Evaluation of effect of poultice (Upanaha Sweda) in low back pain (Katigraha): A randomized comparative clinical trial

Tarun Kumar, Rajashekar V. Sanapeti, B. S. Prasad
Department of Panchakarma, KLEU’s Shri BMK Ayurveda Mahavidyalaya, Shahapur, Belagavi, Karnataka, India

Abstract

Background: Katigraha (low back pain) is a condition where low back is afflicted either with Vata or Sama Vata (Vata involved with the toxins released due to altered digestion and metabolism) and present with symptoms such as pain with stiffness. About 60%–80% population in India suffer from this condition. Upanaha Sweda (poultice) is one of the Swedana (sudation) treatment modalities mentioned for Katigraha. As Sama (affected with toxins released from impaired digestion) and Nirama (without toxins) are two stages of Katigraha, hence, the specific type of Upanaha is required for such condition. Aims and Objective: The study was conducted to evaluate the effect of Upanaha Sweda in Katigraha (low back pain) as per the presentation of stages of Ama. Materials and Methods: Selected patients were categorized into two groups. In group A, patients having Samaja Katigraha, were given Panchakoladi Upanaha once a day till it became Nirama, then shifted to Godhumadi Upanaha for 7 days and patients who had Nirama Katigraha, Godhumadi Upanaha was used once a day for 7 days. In group B Godhumadi Upanaha was used once a day for 7 days irrespective of stages. Subjective parameters assessed were pain in the low back, stiffness, and Oswestry Disability Index (ODI) was also used. The Mann–Whitney U test and Wilcoxon signed-rank test were used to assess results. Results: Patients who were treated considering the Sama and Nirama phases had 78.88% better results in relieving pain, stiffness, and in ODI change than the patients treated without considering the phases. Conclusion: The present study showed significant results in both the groups, but patients treated as per stage wise treatment showed better effect in treating Katigraha than the patients treated with out considering the stage.

Keywords: Katigraha, low back pain, Swedana, Upanaha

Introduction

Vata Dosha or Sama Vata Dosha (Vata Dosha associated with Aama [the toxins released due to altered digestion and metabolism] when afflicts Kati Pradesha (low back) and produce the symptoms such as pain with stiffness, then the condition is known as Katigraha.[1]

This can be correlated with low back pain. It is the most common disorder which is characterized by dull or sharp pain and may also associated with stiffness. About 60%–80% of the general population in India suffer from low back pain during their life time[2] due to several stressful factors seen in their professional or social life and also due to wrong postural habits. It affects both men and women alike and common in the age group of 20–60 years.

Upanaha Sweda (poultice) is one of the Swedana (sudation) treatment modalities mentioned for Katigraha.[1,2] The selection of drugs varies according to the stages of the disease. As there are two stages mentioned in Katigraha that is Samaja (with Ama) and Nirama (without Ama),[1,2] specific type of Upanaha is required for each stage,[3,4] but generally only one type of Upanaha is being applied for both the conditions irrespective of stages, due to which its efficacy might get reduced. Panchakoladi Upanaha consists of Chavya (Piper retrofractum Vahl.), Chitraka (Plumbago zeylanica Linn.), Pippalimula (Piper longum Linn.), Pippali (Piper longum Linn.), Shunthi (Zingiber officinale Roscoe.), Yava (Hordeum vulgare Linn.) and Nirgundi (Vitex negundo Linn.) that are helpful in resolving...
of toxins released due to impaired digestion and Godhumadi Upanaha consists of Godhuma (Triticum sativum Linn.), Tila (Sesamum indicum Linn.), Erandamula (Ricinus communis Linn.) that are helpful in treating Vata condition. Hence, study has been carried out to evaluate the effect of Upanaha Sweda in as per the stage of Katigraha (low back pain).

Materials and Methods

The study was registered under the Clinical Trials Registry – India (CTRI/2017/04/008417) and ethical clearance had been obtained (BMK/13/PG/PK/05). Informed consent was taken before starting the trial in each subject. Forty-one patients of Katigraha fulfilling the inclusion criteria were enrolled irrespective of sex, religion, etc. Five patients dropped out due to personal reasons and 36 patients completed the study as mentioned in Table 1. Selected patients were first openly categorized into two groups: Samaja Katigraha and Niramaja Katigraha. Then, these patients were again categorized into two groups according to the computer-generated randomization chart. In group A (Avasthanusara [stage wise] treatment), patients presenting with Samaja Katigraha, Panchakoladi Upanaha was given once a day till the Niram symptoms appeared and then Godhumadi Upanaha was used once a day for 7 days and the patients presenting with Niramaja Katigraha, Godhumadi Upanaha was used once a day for 7 days. Whereas in group B (Anavasthanusara [without considering stages] treatment), Godhumadi Upanaha was used for 7 days irrespective of stages.

