34], which is a 21-item scale answered on a 4-point Likert scale relating to mood in the last week. Higher scores indicate more depression, with a range from 0 (no depressive symptoms) to 63 (most depressive symptoms).

The original self-rated DAS [20] was translated into Russian and back translated into English independently by two neurologists fluent in English and Russian, reviewed by a team, and pretested in a small sample of healthy volunteers. The DAS is composed of three subscales assessing different dimensions of apathy: Executive, Emotional, and Initiation. The maximum score for each subscale ranges from 0 (no apathy) to 24 (most apathy). The Russian self-rated DAS can be found in the supplementary materials. While cutoffs were available [24], they were calculated based on 2 standard deviations above the control mean.

This study was approved by the local ethical committee of Bashkir State Medical University. All participants provided written informed consent.

### Statistical analysis

Shapiro–Wilk tests and inspection of histograms were used to determine the distribution of the data. Kruskal–Wallis test with post hoc Dunn's tests and Mann–Whitney test were used for comparative analysis of continuous variables, and the Chi-square test was used for categorical comparison. T tests were used for parametric comparisons. Cronbach's standardized alpha coefficient

quantified internal consistency, with < 0.70 classified as good. Spearman's rho ($r_s$) was used for correlational analysis, with correlation interpretation: weak (0.20–0.39), moderate (0.40–0.59), strong (0.60–0.79), and very strong (0.80–1.00). All analyses were performed using R and SPSS (version 25, IBM Corp., Armonk, NY, USA), with a significance level threshold set at $p < 0.05$.

## Results

The main clinicodemographic variables of the 87 recruited stroke patients and 50 controls are shown in Table 1. There was no significant difference between acute stroke patients and controls on age ($U = 1791.5$, $p = 0.09$), sex distribution ($X^2$ (1, $N = 137$) = 0.11, $p = 0.92$), and marital status ($X^2$ (1, $N = 137$) = 0.43, $p = 0.51$).

### Validity and reliability

The Russian DAS Cronbach's standardized alpha in acute stroke patients was found to be 0.70. Table 2 shows that the BDI had a significant moderate positive correlation with Executive and a significant weak positive correlation with Initiation apathy subscales. Additionally, the MoCA was found to have a significant weak negative correlation with the Initiation apathy subscale.

The Russian DAS inter-subscale correlations only showed a significant positive correlation between initiation and executive apathy ($r_s(86) = 0.34$, $p < 0.01$). No significant correlations were observed between executive and emotional apathy ($r_s(86) = 0.15$, $p = 0.15$) or initiation and emotional apathy ($r_s(86) = 0.20$, $p = 0.07$). There were no significant differences based on sex (male and female) and based on marital status (married and single) across all apathy subtypes.

**Table 2** Results of Spearman Rho correlation analysis between different DAS apathy subscales and clinical variables

| | MoCA | NIHSS | mRS | Rivermead | BDI |
|---|---|---|---|---|---|
| DAS | $r = -0.19$ | $r = 0.02$ | $r = -0.09$; | $r = 0.02$ | **$r = 0.53$** |
| Executive | $p = 0.08$ | $p = 0.84$ | $p = 0.42$ | $p = 0.86$ | **$p < 0.001$** |
| DAS | $r = 0.01$ | $r = -0.14$ | $r = 0.03$ | $r = 0.19$ | $r = 0.03$ |
| Emotional | $p = 0.93$ | $p = 0.21$ | $p = 0.76$ | $p = 0.08$ | $p = 0.80$ |
| DAS | **$r = -0.21$** | $r = -0.05$ | $r = 0.03$ | $r = 0.07$ | **$r = 0.25$** |
| Initiation | **$p = 0.05$** | $p = 0.65$ | $p = 0.79$ | $p = 0.54$ | **$p = 0.02$** |

Significant correlations are in BOLD

MoCA: Montreal Cognitive Assessment, NIHSS: National Institutes of Health Stroke Scale, mRs: Modified Rankin Scale, BDI: Becks Depression Inventory, DAS: Dimensional Apathy Scale

