Advanced International Journal for Research (AIJFR)
E-ISSN: 3048-7641 ● Website: www.aijfr.com ● Email: editor@aijfr.com

A Review on the Development and Shelf-Life Evaluation of Ashwagandha-Based Cookies

Priti Yadav[1], Kusum Meghwal[2], Dr. Deepak Rajpurohit[3]

[1]M. Tech Scholar, Department of Processing and Food Engineering, College of Technology and Engineering, Maharana Pratap University of Agriculture and Technology, Udaipur, Rajasthan, India
[2] Assistant Professor, Department of Dairy and Food Engineering, Maharana Pratap University of Agriculture & Technology, Udaipur, Rajasthan, India
[3]Professor & PI, AICRP on PHET, Department of Processing and Food Engineering, Maharana Pratap University of Agriculture & Technology, Udaipur, Rajasthan, India

Abstract

Ashwagandha (Withania somnifera) is a well-known medicinal herb widely used in Ayurvedic medicine because of its therapeutic and health-promoting properties. In recent years, the incorporation of herbal ingredients into bakery products has gained considerable attention due to increasing consumer demand for functional foods. Ashwagandha-based cookies have emerged as a promising nutraceutical product because cookies are widely accepted, convenient, and possess a relatively long shelf life. The incorporation of ashwagandha root powder enhances the nutritional and functional value of cookies by improving antioxidant activity, fiber content, and bioactive compounds such as withanolides and alkaloids. However, the addition of herbal ingredients may influence sensory characteristics, including taste, texture, flavor, and overall acceptability. This review highlights the development, nutritional composition, sensory evaluation, and shelf-life studies of Ashwagandha-based cookies. Various formulations prepared using wheat flour, multigrain flour, jaggery, stevia, butter, and other functional ingredients have been discussed. The review also summarizes the effects of storage conditions and packaging materials on physicochemical properties, microbial stability, and sensory quality of cookies during storage. Studies revealed that moderate incorporation of ashwagandha powder produced acceptable cookies with enhanced functional properties and satisfactory storage stability. Proper packaging and low moisture content contributed significantly to extending shelf life and maintaining product quality. Therefore, Ashwagandha-based cookies have strong potential as functional bakery products for health-conscious consumers and may contribute to the growing nutraceutical food industry.

Keywords: Ashwagandha (Withania somnifera); Functional cookies; Herbal bakery products; Nutraceutical foods; Withanolides; Sensory evaluation; Shelf life; Antioxidant activity.

1. Introduction

Ashwagandha (Withania somnifera), commonly known as Indian Ginseng, Indian winter cherry, Gandhpatri, or Asgandha, is a highly valued medicinal herb that has been used in Ayurvedic medicine for more than 3,000 years. It is one of the oldest traditional medicinal plants known for its therapeutic and health-promoting properties. Ashwagandha is widely distributed throughout India, ranging from the

northern tropical regions to southern parts of the country. (Schliebs et al., 1997) Among the ayurvedic Rasayana herbs, Ashwagandha holds the most prominent place. It is known as the "Sattvic Kapha Rasayana" herb (Changhadi et al., 1938). Most of the Rasayana herbs are adaptogenic / anti-stress agents. It is widely recognized for its rejuvenating, adaptogenic, antioxidant, and therapeutic properties. According to Ayurvedic literature, Ashwagandha is categorized as a Rasayana, which refers to a rejuvenating herb that promotes longevity, vitality, and overall well-being. The root of Ashwagandha is traditionally regarded as a tonic, aphrodisiac, stimulant, diuretic, anthelmintic, and rejuvenating agent (Charak Samhita, 1949). The name "Ashwagandha" originates from the Sanskrit word Ashwa, meaning horse, as the roots possess a horse-like smell and are believed to provide strength and vitality comparable to that of a horse. (Singh et al ., 2011) Traditionally, Ashwagandha is available in the form of churna (fine powder), which is commonly consumed with water, milk, honey, or ghee. The herb is known to enhance brain function, improve memory, strengthen the nervous system, and support reproductive health. It also helps the body adapt to physical and mental stress by improving resilience and immunity. commonly consumed with water, milk, honey, or ghee. The herb is known to enhance brain function, improve memory, strengthen the nervous system, and support reproductive health. It also helps the body adapt to physical and mental stress by improving resilience and immunity.