Diagnostic criteria

a. Pain at low back
b. Stiffness at low back
c. Sama symptoms, i.e., heaviness in the body, anorexia, poor digestion, excessive salivation and laziness.
d. Niramaja symptoms, not having either of heaviness in the body, anorexia, poor digestion, excessive salivation and laziness.

d. Known case of skin allergy and open wound
e. Post surgical backache.

Ingredients of Upanaha 1 and Upanaha 2
Ingredients of Upanaha 1 (Panchakoladi Upanaha) and Upanaha 2 (Godhumadi Upanaha) are mentioned in Table 2.

Preparation and application of Upanaha

Materials required for preparation of Upanaha
Tila Taila (sesame oil) 10 ml for local massage, Saindhava Lavana (rock salt) - 30 g, cotton bandage - 6 inches (2 pieces), Eranda (Ricinus communis Linn.) leaves - (4–5), heating apparatus, pan, table spoon, bowl, thermometer and massage table.

Preparation of paste
All the medicinal powder mentioned in Table 2 were taken in a pan as per the group. Then, 200 ml Dhanyamala (fermented gruel) and 200 ml cow milk was added to Panchakoladi Upanaha and Godhumadi Upanaha respectively and mixed well. Then, 30 g Saindhava Lavana (rock salt) and Tila Taila (sesame oil) as per need were added to it for the poultice and mixed well to make its consistency like dough.

Main procedure
The patient was instructed to lie in the prone position on the massage table. Low back was exposed and the skin sensitivity was checked for temperature or any allergy. Local massage was done with Tila Taila (sesame oil) for 5 min. The prepared paste was then pasted over the low back uniformly of about 5 mm thickness. It was covered with proper-shaped Eranda leaves. Then, it was tied with a cotton bandage for 6 h (360 min).

Post operative procedure
After removal of Upanaha (poultice), gentle massage was done and the part was cleaned well with lukewarm water and the patient was asked to move the joint slowly.

Upanaha Dharana Kala (duration of Upanaha retention)
Panchakoladi Upanaha- 6 h/day till Niramaja symptoms like reduction in the stiffness and feeling of lightness at low back and activeness in the body appears parameters:

Godhumadi Upanaha- 6 h/day for 7 days.

Assessment criteria

Patients were assessed before and after the treatment on the basis of the following parameters:

Assessment of subjective criteria
The assessment criteria for pain and stiffness are given in Tables 3 and 4, respectively.

Visual Analog Scale: (for assessment of pain in grade 0 to 10).

| Pain Assessment | Grade |
|-----------------|-------|
| Low back pain   | 0     |

Table 1: Distribution of registered patients of Katigraha

| Group | Completed | Drop out | Total Registered |
|-------|-----------|----------|------------------|
| A     | 18        | 09       | 27               |
|       | 09 (Samaja) | 01 (Samaja) |                  |
|       | 09 (Niramaja) | 02 (Niramaja) |              |
| B     | 18        | 09       | 27               |
|       | 09 (Samaja) | 01 (Samaja) |                  |
|       | 09 (Niramaja) | 01 (Niramaja) |              |
### Table 2: Ingredients of *Upahanha 1* and *Upahanha 2*

