Efficacy of Munzij wa Mus'hil-e-Balgham and Zimad-e-Sheetraj on Motor Recovery in Falij-e-Nisfi (Hemiplegia)

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Abstract

Background and objectives: Falij is derived from an Arabic word Falij which literally means splitting into halves. It is the paralysis of longitudinal half of the body starting either below the neck, sparing head & face or covering the entire longitudinal half of the body from head to toe. It draws analogy with hemiplegia occurring due to stroke. The estimated age-adjusted prevalence rate for stroke in India is between 84/100,000 and 262/100,000 in rural and between 334/100,000 and 424/100,000 in urban area. Unani physicians have advocated Tanqia and Ta'idel as treatment of Falij. Therefore, a study was designed to evaluate the efficacy of Munzij wa Mus'hil-e-Balgham and Zimad-e-Sheetraj on Motor Recovery in Falij-e-Nisfi (Hemiplegia).

Methods: Present study was an open, single arm, pre and post without control trial, carried out on 29 patients with hemiplegia, secondary to stroke. Patients were given Munzij-e- Balgham in Joshanda (decocion) form, orally, once daily before breakfast for 14 days; the ingredients of Mus'hil-e-Balgham were added in Munzij-e-Balgham and given in decoction form on 12th day. From 13th day of treatment, 5 grams of Saffoofe Sheetraj was applied on spinal column as Zimad for 15 minutes, once daily till the 30th day. The assessment was based on Motor Assessment scale (MAS) and Barthel Index. Pre and post treatment values of the scales were analyzed statistically using paired student's t-test.

Results: The difference between the pre and post treatment values obtained for Barthel Index and MAS were found highly significant (p<0.001).

Interpretation & Conclusion: On the basis of the above observations and results, it may be concluded that the trial formulations are effective in the treatment of motor recovery in stroke. This treatment regimen may be used to reduce the dependence and improve the quality of life in patients of hemiplegia secondary to stroke.

Keywords: Falij, munzij-e-balgham, mushil-e-balgham, barthel index, mas

Introduction

The word Falij is an Arabic word literally meaning "splitting into halves"[1]. Since the body is split into paralyzed and unparalyzed halves, therefore the term Falij is applied to the equal and paradoxical state of the body. Unani scholars have described Falij and Istirkha synonymously [1, 2]. Falij (Hemiplegia) is the commonest manifestation and classical sign of all cerebrovascular diseases or stroke [3]. Stroke is a neurological syndrome of rapidly developing signs and symptoms of focal loss of cerebral function due to sudden death of brain cells caused by disturbance in the blood supply to the brain [4].

Stroke is one of the leading causes of disability, morbidity and mortality worldwide. World Health Organization (WHO) states that it is the second leading cause of death in people who are aged above 60 years and fifth leading cause in people aged between 15-59 years [5]. Global burden of stroke depicts that nearly 20 million people suffer from acute stroke every year and among them 5 million die each year It is the the leading cause of disability and functional impairment of which 20% of the stroke survivors require institutional care after 3 months and around15%–30% are permanently disabled. In addition, such disabilities place a significant burden on caregivers of stroke survivors. Initial walking function is impaired in two-thirds of the stroke population and this impairment is the greatest contributor to functional disability after stroke.