The global interest in medicinal plants and herbal products has increased significantly in recent years because of their health-promoting benefits and fewer side effects compared to synthetic drugs. Medicinal plants contain biologically active compounds in crude or processed forms that are used in traditional and modern medicine. Ashwagandha is one of these plants that is highly prized because it contains several bioactive components that are mostly found in its roots. Its therapeutic qualities are attributed to the presence of alkaloids, volatile oils, flavonoids, withanolides, steroidal lactones, and saponins in the roots. The biologically active compounds present in Ashwagandha include alkaloids such as isopelletierine, anaferine, cuscohygrine, and anahygrine, along with steroidal lactones known as withanolides and withaferins (Mishra et al., 2000). Ashwagandha contains sitoindosides and acylsterylglucosides, which have been shown in numerous studies to have important anti-stress and adaptogenic properties. Active substances like sitoindosides VII–X and withaferin A demonstrated notable anti-stress effects under experimental stress conditions, according to (Bhattacharya et al., 1987). Additionally, it was noted by Ghosal et al. (1989) that several ashwagandha constituents have immunomodulatory effects, which strengthen the body's defenses against illness. Important phytochemicals, such as 5-dehydroxy withanolide-R and withasomniferin-A, have also been found in the aerial parts of Withania somnifera (Atta-ur-Rahman et al., 1991). These compounds further support the therapeutic potential of the plant.

Traditionally, Ashwagandha has been used in the treatment of weakness, fatigue, insomnia, nervous disorders, rheumatism, constipation, stress, anxiety, memory loss, and reproductive disorders (Sharma et al., 1999). The root paste is also applied externally to reduce inflammation, painful swellings, ulcers, and joint disorders (Bhandari et al., 1970). Additionally, the herb has been used in traditional remedies for snakebite, scorpion sting, boils, leucorrhoea, worms, and piles (Misra et al., 2004). Different parts of the plant possess distinct medicinal properties. The leaves are bitter and are used in fever and inflammatory conditions, while the flowers are considered diuretic, astringent, and aphrodisiac. The seeds exhibit anthelmintic properties, and formulations such as Ashwagandharishta are commonly prescribed for hysteria, anxiety, syncope, and memory-related disorders (Sharma et al., 1938). Ashwagandha roots are highly perishable because of their high moisture content and susceptibility to microbial contamination.

Therefore, preservation techniques are essential for maintaining quality and extending shelf life. Drying is one of the oldest and most effective methods used for preserving medicinal roots. Traditional drying methods such as sun drying and shade drying are now increasingly replaced by advanced techniques, including tray drying, cabinet drying, convective drying, and microwave drying, due to improved hygiene, shorter drying time, and better retention of active compounds.

Microwave drying has emerged as an advanced drying technology in medicinal plant processing. Unlike conventional drying methods, microwave drying reduces microbial growth, minimizes post-harvest losses, and preserves bioactive compounds more effectively. Industrial microwave frequencies of 915 MHz and 2450 MHz are commonly used because they efficiently convert absorbed microwave energy into heat within water-containing materials (Khraisheh et al., 1997). Combined microwave-convective drying methods have shown synergistic effects in improving drying efficiency and product quality.

Overall, scientific investigations support the traditional claims regarding the adaptogenic and anti-stress properties of Ashwagandha. Due to its rich phytochemical composition and therapeutic potential, Ashwagandha continues to gain importance in pharmaceutical, nutraceutical, and functional food industries.

2. Products Made from Ashwagandha Root and Leaf:

Extrudates

When (Choudhury et al., 2014) created an ashwagandha-fortified snack, they discovered more antioxidants than the control. Extrusion cooking of herbal snacks was found to retain more bioactive compounds than traditional cooking methods for dried goods. Herbal antioxidant value addition processing is a promising field that needs to be investigated for commercial use.

Juices and Beverages

The goal of the study was to create a functional ready-to-serve (RTS) beverage blend using orange juice (Citrus sinensis L.) and Withania somnifera (Ashwagandha) and Solanum nigrum (Makoi) separately. In both fresh and stored samples, the quality characteristics of the ashwagandha-fortified beverage blend and the fortified beverage were found to be roughly equivalent. The developed products were acceptable till 90 days when stored at room temperature. The results were found by researchers that antioxidant-rich Ashwagandha (AFBB antioxidant activity: 899±22.4 µmol TE/100 gms) and Solanum nigrum (MFBB antioxidant activity: 750±21.8 µmol TE/100 gms) could be successfully utilized to develop functional fruit beverages to improve quality of nutrition in today's way of life (Jairajpuri et al., 2015).