| Ingredients                                      | *Upahanha 1 (Panchakoladi *Upahanha*) | Quantity       | *Upahanha 2 (Godhumadi *Upahanha*) | Quantity       |
|--------------------------------------------------|---------------------------------------|----------------|-------------------------------------|----------------|
| Medicinal powder                                 | Chavaya (*P. retrofractum* Vahl.) powder | 10 g-15 g  | Godhuma (*T. sativum* Linn.) powder | 50 g-75 g  |
|                                                  | Chitraka (*P. zeylanica* Linn.) powder | 10 g-15 g  | Tila (*S. indicum* Linn.) paste     | 30 g-45 g  |
|                                                  | Pippalimula (*P. longum* Linn.) powder | 10 g-15 g  | Erandamula (*R. communis* Linn.) powder | 100 g-125 g |
|                                                  | Pippali (*P. longum* Linn.) powder     | 10 g-15 g  |                                      |               |
|                                                  | Shunti (*Z. officinale* Roscoe.) powder | 10 g-15 g  |                                      |               |
|                                                  | Yava (*H. vulgare* Linn.) powder       | 50 g-75 g  |                                      |               |
|                                                  | Nigundli (*V. negundo* Linn.) powder   | 50 g-75 g  |                                      |               |
| Drava Dravya (liquids)                           | Dhanyamla (fermented gruel)            | 200 ml -300 ml | Gokshira (cow milk)               | 200 ml -300 ml |
|                                                  | Saindhava Lavana (rock salt)           | 30 g         | Saindhava Lavana (rock salt)       | 30 g         |
| Oil                                             | Tila Taila (sesame oil)                | 20 ml-30 ml  | Tila Taila (sesame oil)            | 40 ml-60 ml  |

*P. retrofractum: Piper retrofractum, P. zeylanica: Plumbago zeylanica, P. longum: Piper longum, Z. officinale: Zingiber officinale, H. vulgare: Hordeum vulgare, V. negundo: Vitex negundo, T. sativum: Triticum sativum, S. indicum: Sesamum indicum, R. communis: Ricinus communis*

### Statistical analysis

#### Oswestry disability index total score

Pain, stiffness and Oswestry Disability Index (ODI) changes were assessed on comparing their values after applying Mann–Whitney U test and Wilcoxon signed-rank test.

### Observations

Table 5 shows that out of 36 cases of *Katigraha*, 41–60 years (69.44%) of age group people were found more affected than 20–30 years (11.11%) and 31–40 years (19.44%); Table 6 shows that males (52.78%) were found more affected with low backache than females (47.22%); Table 7 shows that farmers and labourers (27.78%) and homemakers (33.33) were more prone to low backache than private job workers (16.67%), teachers (13.88%), policeman (2.78%) and tailors (5.56%); Table 8 shows that prolong standing posture (38.89) persons are more prone to low backache than prolong sitting postures (30.56%) and continuous travellers (8.33%).

### Results

Results of the treatment in both the groups are mentioned in Tables 9 and 10.

Table 9 shows that 18 patients of *Katigraha* when treated according to *Avastha* (stages) showed 43.33% effect with *P* < 0.0001 in relieving pain, 36.07% effect with *P* = 0.0002 in reducing stiffness, and 37.25% effect with *P* < 0.0001 in improving ODI index and another 18 patients of *Katigraha* when treated without assessing the *Avastha* (stages) showed 27.20% effect with *P* = 0.0024 in relieving pain, 15.73% effect with *P* = 0.0204 in reducing stiffness, and 18.44% effect with *P* < 0.0001 in improving of ODI index.

Table 9 also shows that there was a significant difference between the two groups with *P* = 0.0107 in relieving pain, with *P* = 0.0351 in reducing stiffness and with *P* = 0.0002 in improving of ODI index.

Table 10 shows that 9 patients of *Samaja Katigraha* when treated according to *Avastha* (stages) had 50.96% effect with *P* < 0.0001 in relieving pain, 55.5% effect with *P* < 0.0001 in reducing stiffness, and another 9 patients of *Samaja Katigraha* when treated without assessing the *Avastha* (stages) showed 21.41% effect with *P* = 0.0278 in relieving pain, 11% effect with *P* = 0.1690 in reducing stiffness, and 16.16% effect with *P* = 0.0058 in improving of ODI index.

Table 10 also shows that there was a significant difference between the results in *Samaja Katigraha* of the two groups with *P* = 0.0016 in relieving pain, with *P* = 0.0002 in reducing stiffness and with *P* = 0.0013 in improving of ODI index.

### Table 3: Assessment and grading of pain

| Pain (VAS)             | Scale | Grade |
|------------------------|-------|-------|
| No pain                | 0     | 0     |
| Mild, annoying pain    | 1     | 1     |
| Nagging, uncomfortable, troublesome pain | 2     | 2     |
| Distressing, miserable pain | 3     | 3     |
| Intense, dreadful, horrible pain | 4     | 4     |