### Apathy profile in acute stroke patients

DAS cutoffs based on normative data were the same as those in the original study (executive ≥ 14, emotional ≥ 15, initiation ≥ 16). Overall, 34.6% ($N = 18$) of

**Table 1** Demographic and clinical characteristics of the stroke patients

| | Stroke patients ($n = 87$) | Control group ($n = 50$) |
|---|---|---|
| Age, mean (SD) | 65.7 (10.1) | 61.0 (14.8) |
| Sex, males/females *N* (%) | 53 (60.9)/34 (39.1) | 30 (60)/20 (40) |
| Martial status, married/single *N* (%) | 67 (77.0)/20 (23.0) | 36 (72.0)/14 (28.0) |
| Vascular territory of stroke, right carotid/left carotid/posterior *N* (%) | 37 (42.6)/29 (33.3)/21 (24.1) | |
| NIHSS score, median, (IQR) | 4 (3) | |
| mRs score, median, (IQR) | 3 (1.5) | |
| RMI score, median, (IQR) | 9 (10.5) | |
| MoCA score, median, (IQR) | 23 (5) | |
| MoCA impaired, N (%) | 32 (36.8) | |
| BDI score, median, (IQR) | 9 (9) | |
| BDI severity, N (%) | | |
| No to minimal | 44 (50.6) | |
| Mild to moderate | 31 (35.6) | |
| Moderate to severe | 11 (12.6) | |
| Severe | 1 (1.2) | |
| DAS scores, mean (SD) | | |
| Executive | 8.6 (3.8) | 7.6 (3.3) |
| Emotional | 8.1 (3.1) | 8.3 (3.5) |
| Initiation | 9.8 (4.3) | 8.6 (3.8) |

N: number, IQR: interquartile range, SD: standard deviation, RMI: Rivermead Mobility Index, NIHSS: National Institutes of Health Stroke Scale, mRs: Modified Rankin Scale, MoCA: Montreal Cognitive Assessment, BDI: Becks Depression Inventory, DAS: Dimensional Apathy Scale

stroke patients were impaired on one or more apathy subtypes, compared to 8% ($N=4$) of controls. In stroke patients, 21.2% ($N=11$) displayed executive apathy, followed by 15.4% ($N=8$) displaying initiation apathy, with emotional apathy being the least common at 3.8% ($N=2$).

### Apathy subtypes, depression severity and cognitive impairment

Figure 1 shows that there was a significant difference in Executive apathy scores across depression severity categories ($H(2)=21.11$, $p<0.001$), with the severe category not included (due to small sample size). Post hoc analysis showed that those with mild-to-moderate depression (median = 10) and moderate to severe depression (median = 13) had significantly higher Executive apathy ($p<0.001$) compared to the no to minimal depression (median = 6).

Figure 2 shows that acute stroke patients with cognitive impairment ($M=11.3$, SD = 4.6) had significantly higher Initiation apathy than those with no cognitive impairment ($M=9.0$, SD = 3.4), based on the MoCA stroke-specific cutoffs ($t(85)=-2.40$, $p<0.05$). No other differences across apathy subtype, functional disability, stroke severity, cognition, and depression were observed.

## Discussion

The Russian self-rated DAS showed good internal consistency reliability and strong divergent validity when compared with depression measures in acute stroke. Furthermore, there were expected apathy subtype intercorrelations observed, similar to previous DAS translation research [21–23]. Additionally, the DAS did not show associations with functional disability, similar to previous research [24] as well as stroke severity, which