Sweet Products

According to a study, adding 0.5% Withania somnifera powder to shrikhand increased its organoleptic quality and made it self-stable and palatable for up to 52 days at refrigerated temperatures. (Sreenivas et al., 2017).

(Choudhury et al., 2014) developed a cereal-legume-based ashwagandha root powder containing sweet ladoo and studied its sensory properties as well as its nutritional composition, including crude fat, crude fiber, total dietary fiber, and mineral content. The ladoo suggested that the variation in the ratio of cereal to legume had a greater impact on the sensory ratings of the ladoo than the amount of ashwagandha root

powder incorporated. The ladoo had a slightly bitter taste and was sweet. The sweetness of jaggery overwhelmed the taste of ashwagandha root powder. According to the sensory score, which measures the ladoo's overall acceptability negatively, adding ashwagandha root powder up to a 5% level was acceptable. The ladoos can be preserved for 30 days, although it's best to eat them within 15 days, according to the shelf-life study. By adding more fat and jaggery, these ladoos' shelf life can be extended. The nutritional evaluation's findings showed that adding ashwagandha root powder enhanced the product's shelf life and nutritional value. According to the study's findings, ashwagandha root powder supplementation can be utilized successfully as a source of value addition in sweet preparations to boost the quantity of fat, fiber, and other micronutrients while also adding advantageous medicinal qualities.

Bakery and Cereal Products

A 2.5% level of Withania Somnifera powder was used in sweet and salt biscuits (a blend of sorghum and wheat flour), according to customer evaluation and a sensory evaluation of the developed products by semi-trained panels. (Sowmya et al., 2011) and (Narayan et al., 2007) found the developed product to be satisfactory. However, it was allowed to add 5% of ashwagandha powder to Namakpara, Muruku, Pappu and Chakalu and up to 10% to Missi roti and chutney powder. Using ashwagandha leaf powder, (Anita et al., 2017) developed a herbal-based functional food and found that it had a nutritional value that was greater than the control sample. The cookies made with ashwagandha were a good source of various bioactive components that can enhance general health. Using ashwagandha root powder in several amounts (3%, 4%, and 5%) (Indu et al., 2018) produced cereal-legume-infused biscuits; the optimal combination was discovered at the 5% additive level. According to the study, enhanced biscuits had more protein, fiber, minerals, energy, and improved therapeutic qualities. When ashwagandha root powder (2%) is added to baked goods such as flatbread and thepla, the glycemic index is lowered, which also reduces the risk of diabetes mellitus (Chaturvedi et al., 2018). The incorporation of medicinal root powder with besan in cheela and refined wheat flour in cookies increased the prepared products' protein, fat, crude fiber, energy, carbohydrate, iron, calcium, and vitamin C content, according to the nutrient calculation of Cheela and cookies. Cheela and biscuits also showed a notable increase in antioxidant content, including total polyphenols and antiradical scavenging activity. The price of prepared goods dropped as the amount of dehydrated medicinal herb leaves added increased (Kumari et al., 2016).

Dairy Products

Ashwagandha extract has a nutraceutical effect and can be added to dairy products in liquid or powder form. When ashwagandha powder, vidarikand, and shatavari were used, (Pawar et al.,2014) discovered that these herbs have the strongest antioxidant qualities. The National Dairy Research Institute (NDRI) in Karnal, India, created Arjuna herb-infused ghee. When compared to conventional ghee, the created ghee's functionality and stability against fat oxidation were shown to be superior. Arjuna extract's therapeutic qualities effectively combat cardiovascular disease (Bhatnagar et al., 2005). According to research by Sharma and Vigyan et al., Withania somnifera contains steroidal lactones, sitoindosides, and steroidal alkaloids. It is the most significant herbal tonic in the kingdom of plants and is used to increase immunity.