### Table 4: Assessment and grading of stiffness (range of motion)

| Stiffness (ROM)        | Grade |
|------------------------|-------|
| No stiffness           | 0     |
| With up to 25% impairment in ROM of joint and patient can perform daily work without any difficulty | 1     |
| With up to 25%-50% impairment in the ROM of joint and patient can perform daily routine work with mild or moderate difficulty | 2     |
| With up to 50%-75% impairment in ROM of joint and patient can perform daily routine work with moderate or severe difficulty | 3     |
| With >75% impairment in ROM of joint and patient totally unable to perform daily routine work | 4     |

ROM: Range of motion

*P* < 0.0001 in reducing stiffness, and 40.40% effect with *P* < 0.0001 in improving ODI index and another 9 patients of *Samaja Katigraha* when treated without assessing the *Avastha* (stages) showed 21.41% effect with *P* = 0.0278 in relieving pain, 11% effect with *P* = 0.1690 in reducing stiffness, and 16.16% effect with *P* = 0.0058 in improving of ODI index.
Kumar, et al.: Effect of stage wise application of Upanaha Sweda in low back pain

**Table 5: Age wise distribution of patients**

| Age (Years) | Avasthanusara Group | Anavasthanusara Group | Total |
|-------------|---------------------|-----------------------|-------|
| No. | % | No. | % | No. | % |
| 20-30 | 03 | 16.16 | 01 | 5.56 | 04 | 11.11 |
| 31-40 | 04 | 22.22 | 03 | 16.67 | 07 | 19.44 |
| 41-60 | 11 | 61.11 | 14 | 77.77 | 25 | 69.44 |

**Table 6: Distribution of patients according to gender**

| Sex | Avasthanusara Group | Anavasthanusara Group | Total |
|-----|---------------------|-----------------------|-------|
| No. | % | No. | % | No. | % |
| Male | 09 | 50 | 10 | 55.56 | 19 | 52.78 |
| Female | 09 | 50 | 08 | 44.44 | 17 | 47.22 |

**Table 7: Distribution of patients on the basis of occupation**

| Occupation | Avasthanusara Group | Anavasthanusara Group | Total |
|------------|---------------------|-----------------------|-------|
| No. | % | No. | % | No. | % |
| Farmer/Labor | 06 | 33.33 | 04 | 22.22 | 10 | 27.78 |
| Teacher | 03 | 16.67 | 02 | 11.11 | 05 | 13.88 |
| Private job | 04 | 22.22 | 02 | 11.11 | 06 | 16.67 |
| House wife | 05 | 27.77 | 07 | 38.88 | 12 | 33.33 |
| Policeman | 00 | 00 | 01 | 5.55 | 01 | 2.78 |
| Tailor | 00 | 00 | 02 | 11.11 | 02 | 5.56 |

**Table 8: Distribution of patients on the basis of postural details**

| Postural Details | Avasthanusara Group | Anavasthanusara Group | Total |
|------------------|---------------------|-----------------------|-------|
| No. | % | No. | % | No. | % |
| Prolonged sitting | 06 | 33.33 | 05 | 27.78 | 11 | 30.56 |
| Prolong standing | 07 | 38.89 | 07 | 38.89 | 14 | 38.89 |
| Continuous travel | 01 | 5.56 | 02 | 11.11 | 03 | 8.33 |
| Not related | 04 | 22.22 | 04 | 22.22 | 08 | 22.22 |

**Discussion**

Of 36 cases of Katigraha males, prolong standing posture, moderate working lifestyle, labourers, and homemakers were affected more with Katigraha might be because they have to do more laborious work and prolong standing posture exerts pressure over low back and provides favorable condition for lodging (Sithana Samshraya) of already vitiated Vata Dosha. Age-wise distribution showed that 40–60 years of age group were found more prone to Katigraha because degenerative changes starts in this age group that leads to Vata vitiated disorders.

The effect of Avasthanusara treatment is better than Anavasthanusara treatment might be because:

a. Pain is the symptom of Vata Dosha. Drugs used in Panchakoladi Upanaha were having Ushna (hot) and Tikshna (sharp) properties, so it did Doshavilayana (liquefaction of Dosa) and Srotoshodhana (purification of channels) which helped in relieving Margavarana (obstruction in channels) of Vata Dosha, followed by Godhumadi Upanaha that is having Snigdha (unctuous) property along with Ushna property, that helped in pacifying Vata Dosha, thus helped in relieving pain

b. Stiffness is either due to Sheeta (cold) – Ruksha (dry) properties of Vata or Sheetra - Snigdha properties of Ama. Drugs used for Panchakoladi Upanaha are having Ushna, Ruksha and Tikshna properties which helped in pacifying Sheeta - Snigdha properties of Ama efficiently

c. Avasthanusara treatment had a significant effect on reducing pain and stiffness both, thus it helped in improving quality of life of the patients. Although Avasthanusara treatment group provided effect on reducing pain and stiffness, but as it is having Amaja stage of patients and were treated without considering stages, it was not effective statistically.