Motor recovery remains the major objective in the rehabilitation of stroke patients. By definition, motor recovery refers to a comprehensive program designed to regain as much as possible and compensate for the permanent losses. In modern medicine, management of acute stroke involves thrombolytic agents, anticoagulants, anti-platelet aggregation agents for effectively controlling and reducing the cerebral damage but long...
term management of disability and neurorehabilitation is still a challenge. Despite perpetual advancement in its treatment, the figures in terms of death and disability grossly suggest the limitation in its management. Considering this unconvincing scenario, Unani medicine on its own merit comes to the fore, as the *Falij* has successfully been treated since ancient times without any significant and obnoxious side effects by eminent Unani physicians. Hippocrates (Bugarat 460-370 BC) was the first to describe the phenomenon of sudden paralysis that is often associated with ischemia of brain. Among others, Ibnne Sina, Jalnoos, Ali Ibn Majooosi, Rabban Tabri, Sabit Bin Qurrrah, Hakim Azam Khan have described *Falij* in detail. They clearly mentioned the risk factors, aetiology, pathogenesis, clinical features and the treatment of the disease in detail in their respective treatises. *Falij* is considered a disease caused by *Sue Mizaj Maddi* (including *Balgham*) and *Taadleet* (evacuation and normalization of temperament). *Tanqiya* or *Isitfraghe Mawad* (elimination of causative matter) is brought about by Munzijs Advia which have properties such as *Taheel*, *Taqtee* and *Talteef*. The Munzijs is followed by *Mus'il* Advia having properties to expel the morbid *Akhat* from whole body, particularly from vessels and structures neighbouring intestine. *Taadleet* or *Islah Mizaj* (rejuvenation) of affected organ is achieved after *Tanqiya* by judicious employment of various *Tadabeer* such as *Dalk*, *Hammam*, *Riyazat*, *Takmeed*, *Nutool*, *Zimad* etc.

In light of the above facts, Unani formulations, consisting of Joshanda Munzijs-e-Balgham, Joshastra Munshiil-e-Balgham and Zimad-e-Sheetraj were selected from the reputed Unani pharmacopeia to evaluate the efficacy of this whole regimen in *Falij*-e- *Nisfi* in present study.

**Materials and Methods**

An open, single arm, pre and post without control clinical trial was conducted at National Institute of Unani Medicine (NIUM) Hospital Bengaluru, which spanned from April 2016 to March 2017. A comprehensive protocol was framed and put forward to Ethical Committee of National Institute of Unani Medicine which approved it with the no. (NIUM/IEC/2014-15/02/IBT/02 Dated: 16/04/14). After the approval patients were screened for the eligibility criteria from both IPD/OPD of the hospital. During the selection procedure, complete history including general physical and systemic examination was carried out and recorded on a prescribed proforma which was designed according to the objectives of the study. Written consent was taken from all the subjects who were enrolled for the study. Radiologically and clinically diagnosed cases of *Falij*-e-*Nisfi* (Hemiplegia) secondary to stroke, or having history of stroke (at least more than 15 days) of either gender and between 30-70 years were enrolled in present study. Subjects with minor stroke with non-disabling deficit, altered sensorium, aphasia, serious enough to impair understanding of simple commands, having Orthopaedic or Rheumatologic diseases impairing mobility, evidence of fixed contracture, and those with liver, kidney, cardiac, uncontrolled diabetes mellitus, severe hypertension and other co-morbidities were excluded from the study. Pregnant and lactating women were also excluded.

**Investigations**

Certain laboratory investigations were carried out in present study aiming at two important objectives: a) Exclusion of the patients as per study protocol and b) Establishing the safety of the test drug. Investigations done before and after the treatment were Hb%, TLC, DLC, ESR, Routine & Microscopic, Blood Sugar-V/PP, Blood Urea & Serum Creatinine, AST, ALT, Serum Bilirubin and ECG.

**Intervention**

Study subjects were given *Munzij*-e-*Balgham* in Joshanda (decocion) form, orally, once daily before breakfast for 14 days which contains *Aslussoons*, *Badyan*, *Bekhe* *Badyan*, *Ustukhaddoos*, *Anisoon*, *Tukhme Karafs*, *Ood Saleeb*, *Bekhe* *Ezkhir* and *Barge Gauzaban* 4 gm each. *Mus'hil* *Balgham* also in *Joshanda* (decocation) form containing *Ustukhaddoos* 5 gm, *Barge Sana* 10 gm, *Turbud* 3 gm, *Maghze Fuloos* Khayar Shambar 7 gm and Raughane Zard 5 gm were added in *Munzij*-e-*Balgham* on 12th day. From 13th day of treatment *Safoofe Sheetraj* was applied on spinal column as *Zimad* and *Zimad-e-Sheetraj* consists of *Sheetraj* only.