Health Benefits

The product containing 2% root powder was found to be more palatable. Two primary withanolides, withaferine A and withanolide A, have been identified as responsible for the pharmacological activity of

Withania somnifera. Ashwagandha root powder can be used as a useful ingredient to produce low glycemic index (GI) food products with favorable sensory characteristics and to prove to be positive in the healing and/or hindrance of impaired glucose acceptance and insulin resistance, in addition to being an effective means of controlling glucose levels. As a result, it is essential for wholesome and nourishing products that may help prevent and treat Type II Diabetes. While beverages with ashwagandha root powder added were not very acceptable, biscuits made with ashwagandha root powder were found to be more suitable than ashwagandha churan balls. Value-added goods made with powdered ashwagandha root were more palatable. Hence, there is a need to standardize and develop more value-added products of Ashwagandha root powder based on it to promote its health-beneficial effects because, despite possessing great therapeutic value, Ashwagandha cannot be consumed in raw form due to its bitter taste. (Singh et al., 2014)

3. Conclusion

Food is a component that provides us with the daily nutrition and energy we need. The natural herb ashwagandha and its bioactive compounds, which are useful in the prevention and treatment of various diseases, are added to the food products. In markets, value-added goods containing powdered ashwagandha root are more well-liked. Therefore, even though ashwagandha root powder has significant therapeutic value, it is necessary to standardize and create more value-added products based on it to promote its health-beneficial effects. Because of its bitter flavor, ashwagandha cannot be eaten raw.

References

1. Alam, N., Hossain, M., Mottalib, M. A., Sulaiman, S. A., Gan, S. H., and Khalil, M. I. Methanolic extracts of Withania somnifera leaves, fruits and roots possess antioxidant properties and antibacterial activities. BMC complementary and alternative medicine. 12, 1, December 2012, pp. 175.
2. Alavi, S. H., Gogoi, B. K., Khan, M., Bowman, B. J. and Rizvi, S. S. Structural properties of protein-stabilized starch-based supercritical fluid extrudates. Food Research International. 1, 32(2), March 1999, pp.107-18.
3. 3.Anita, S., Moniha, D., Sundararajan, P., Narasimman, S. and Bharath, G. Formulation of withania somnifera based herbal cookies using response surface methodology, International Research Journal of Pharmacy, 8, 6, 2017, pp. 100-108.
4. AOAC. Association of official analytical chemists. Official methods of analysis. 12, 1990.
5. Atta-ur-Rahman, A. U. R., Samina Abbas, S. A., Dur-e-Shahwar, D. E. S., Jamal, S. A., & Choudhary, M. I. (1993). New withanolides from Withania spp.
6. Bhandari, C. R. (1970). Ashwagandha (Withania somnifera)“Vanaushadhi Chandroday”(an encyclopedia of Indian herbs). Publisher: CS Series of Varanasi Vidyavilas Press, Varanasi, India, 1, 96-97.
7. Bhattacharya, S. K., Goel, R. K., Kaur, R., & Ghosal, S. (1987). Anti-stress activity of sitoindosides VII and VIII, new acylsterylglucosides from Withania somnifera. Phytotherapy research, 1(1), 32-37.
8. Bhatacharjee, S. K. Handbook of medicinal plants. Pointer publishers, SMS highway, Jaipur, 1-6, 1998, pp. 377- 78.