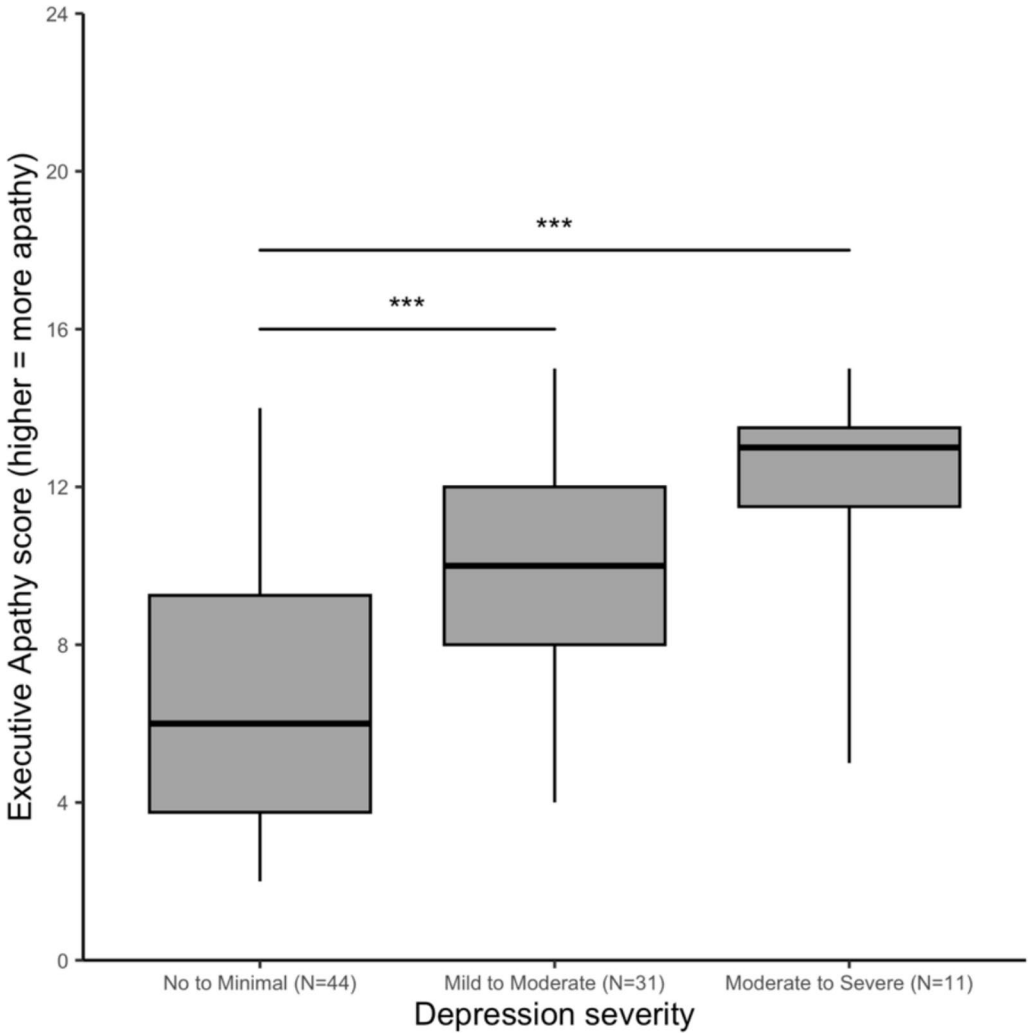


**Fig. 1** Executive apathy scores across depression severity (no to minimal, mild to moderate, moderate to severe). Whiskers indicate range. ***$p < 0.001$