**Procedure of the study**

The ingredients of *Munzij*-e-*Balgham* wa *Mus'hil-e-Balgham*, and *Zimad-e-Sheetraj* were provided by NIUM pharmacy. The ingredients of *Munzij*-e-*Balgham*, *Mus'hil-e-Balgham*, and *Zimad-e-Sheetraj* were cleaned of any unwanted material or wild plants, pounded and placed in separate airtight containers. Later, these drugs were given to the patients to follow the treatment as given under;

The ingredients of *Munzij*-e-*Balgham* were soaked in 250 ml of water and left for whole night. Next morning they were boiled on low flame to prepare *Joshanda* (decocion). After filtration of *Joshanda* (decocation), the filtrate was given to patients to drink it before breakfast in the morning once a day for 14 consecutive days. On the 12th day, the ingredients of *Mus'hil-e-Balgham* were mixed with those of *Munzij*-e-*Balgham*; The *Joshanda* was prepared and given to drink before breakfast in the morning for 1 day only. From 13th day of treatment, 5 grams of *Zimad-e-Sheetraj* was applied on spinal column for not more than 15 minutes, once daily till the 30th day.

**Assessment**

The assessment was based on reliable, specific and valid scales-Motor Assessment scale (MAS) and Barthel Index. Assessment was carried on 0th day, 15th day and 30th day.

**Motor Assessment Scale**

The Motor Assessment Scale (MAS) is a performance-based scale that was developed as a means of assessing every day motor function in patients with stroke. The MAS is based on a task-oriented approach that assesses performance of functional tasks rather than isolated patterns of movement.

**Barthel Index**

The Barthel scale or Barthel ADL index is an ordinal scale used to measure performance in activities of daily living (ADL). Each performance item is rated on this scale with a given number of points assigned to each level or ranking. It uses ten variables describing ADL and mobility.

**Statistical Analysis**

Descriptive and inferential statistical analysis has been carried out in the present study to evaluate the efficacy of
the drugs. Results on continuous measurements are presented on Mean ± SD (Min-Max). Significance is assessed at 5% level of significance. Student’s t-test (two tailed, dependent) has been used to find the significance of mean difference of study parameters on continuous scale within group. The Statistical software namely SAS 9.2, SPSS 15.0, Stata 10.1, MedCalc 9.0.1, Systat 12.0 and R environment ver.2.11.1 were used for analysis of the data and Microsoft word and Excel have been used to generate graphs, tables etc.

Results
A total of 50 patients were screened, out of which 40 cases fulfilled the inclusion criteria; hence, were subjected to clinical & laboratory investigations. Four patients had abnormal values of investigative parameters and therefore excluded. Finally 36 cases were enrolld. A total of 29 cases presented with left hemiplegia; while, 10 (34.5%) presented with right hemiplegia. (Figure no. 21) Our study suggested a preponderance of left sided hemiplegia. This trend coincides with the findings of Almani SA et al. and Maimadi P et al. [11,16].

In present study, distribution of subjects with respect to occurrence of stroke includes 4 patients (13.8%) of less than 6 months duration, 10 (34.0%) of 6 months to 1 year duration, 6 (20.7%) of 1-2 year duration, 7 (24.1%) of 3-5 year duration and 2 (6.9%) with more than 5 years duration. In relation to the risk factors of stroke, 11 (38%) subjects were hypertensive followed by 3 (10%) as alcoholics, 2 (7%) each of the subjects as smokers and diabetic. Subjects with both hypertension and alcoholism were 4 (14%), with hypertension and DM were 3 (10%) and with smoking and alcoholism were 1 (3%), 1(3%) subject had hypertension and smoking; While, 2 (7%) were without any risk factor as shown in table no. 2.

Table 1: Sociodemographic characteristic of the studied subjects

<table>
<thead>
<tr>
<th>Age Group</th>
<th>No. of subjects</th>
<th>% age</th>
</tr>
</thead>
<tbody>
<tr>
<td>30-40</td>
<td>13</td>
<td>44.8</td>
</tr>
<tr>
<td>41-50</td>
<td>7</td>
<td>24.1</td>
</tr>
<tr>
<td>51-60</td>
<td>7</td>
<td>24.1</td>
</tr>
<tr>
<td>&gt;60</td>
<td>2</td>
<td>6.9</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Gender</th>
<th>Marital status</th>
<th>Religion</th>
<th>Socioeconomic Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>Married</td>
<td>Hindus</td>
<td>Lower</td>
</tr>
<tr>
<td>Female</td>
<td>Unmarried</td>
<td>Muslims</td>
<td>Lower middle</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Christians</td>
<td>Upper middle</td>
</tr>
</tbody>
</table>

In present study, the highest incidence of 19 (65.5%) patients presented with left hemiplegia; while, 10 (34.5%) with right hemiplegia. (Figure no. 21) Our study suggested a preponderance of left sided hemiplegia. This trend coincides with the findings of Almani SA et al. and Maimadi P et al. [11,16].