**Probable mode of action of Upanaha**

The lipoidal bond is suitable for penetration of drug molecule through stratum corneum. On this basis, it can be assumed that in Upanaha, oil helps in the formation of lipoidal bond with other drugs thus helps in the penetration of drug molecules. Upanaha is a type of Swedana, so it induces hyperthermia which improves local blood and lymphatic circulation and thereby improving local tissue metabolism. It reduces inflammation by modifying secretion of various inflammatory mediators, relaxes local musculature by physical effect of heat, increases the rate of transdermal drug delivery and thereby reduces pain.

The drugs used for Panchakoladi Upanaha are having alkaloids such as piperine in Pippali, terpenoids in Chavya, gingerol in Shunthi, tanning, and saponins in Yava, thus they inhibit prostaglandins (acting as a vasodilators and cause inflammation), which, in turn, may reduce the inflammation.

Drugs used in Panchakoladi Upanaha are Ushna, Tikshna in nature and due to its counter irritant effect, helped in relieving pain.

**Conclusion**

Patients of low back pain treated with Avasthanusara (stage wise treatment) had better effect in relieving pain, stiffness and in Oswestry Disability Index (ODI) change than the patients treated with Anavasthanusara Upanaha Sweda without stage wise treatment. Also, patients of Samaja Katigraha treated with Panchakoladi Upanaha had better effect in relieving pain, stiffness and in ODI change than the patients of Samaja Katigraha treated with Godhumadi Upanaha. Thus, it can be concluded that Panchakoladi Upanaha was effective in relieving Samaja stage of Katigraha and Avasthanusara treatment is more effective in the management of Katigraha than that of Anavasthanusara.
Table 9: Results of the treatment on parameters of low back pain

| Parameter | Group | Mean±SD | Improvement (%) | Z     | Significance/P  |
|-----------|-------|---------|-----------------|-------|-----------------|
|           |       | BT      | AT              |       |                 |
| VAS       | Avasthanusara treatment | 5.11±0.74 | 2.89±0.99 | 43.33 | 10.00          | <0.0001 |
|           | Anavasthanusara treatment | 4.89±1.24 | 3.56±1.30 | 27.2  | 5.49           | <0.0001 |
|           | Between the groups |         |                 | 2.7   | 0.0107         |         |
| Stiffness | Avasthanusara treatment | 1.83±0.6  | 1.17±0.76 | 36.07 | 4.76           | 0.0002  |
|           | Anavasthanusara treatment | 1.78±0.71 | 1.5±0.76 | 15.73 | 2.56           | 0.0204  |
|           | Between the groups |         |                 | 2.19  | 0.0351         |         |
| ODI       | Avasthanusara treatment | 47.11±6.41 | 29.56±9.04 | 37.25 | 9.47           | <0.0001 |
|           | Anavasthanusara treatment | 45.44±10.87 | 37.06±10.9 | 18.44 | 7.69           | <0.0001 |
|           | Between the groups |         |                 | 4.26  | 0.0002         |         |

SD: Standard deviation, VAS: Visual analog scale, ODI: Oswestry Disability Index, BT: Before treatment, AT: After treatment

Table 10: Results of the treatment in Samaja Katigraha

| Parameter | Group | Mean±SD | Improvement (%) | Z     | Significance/P  |
|-----------|-------|---------|-----------------|-------|-----------------|
|           |       | BT      | AT              |       |                 |
| VAS       | Avasthanusara treatment | 5.22±0.63 | 2.56±0.83 | 50.96 | 11.31          | <0.0001 |
|           | Anavasthanusara treatment | 4.67±1.25 | 3.67±1.33 | 21.41 | 2.68           | 0.0278  |
|           | Between the groups |         |                 | 3.78  | 0.0016         |         |
| Stiffness | Avasthanusara treatment | 2.0±0.47  | 0.89±0.57 | 55.5  | 10.00          | <0.0001 |
|           | Anavasthanusara treatment | 2.0±0.67  | 1.78±0.63 | 11    | 1.51           | 0.1690/\text{ns} |
|           | Between the groups |         |                 | 4.82  | 0.0002         |         |
| ODI       | Avasthanusara treatment | 48.11±5.74 | 28.67±7.92 | 40.40 | 8.58           | <0.0001 |
|           | Anavasthanusara treatment | 46.78±11.45 | 39.22±12.16 | 16.16 | 3.73           | 0.0058  |
|           | Between the groups |         |                 | 3.90  | 0.0013         |         |