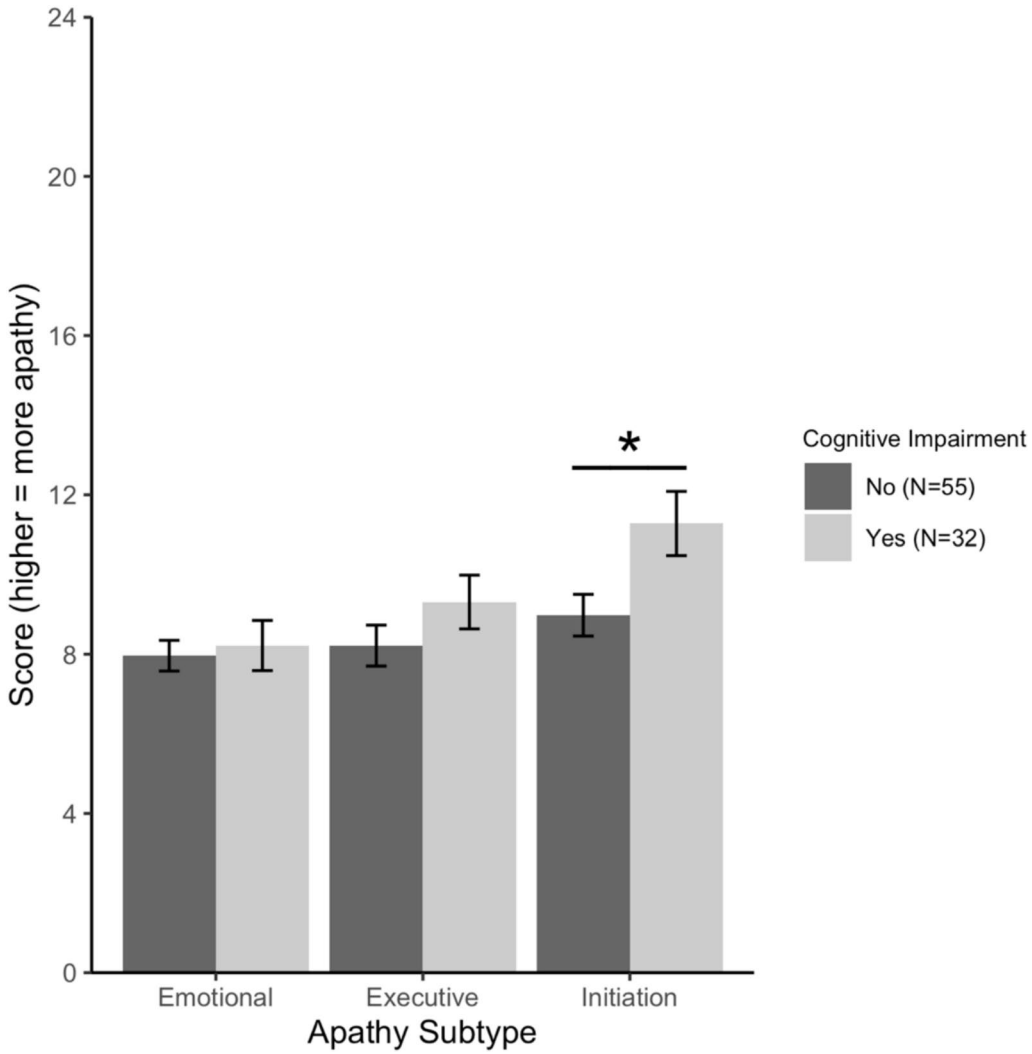


**Fig. 2** Apathy subtype (executive, emotional, initiation) score comparison based on cognitive impairment (yes/no). *$p < 0.05$

substantiated DAS as an assessment of apathy subtypes independent of functional or motor disability.

While apathy was observed in 34.6% of acute stroke patients, executive apathy (as a lack of motivation for planning, organization, or attention) was the most commonly observed subtype. Previous research has also identified executive apathy as a key motivational difficulty for stroke survivors; however, in the latter stages of stroke recovery [11, 27]. It is possible that acute stroke can have an immediate and wide-ranging motivational impact on higher order processing, relative to task setting and monitoring and goal management, akin to characteristics of executive apathy. Further to this, executive apathy is associated with depression scores to a moderate strength and shows a group difference relating to depression severity. Previous research has indicated a varying overlap between depression and stroke [5], with Executive apathy showing associations with depression in previous stroke research [11, 27]. However, our findings suggest a complex relationship between multidimensional apathy and the severity of depression in the acute stages of stroke, which might be associated with neuroanatomical damage or psychosocial impacts and changes immediately after stroke. Future research should explore how such apathy subtypes, particularly Executive apathy, and different characteristics of depression relate in people living with stroke, to aid further understanding of their clinical impact. A potentially fruitful avenue for research on the mechanisms of apathy after stroke would be analysis of its relationship with chronic white matter lesions in the brain, which are common in people with vascular risk factors [35]. Further exploration of apathy in stroke patients in