In present study, Mean ± SD of Barthel Index Scores at 0 day, 15th day and 30th day were 34.14 ± 8.03, 42.24 ± 8.41 and 49.14 ± 8.25, respectively. The pre and post treatment values obtained for Barthel Index were subjected to statistical analysis using student’s t-test (dependent). The difference between the Mean ± SD score from baseline and 15th day was found highly significant (p<0.001). Statistical difference was also significant (p<0.001) between 15th day and 30th day score as well as between baseline and 30th day.

Table 2: Risk factors of the studied subjects

<table>
<thead>
<tr>
<th>Risk Factors</th>
<th>No. of patients (n=29)</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>2</td>
<td>6.9</td>
</tr>
<tr>
<td>HTN only</td>
<td>11</td>
<td>37.9</td>
</tr>
<tr>
<td>Alcoholism only</td>
<td>3</td>
<td>10.3</td>
</tr>
<tr>
<td>Smoking only</td>
<td>2</td>
<td>6.9</td>
</tr>
<tr>
<td>DM only</td>
<td>2</td>
<td>6.9</td>
</tr>
<tr>
<td>HTN+DM</td>
<td>3</td>
<td>10.3</td>
</tr>
<tr>
<td>HTN+Alcohol</td>
<td>4</td>
<td>13.8</td>
</tr>
<tr>
<td>HTN+Smoking</td>
<td>1</td>
<td>3.4</td>
</tr>
</tbody>
</table>

In this study, Mean ± SD of Motor Assessment Scale scores at 0 day, 15th day and 30th day were 15.07 ± 5.35, 17.24 ± 4.85 and 19.38 ± 4.55, respectively as shown in the table no. 4. The difference between Means scores from baseline and 15th day was found highly significant (p<0.001). Statistical difference was also significant (p<0.001) between 15th day and 30th day score as well as between baseline and 30th day.

Table 3: Motor Assessment Scale scores of the subjects

In order to determine the adverse effects of the test drug, safety parameters like Hematological investigations, ECG, urine (routine & microscopy), blood glucose, LFT and RFT were carried out at the baseline and at the end of the treatment. (Table no.5) It was found that all the safety parameters were within the normal range after the completion of the trial. This suggests that the test formulation can be used safely at mentioned therapeutic dose.
Discussion

According to Unani medicine, the Mizaj (temperament) of a person, in Falij-e-Nisfi, from normal, changes into abnormal character, known as Sue-Mizaj (ill-temperament). This Sue Mizaj alters the normal physiology into morbidity, leading to malfunction or non-functioning of the organs or whole body. Sue Mizaj is divided into two types, Sue Mizaj Sada and Sue Mizaj Maddi. Sue Mizaj Sada is treated by reverting the Sue Mizaj to Mizaj Moatadil only by using drugs and specific regimen. It is known as Ta’deel-e-Mizaj (normalization of temperament). Sue Mizaj Maddi involves a derangement in normal Mizaj coupled with abnormalidad in Madda (material). Correction of Sue Mizaj Maddi requires elimination of abnormal Madda resulting in restoration and potentiation of Mizaj Tabayi [12]. Falij-e-Nisfi is considered a Balghami Marz because of involvement of Balghame Ghair Tabayi in its causation and thus, produces Sue Mizaj Maddi. The treatment of Falij-e-Nisfi-e-Nisfi in Unani medicine comprises detoxification and removal of the causative material, followed by reinvigoration of physiological functions of the diseased organ. The removal of vitiated matter is in order to bring back Mizaj Tabayi is known as Tanqiya (Evacuation) and invigoration of normal functions is termed as Ta’deel (rejuvenation) [10].