SD: Standard deviation, VAS: Visual analog scale, ODI: Oswestry Disability Index, BT: Before treatment, AT: After treatment

References

1. Brahmashankara M, editor. BhavaPrakash of Bhava Mishra. Ch. 26, Ver. 53. Part 2. 12th ed. Varanasi: Chaukhambha Sanskrit Sansthan; 2016. p. 292.
2. Rubin DL. Epidemiology and risk factors for spine pain. NeuroClin 2007;25:353-71.
3. Tiwari PV, editor. Charaka Samhita of Agnivesha: Sutra Sthana. Ch. 14, Ver. 22. 1st ed. Varanasi: Chaukhambha Vishvabharti; 2018. p. 255.
4. Tiwari PV, editor. Charaka Samhita of Agnivesha: Sutra Sthana. Ch. 14, Ver. 35-38.1st ed. Varanasi: Chaukhambha Vishvabharti; 2018. p. 258.
5. Krishna TK, editor. Sushruta Samhita of Sushruta: Chikitsa Sthana. Part 2. Ch. 32, Ver. 12. 1st ed. Varanasi: Chaukhambha Orientalia; 2014. p. 495.
6. Lal GB, editor. Ashatanga Hridayam of Vagbhatta: Sutra Sthana. Part I. Ch. 17, Ver. 2-5. 6th ed. Varanasi: Chaukhambha Orientalia; 2013. p. 294-5.
7. Sharma S, editor. Ashtanga Sangraha of Vagbhatta: Sutra Sthana. Part I. Ch. 26, Ver. 4. 3rd ed. Varanasi: Chaukhambha Sanskrit Series Office; 2012. p. 196.
8. Acharya YT, editor. Sushruta Samhita of Sushruta with Nibandha Sangraha commentary: Dalhana commentary: Chikitsa Sthana. Part 2. Ch. 32, Ver. 22. 1st ed. Varanasi: Chaukhambha Subharti; 2017. p. 514.
9. Namjoshi PV, Abhinav. Possible scientific reasons behind the supportive actions of Sthanika Snehana and Swedana. Pharma Sci Monit 2015;6:110-8.
10. Shirotai H, Goto M, Katayama K. Application of adjuvant induced local hyperthermia for evaluation of anti-inflammatory drugs. J Pharmacol Exp Ther 1988;247:1158-63.
11. Brosseau L, Yonge KA, Robinson V, Marchand S, Judd M, Wells G, et al. Thermotherapy for treatment of osteoarthritis. Cochrane Database Syst Rev 2003;4:CD004522.
12. Jun SB, Da HO, Hyun MC, Bong JS, Sung JL, Jung YK, et al. Anti-inflammatory and antiarthritic effects of piperine in human interleukin 1β-stimulated fibroblast-like synoviocytes and in rat arthritis models. Arthritis Research and Therapy 2009;11(2):R49.
13. Ved P. Terpenoids as source of anti-inflammatory compounds. Asian Journal of Pharmaceutical and Clinical Research 2017;10(3):68-76.
14. F Kiuchi S Iwakami, M Shibuya, F Hanaoka, U Sankawa. Inhibition of Prostaglandin and Leukotriene Biosynthesis by Gingerols and Diarylheptanoids. Chemical and Pharmaceutical Bulletin 1992;40(2):387-91.
15. Kolchi N, Yoshiaki D, Yoshitaka Y, Masanori H, Masayuki K, Kuniaiki S, et al. Tannin-fluoride Preparation Attenuates Prostaglandin E2 Production by Dental Pulp Cells. Molecular Medicine Reports 2015;6:110-8.
16. Camila RA, Bernadete PS, Jose PP. A new steroidal saponin with antiinflammatory and antiulcerogenic properties from the bulbs of Allium ampeloprasum var. porrum. Fitoterapia 2011;82(8):1175-80.
17. Emanuela R, Garret AF. Prostaglandins and Inflammation. Arteriosclerosis, Thrombosis, and Vascular Biology. 2011;31:986-1000.