relation to age could be of interest [36], as well as in the context of other psychosocial factors (such as relationships, systemic, and family roles). Furthermore, previous research has shown that apathy in the early stages of stroke can negatively impact poor functional outcomes [8], with depression having a further impact on recovery after stroke [6], which might benefit from further research in the context of different apathy subtypes. As such, it would also be useful to explore longitudinal outcomes of acute to post-stroke presence of apathy subtypes to determine functional and engagement impacts.

This study also observed a moderate strength association between increased Initiation apathy and worse cognitive functioning. Apathy has been previously found to associate with cognitive impairment in stroke [18], with notable executive functioning deficits observed, specifically verbal fluency deficits as tasks of initiation [37, 38]. Previous neurodegenerative disease research has found cognitive impairment, particularly verbal fluency (response generation), is associated with initiation apathy [39]. A more recent study additionally found individual differences and heterogeneity relative to lesion location, neuropsychological deficits, and apathy subtypes in stroke [28]. Additionally, other factors such as spirituality and attention as aspects of cognitive functioning [40, 41], could play a role as a mediator in the association between initiation apathy and cognition, but this requires further large-scale research. As such, future research is needed to elucidate the complexities of specific neuropsychological deficits and their relationships to apathy subtypes in different stages of recovery from stroke, and to further determine any shared cognitive functioning–apathy mechanisms.

There are limitations to this study. While the Russian self-rated DAS has been shown to be valid and reliable, there were no valid "gold-standard" comparable apathy scales available in Russian for further psychometric exploration. Notably, the DAS cutoffs determined by this study were found to be the same as previously published cutoffs [24], but larger scale normative culturally specific data might be useful. Additionally, further translation, validation, and application of the informant/caregiver-rated DAS in Russian would allow for a more comprehensive assessment of apathy. There was also limited availability of detailed cognitive assessment in this study due to the recruitment of people in the acute stages of stroke, apart from the brief screening done by the MoCA. The frequency of apathy subtypes was not assessed in lacunar versus non-lacunar ischemic strokes, which could have helped with a better understanding of its pathogenesis [42].

## Conclusions

Overall, the Russian self-rated DAS was a psychometrically robust tool to assess different apathy subtypes both clinically and in research practice. Apathy was found to occur in a third of acute stroke patients, with executive and initiation apathy being most prevalent, showing associations with depression severity and cognitive impairment. Future research should look to further elucidate the relationship of apathy subtypes, depression, and cognitive functioning across different stages of recovery from stroke. Advanced neuroimaging techniques could elucidate the mechanisms of different subtypes of apathy at different stages of stroke, which is important for the development of specific approaches to post-stroke apathy management.

#### Abbreviations

| | |
|---|---|
| DAS | Dimensional Apathy Scale |
| RMI | Rivermead Mobility Index |
| NIHSS | National Institutes of Health Stroke Scale |
| mRs | Modified Rankin Scale |
| MoCA | Montreal Cognitive Assessment |
| IQR | Interquartile range |
| SD | Standard deviation |
| BDI | Becks Depression Inventory |

## Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s41983-025-01037-5.

Supplementary Material 1.

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#### Author contributions

All authors contributed to the study conception and design. Material preparation, data collection, and analysis were performed by M.A.K. and A.I.A. The first draft of the manuscript was written by M.A.K. and R.R., and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

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#### Data availability

The data are available upon reasonable request from the authors.

## Declarations

#### Ethics approval and consent to participate

The study was approved by the institutional ethical committee, Bashkir State Medical University. After receiving written informed consent from each subject, the study was carried out with their permission.

#### Consent for publication

Not applicable.

#### Competing interests

The authors declare no competing interests.

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## Publisher's Note