Tanqiya is considered as the basic step in the treatment of Falij-e-Nisfi and is performed by employing Munzij and Mus’hil-e-Balgham drugs and Ta’deel is the next step which is achieved by institution of various compound drugs along with a range of a regimen procedures like Dalh, Hijamah, Inkebabs, Hammam, Zimad etc. [10, 17]. The properties of Munzij Advia include Tahleeel, Taqteet and Talteef, making the premise of Tanqiya which possibly resembles with the current treatment of stroke in modern medicine comprising anti-inflammatory, antithrombotic agents, thrombotics and neuroprotective treatments.

Munzij-e-Balgham Advia possess some synergistic properties like Mufatteh Sudd, Muqavvie Asaab, Munacqie Dimagh, Munacqie Akhlat-e-Ghaleeza, Jali etc [10, 18, 19]. Ancient Unani physicians had a strong belief that Mus’hil drugs expel out both Raqeeg as well as Ghaleeze constituents of Ghair Moatadil Akhlat to which they have affinity with due to their inherent properties like Mus’hile Akhlal Salasa, Mus’hile balgham, Mukhrije Balgham, Qate Balgham, Munacqie Dimagh, Mulattif, Mufatteh Sudd and Jali etc [10].

In present study Ta’deel was achieved by Zimad-e-Sheetraj to restore Mizaj Moatadil of the affected organ. The Barooodat, which remains diffused in Asaab after the Tanqiya, is removed by the local application of Zimad-e-Sheetraj having Har Yabis Mizaj (Hot and dry temperament).

Processes mediating motor recovery

Number of processes has been mentioned in literature that may contribute to the recovery of motor functions after an attack of stroke summarized up below:

(i) Hypothetical role of test formulation in resolution of the pathology of stroke

In acute stages after stroke, recanalisation of occluded vessels, establishment of collateral flow and reduction in inflammation, all contribute to salvaging partially spared tissue. The major goal for therapeutic intervention in Falij-e-Nisfi patients is to limit neuronal damage in the surrounding penumbra and removal of local inhibition. In conventional system, specific drugs like antiplatelets, anticoagulants, thrombolytic therapy, neuroprotective agents, and surgical interventions are employed during initial stage of stroke management. The pathological changes in and around the infarcted zone provide a hypothesis for the probable mechanism of action of the ingredient of test formulation. Our test drug formulations possess properties such as Muhalil (dissolvent), Mulattif (attenuant), Mufatteh Sudd (deodorant), Munacqie Dimagh (brain purifier), Muqavvie Aa’saab (neurotonic), Muqatte, Jali (cleaner) etc. Test formulation drugs such as Asalussos is reported to possess Glycyrrhizin and aglycone- an important compounds which exhibit anti-inflammatory, antiaggregant, antioxidant, antiviral, antithrombotic properties [20]. Further Studies suggest that glabridin, a major flavonoid of it, significantly decreases the cerebral histological damage, focal infarct volume as well as apoptosis. Similarly Badiyan (Foeniculum vulgare) possesses a vital chemical constituent transanethole, which has been reported for its anti-inflammatory effect, blocking LPS-induced inflammation, regulating pro-inflammatory cytokines, transcription factors, and Nitrous oxide. Also, essential oils derived from it showed antithrombotic activity [23]. Further, Anisoon (Pimprenella anisum) one of the ingredient drug of test formulations has been reported to