9. Bhatnagar, M., Sisodiya, S. S. and Bhatnagar, R. Antiulcer and antioxidant activity ofAsparagus racemosus Wild and Withania somnifera Dunal in rats. Annals of the New York Acad Sci., 1056, 2005, pp. 261–270.
10. Chadha, Y. R. The wealth of India, publication and information directorate, New Delhi, 581, 1976.
11. Changhadi, G. S. (1938). Ashwagandharishta—Rastantra Sar Evam Sidhyaprayog Sangrah. Krishna-Gopal Ayurveda Bhawan (Dharmarth Trust), Nagpur, 743-774.
12. Chaturvedi, N., Raj, N. and Agarwal, A. Value-added Indian flatbreads1 with Ashwagandha and its glycaemic response among normal healthy subjects. Asian Journal of Dairy & Food Research. 1, 37(1), March 2018.
13. Choudhury, M. H., Chakraborty, R., Chaudhuri, U. R. Optimisation of Twin-Screw Extrusion Process for Production of Snacks from Ashwagandha (Withania somnifera) Rice (Oryza sativa) and Chapra (Fenneropenaeus indicus) for Antioxidant Effect. British Journal of Applied Science & Technology. 21, 4(9), March 2014, 1334.
14. Engels, G. and Brinckmann, J. Ashwagandha. The Journal of the American Botanical Council. 99, 2013, 1-7.
15. Gamlath, S. Impact of ripening stages of banana flour on the quality of extruded products. International journal of food science & technology. 43, 9, September 2008, pp. 1541-1548.
16. Ganzera, M., Choudhary, M. I. and Khan, I. A. Quantitative HPLC analysis of withanolides in Withania somnifera. Fitoterapia. 1, 74, February 2003, pp. 68-76.
17. Ghosal, S., Srivastava, R. S., Bhattacharya, S. K., Upadhyay, S. N., & Jaiswal, A. K. U. Chattopadhyay. 1989. Immunomodulatory and CNS effects of sitoindosides IX and X, two new glycowithanolides form Withania somnifera. Phytotherapy Research, 2, 201-6.
18. Gilani, S.A., Kikuchi, A. and Watanabe, K. N. Genetic variation within and among fragmented populations of endangered medicinal plant, Withania coagulans (Solanaceae) from Pakistan and its implications for conservation. African Journal of Biotechnology. 8, 13, 2009.
19. Goldberg, J. "Introduction. Goldberg." Functional Foods; Designer Foods; Pharmafoods; Nutraceuticals, Chapman and Hall, London, 1994, 3-16.
20. Gupta, S. and Abu-Ghannam, N. Probiotic fermentation of plant based products: possibilities and opportunities. Critical reviews in food science and nutrition. 1, 52(2), February 2012, pp. 183-99.
21. Hill. A. F. Economic botany. Economic Botany. 1952.
22. Indu, P. C. and Awasthi, P. Development and evaluation of cereal-legume based ladoo supplemented with Ashwagandha (Withania somnifera). The Pharma Innovation Journal. 7, 7, 2018, pp. 358-362.
23. Jairajpuri, D.S. and Saqib, Q. Fortification of orange juice with Withania somnifera and Solanum nigrum extract-a potential functional fruit beverage and its quality evaluation. Pakistan Journal of Food Sciences. 25, 2, 2012, pp. 58-65.
24. Kaul, K. N. The origin, distribution and cultivation of Ashwagandha the so called Withania somnifera of Indian literature. In Symposium on the utilization of Indian medicinal plants. 1957 (pp. 7-8). CSIR New Delhi.
25. Khanna, P. K., Kumar, A., Ahuja, A. and Kaul, M. K. Biochemical composition of roots of Withania somnifera (L.) Dunal. Asian Journal of Plant Science. 5, 6, 2006, pp. 1061-3.

26. Klaenhammer, T. R. and Kullen, M. J. Selection and design of probiotics. International journal of food microbiology. 15, 50(12), September 1999, pp. 45-57.
27. Kritikar, K. R., & Basu, B. D. (1774). Withania somnifera. Indian medicinal plants, 2nd Edition, IIIrd Vol., Lalit Mohan Basu, Allahabad, 1776.
28. Kumar, N. Functional Properties of Pomegranate (Punicagranatum L.). 83, 172, 2018.
29. Kumar, S. and Prasad, K. Storage changes in chocolate coated roasted flaked and puffed rice. Proceeding in 6th International Conference on Advancements in Engineering & Technology (ICAET-2018), Feb. 23-24, Bhai Gurdas Institute of Engineering and Technology, Sangrur, Punjab (India) 2018.
30. Kumari, S. and Gupta, A. Nutritional composition of dehydrated ashwagandha, satavari, and ginger root powder. International Journal of Home Science. 2, 68-70, 2016.
31. Lamsal, B. P. and Faubion, J. M. The beneficial use of cereal and cereal components in probiotic foods. Food Reviews International. 6, 25(2), March 2009, pp. 103-14.
32. Landge, U. B., Pawar, B. K., Choudhari, D. M. Preparation of Shrikhand using ashwagandha powder as additive. Journal of Dairying Foods & Home Sciences. 1, 30(2), June 2011.
33. Mahomoodally, M. F. Traditional medicines in Africa: anappraisal of ten potent African medicinal plants. EvidenceBased Complementary and Alternative Medicine, 2013.
34. Matsuda, H., Murakami, T., Kishi, A. and Yoshikawa, M. Structures of withanosides I, II, III, IV, V, VI, and VII, new withanolide glycosides, from the roots of Indian Withania somnifera DUNAL. and inhibitory activity for tachyphylaxis to clonidine in isolated guinea-pig ileum. Bioorganic & medicinal chemistry. 1, 9(6), June 2001, pp. 1499-507.
35. Misra, B. (2004). Ashwagandha-Bhavprakash Nigantu (Indian Materia Medica) Varanasi. Chaukhambha Bharti Academy, 393-394.
36. Mishra, L. C., Singh, B. B., & Dagenais, S. (2000). Scientific basis for the therapeutic use of Withania somnifera (ashwagandha): a review. Alternative medicine review, 5(4), 334-346.
37. Narayan, M. Utilization of Ashwagandha (Withania somnifera) Root Powder in Formulation of Health Foods. Diss. Acharya Ng Ranga Agricultural University, Rajendranagar, Hyderabad, 2007.
38. Patwardhan, B., Panes, G.T. and Kulkarni, P.H. Ashwagandha (Withania Somnifera)–A review Journal of national integrated medical association. 30, 6, 1988.
39. Pawar, N., Gandhi, K. and Purohit, A. Effect of added herb extracts on oxidative stability of ghee (butter oil) during accelerated oxidation condition. Journal of Food Science Technology. 51, 10, 2014, pp. 2727–2733.
40. Pole, S. Ayurvedic Medicine: The Principles of Traditional Practice, (London. Singing Dragon. 133, 2013.
41. Pullaiah, T. Withania Somnifera. Encyclopedia of World Medicinal Plants: pp. 207-72, 2006.
42. Rao, B. R. Opportunities and challenges in the cultivation of Ashwagandha {Withania somnifera (L.) Du-nal}. Journal of Pharmacognosy, ISSN. 2012.
43. Samhita, C. (1949). Charaka Samhita. Vols I--VI, Jamnagar, India: Shree Gulab Kunverba Ayurvedic Society.
44. Schliebs, R., Liebmann, A., Bhattacharya, S. K., Kumar, A., Ghosal, S., & Bigl, V. (1997). Systemic administration of defined extracts from Withania somnifera (Indian Ginseng) and