### Table 5: Safety parameters of the subjects

<table>
<thead>
<tr>
<th>Variables</th>
<th>BT</th>
<th>AT</th>
<th>Difference</th>
<th>t value</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hemoglobin gm%</td>
<td>13.76±1.61</td>
<td>13.11±1.56</td>
<td>0.645</td>
<td>2.037</td>
<td>0.051</td>
</tr>
<tr>
<td>TLC cells/cu mm</td>
<td>7568.97±1539.50</td>
<td>7251.72±1533.35</td>
<td>317.241</td>
<td>1.563</td>
<td>0.129</td>
</tr>
<tr>
<td>DCL%: P</td>
<td>60.59±6.73</td>
<td>61.07±8.82</td>
<td>-0.483</td>
<td>-0.333</td>
<td>0.741</td>
</tr>
<tr>
<td>L</td>
<td>30.66±6.01</td>
<td>30.38±8.02</td>
<td>0.276</td>
<td>0.241</td>
<td>0.811</td>
</tr>
<tr>
<td>E</td>
<td>4.45±1.18</td>
<td>4.52±1.09</td>
<td>-0.069</td>
<td>-0.235</td>
<td>0.816</td>
</tr>
<tr>
<td>MO</td>
<td>3.93±1.25</td>
<td>4.03±1.12</td>
<td>-0.103</td>
<td>-0.422</td>
<td>0.676</td>
</tr>
<tr>
<td>ESK mm/hr</td>
<td>Min-Max</td>
<td>Difference</td>
<td>t value</td>
<td>P value</td>
<td></td>
</tr>
<tr>
<td>AT</td>
<td>1.00-80.00</td>
<td>23.21±20.96</td>
<td>4.069</td>
<td>1.247</td>
<td>0.223</td>
</tr>
<tr>
<td>Variables</td>
<td>BT</td>
<td>AT</td>
<td>Difference</td>
<td>t value</td>
<td>P value</td>
</tr>
<tr>
<td>FBS mg/dl</td>
<td>96.31±18.47</td>
<td>100.69±21.94</td>
<td>-4.379</td>
<td>-1.094</td>
<td>0.283</td>
</tr>
<tr>
<td>PPBS mg/dl</td>
<td>135.66±45.82</td>
<td>138.17±43.27</td>
<td>-2.517</td>
<td>-0.288</td>
<td>0.776</td>
</tr>
<tr>
<td>Blood Urea mg/dl</td>
<td>31.05±12.28</td>
<td>31.76±13.81</td>
<td>-0.707</td>
<td>-0.211</td>
<td>0.835</td>
</tr>
<tr>
<td>Serum Creatinine mg/dl</td>
<td>1.00±0.61</td>
<td>0.89±0.23</td>
<td>0.106</td>
<td>0.892</td>
<td>0.380</td>
</tr>
<tr>
<td>SGOT IU/L</td>
<td>36.93±37.20</td>
<td>26.58±11.33</td>
<td>10.348</td>
<td>1.446</td>
<td>0.159</td>
</tr>
<tr>
<td>SGPT IU/L</td>
<td>37.57±36.84</td>
<td>23.37±29.25</td>
<td>14.200</td>
<td>1.963</td>
<td>0.060+</td>
</tr>
<tr>
<td>Total Bilirubin, mg/dl</td>
<td>0.90±0.40</td>
<td>1.01±0.43</td>
<td>-0.114</td>
<td>-1.431</td>
<td>0.163</td>
</tr>
</tbody>
</table>
have a significant relaxant effect due to inhibitory effect on muscarinic receptors and anti-inflammatory action by inhibitory effect on prostaglandin synthesis \[22, 23\]. It also possesses neuroprotective activity and also contains constituents having COX inhibitory activity which may significantly reduce the inflammatory process. *Ood saleeb* (*Paeonia emodi*) has been proven to exhibit anti-inflammatory, anti-coagulant and spasmyotic activities; therefore, used for blocking effect on neuromuscular junctions. Similarly, *Turber* is endowed with important chemical constituents such as lupeol, betulin and sitosterol which exhibit hepatoprotective, anticancer and anti-inflammatory effects \[24\].

Thus, from the scientific reports of test formulation, it can be inferred that the trial drugs act as antiinflammatory, antithrombotic, anticoagulant and neuroprotective agents which tend to open the obstruction of vessels and recanalise them, reduce the inflammation as well as edema along with reduction in the damage of ischemic penumbra and, thereby, limiting the neuronal damage.

(ii) Development of compensatory movement strategies enabling recovery of certain motor functions

Oral antispasmodic agents such as baclofen, diazepam, dantrolene sodium, clonidine, and tizanidine are used to relieve spasticity \[25\]. Experimental studies revealed that antispasmodic or spasmyotic activities were present in *Ustukhudoos* i.e *Lavandula stoechas*, mediated through calcium channel blockade \[26\]. *Anisoon* (*Pimpinella anisum*), through inhibition of acetylcholine \[22\], and *Karafs* (*Apium graveolens*) mainly by suppressing the Ca2+ influx \[27\].

Another study done by Karimzadhah F *et al.* shows anise oil having anti-convulsant and neuroprotective effect and suggested a mechanism of inhibition of synaptic plasticity. Study done by Ghahremanitamadon F *et al.* suggested that *Gauzaban* (*Borago officinalis*) could improve the learning impairment and oxidative damage in the hippocampal tissue and may lead to an improvement of cognitive dysfunction \[28\]. Aglycone and glabridin from *Aslussoos* inherit properties like memory enhancer, spatial learning improver and neuroprotective properties \[20\]. The mode of action as mentioned above is similar to botulinum toxin which is commonly used in spasticity management and, hence, gives an idea about the recovery of motor functions.

(iii) Enhancement of brain plasticity

Neural plasticity can be defined as "the ability of brain to change and repair itself". Experimental study done by Yang *et al.* on *Anisoon* mentions that a compound named 3-n-butyphthalide promotes neurogenesis and neuroplasticity in cerebral ischemic rats \[20\]. Another study done by Murlidharan P *et al.* on hypoxic rat showed cerebroprotective activity of *Aslussoos* \[30\], similarly a review by Pieszak M *et al.* on Gauzaban mentioned its cerebroprotective activity. In our test formulation drugs like *Ustukhudoos* and *Badyan* possess *Muqavvie dimagh* properties. Similarly *Muqavvie Aasaab*, *Muqaqvie Aasaab* and *Muharikke Aasaab* properties were found in *Ustukhudoos*, *Badyan*, *Maghz Faloo* Khayar Shambar and *Aslussoos*. Thus, the properties of the test drugs used in present trial seem to have enhanced the plasticity of the brain and are further, capable of upregulating the functions of the undamaged area and help them take over the function of the affected part/areas.

(iv) Sprouting of new connections

It takes place by two processes, firstly, regenerative synaptogenesis, which refers to sprouting of the injured axons to innervate previously innervated synapses, secondly, reactive synaptogenesis, (collateral sprouting) which refers to reclaiming of synaptic sites of the injured axon by dendritic fibers from neighbouring axons. In a study on *Aslussoos*, it has been shown that the aqueous root extract possesses neuronal dendritic growth stimulating properties. According to Ganesan K *et al.* *Sheetraj* possesses neuroprotective and central nervous system stimulating properties due to plambogin. *Manaqqie Dimagh*, *Muqavvie Dimagh*, *Muqavvie Aasaab* properties of the drugs in our test formulation might have a significant role in stimulation of sprouting of new connection in and around the damaged area so as to restore the lost functions.

In present study, almost all patients reported improvement in motor power of paralyzed limbs as well as improvement in Activities of Daily Living (ADL) e.g. dressing and personal hygiene which are considered to be an important goal of management in such patients. This improvement is expected to reduce the dependence on caregivers as well as burden for patient’s family. Three patients complained of increased frequency of urination and two patients complained of loose motions during the trial period. The possible reason for these side effects may be the *Haar Mizaj* of the test formulation as well as its *Mdird* properties. Itching was also complained by two patients over the application region of *Zimad* i.e spinal region. This may be due to local irritation or hypersensitivity.

Limitations

Some of the potential limitations inherent in this study include small sample size, short duration of the study and limited parameters of assessment. Thus, it is recommended that clinical trial of this type should be done on larger sample size, for longer duration with other assessment scales including Barthal Index scale and MAS scale. Further studies are recommended with improved methodology to limit these inadequacies for better reliability and acceptability of such clinical trials.

Conclusion

The primary aim of treatment in stroke survivors emphasizes on motor recovery so as to reduce the dependency on caregivers as well as burden on patient’s family. Unani medicine is one among the alternative pathies which is still capable in the treatment of such disorders. Thus, from the above discussion the conclusion may be drawn that the trial formulations are effective in the treatment of motor recovery in patient’s secondary to stroke. This treatment regimen may be used to reduce the dependence and improve the quality of life in patient of Falij-e-Nisfi.

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