Shilajit differentially affects cholinergic but not glutamatergic and GABAergic markers in rat brain. Neurochemistry International, 30(2), 181-190.
45. Sharma, C. G. (1938). Ashwagandharishta–Rastantra Sar Evam Sidhyaprayog Sangrah–Krishna–Gopal Ayurveda Bhawan (Dharmarth Trust).
46. Sharma, R. Agro-techniques of medicinal plants. Daya Publishing House; 2004.
47. Sreenivas, K. N., Davuddin, M. D., Dharanikumar, M., Banakar and Rajakumar. Recent advances in the development of herbal based dairy foods. International Journal of Recent Scientific Research, 8, 3, 2017, pp. 15830-15833.
48. Sharma, P. V. Dravyaguna, V. and Chowkambha Sanskrit Sansthan. 2nd ed. India: Chaukhambha Bharti Academy, 1998. pp. 120–123.
49. Singh, S., Gamlath, S. and Wakeling, L. Nutritional aspects of food extrusion: a review. International Journal of Food Science & Technology. 42, 8, August 2007, 916-929.
50. Singh, N., Bhalla, M., de Jager, P., & Gilca, M. (2011). An overview on ashwagandha: a Rasayana (rejuvenator) of Ayurveda. African Journal of Traditional, Complementary, and Alternative Medicines, 8(5 Suppl), 208.
51. Singh, R. S., Mundkinajeddu, D., Agarwal, A., Nguyen, J., Sudberg, S., Gafner, S., & Blumenthal, M. (1983). Ashwagandha. Vanaushadhi Nidharsika (Ayurvedic Pharmacopia), UP Sansthan, 30-31.
52. Singh, N., Pande, R., Singh, N., Malhotra, S. R. and Satyabhama, Utilization of Ashwagandha (withania somnifera) for development of value added products. Asian Journal of Dairy & Food Research, 1, 33 (3), September 2104, pp. 221225.
53. Sowmya, C. H. "Formulation And Evaluation Of Millet Based Herbal Biscuits." Phd Diss., Acharya Ng Ranga Agricultural University, 2011.
54. Van Wyk, Ben-Erik, et al. medicinal plants of South Africa. Vol. 184. Pretoria: Briza publications, 1997..
55. Bhandari, C. R. (1970). Ashwagandha (Withania somnifera)“Vanaushadhi Chandroday”(an encyclopedia of Indian herbs). Publisher: CS Series of Varanasi Vidyavilas Press, Varanasi, India, 1, 96-97.
56. Bhattacharya, S. K., Goel, R. K., Kaur, R., & Ghosal, S. (1987). Anti-stress activity of sitoindosides VII and VIII, new acylsterylglucosides from Withania somnifera. Phytotherapy research, 1(1), 32-37.