

A Review of Antler Supplements: Benefits, Trends, and Potential

Galina Arkadevna Dorn, Evgeniya Yuryevna Lobach, Elena Victorovna Ragozinnikova, Valentina Yuryevna Lapina, Valeriy Mikhailovich Poznyakovsky, Boisjoni Tokhiriyon*

Received: 06 January 2022 / Received in revised form: 10 March 2022, Accepted: 14 March 2022, Published online: 28 March 2022

Abstract

To sustain health and development, researchers all around the world are looking for new products to improve contemporary diets. People have been interested in using antler products to treat different health conditions for a great number of years. Many examples can be found in traditional Chinese medicine where antlers are used to increase stamina and vitality. Antler products are considered to be highly beneficial for health and are used to improve the body's nonspecific resistance to unfavorable environmental factors, regulate and support the functions of organ systems, enhance endurance and promote quicker recovery, and compensate for nutrient deficiencies. Therefore, regular consumption of antler products can boost health, reduce morbidity and improve the quality of life. For this work, the market for antler products currently produced in the Russian Federation was analyzed. The study focused on the information provided by the antler supplements producers. The review has identified the growing consumer interest and the lack of antler processing companies.

Keywords: Antler product, Dietary supplement, Nutritional deficiency, Natural tonic

Introduction

Recent epidemiologic studies examining the diets of contemporary humans have discovered numerous health-related conditions including vitamin and mineral deficiencies. On the one hand, these

conditions are often attributed to the disastrous civilization's impact on the environment; on the other hand, the food industry

technology advances have introduced new food processing and preservation technologies, which might sometimes lead to the loss of essential nutrients in processed foods. Nutritional deficiency has an adverse health effect, causes the development of metabolic disorders and nutrient-related diseases, hinders the building of a healthier generation, and, eventually, might trigger social and economic losses (Pokrovskij *et al.*, 2002; Boks *et al.*, 2012; Mirmiran *et al.*, 2014; Flodin *et al.*, 2015; Chelnakova, 2016; Poznyakovsky *et al.*, 2017; Rana & Paul, 2017; Vekovtsev *et al.*, 2017; Garthe & Maughan, 2018; Tokhiriyon *et al.*, 2019, 2020).

Food consumption patterns have changed, with increased food consumption leading to a significant rise in calorie intake, obesity, and other concomitant problems. And now it has become apparent that designing a healthy diet for adults which meets the following requirements: a) only natural products are used; b) all the necessary nutrients are provided; c) energy value does not exceed 2500 – 3000 calories is problematic.

One of the effective solutions for maintaining good nutrition and health is the use of various functional foods, including dietary supplements which can contain vitamins, minerals, amino acids, probiotics, oils, herbs, and other essential ingredients. Another tested way to sustain good health and development is regular consumption of foods fortified with essential nutrients (Lamas *et al.*, 2016; Gervasi *et al.*, 2018; Zia & Sumbal, 2019; Olson *et al.*, 2021).

And that brings us to discussing the foods fortified with antler products (Institute of Medicine Food and Nutrition Board, 2000; World Report on Noncommunicable Diseases 2010 Executive Summary, 2011; Russia's health: Atlas, 2012).

Materials and Methods

The objective of the present study is to analyze available dietary supplements with antler products (pantothenatogen and antler powder), extracts made of native plants and fruit, vitamin and mineral supplements, and honey. Let us start with the biochemical compositions of antler powder and which is the most commonly used active ingredient in antler supplements.

To obtain antler powder, a spongy substance of canned antlers is dried, scraped, and ground. Antlers of the Altai wapiti, the Sika deer, and the Tundra Reindeer are used for antler powder

Galina Arkadevna Dorn

Institute of Distance Education, State, Agricultural University Northern Trans-Ural, Tyumen, Russia.

Evgeniya Yuryevna Lobach

Department of Economics and Management, Kemerovo State University, Kemerovo, Russia.

Elena Victorovna Ragozinnikova, Valentina Yuryevna Lapina, Boisjoni Tokhiriyon*

Institute of Commerce, Food Technology and Service, Ural State University of Economics, Ekaterinburg, Russia.

Valeriy Mikhailovich Poznyakovsky

Scientific and Educational Center for Applied Biotechnology and Nutrition, Kemerovo State Medical University, Kemerovo, Russia.

*E-mail: tohiriyoni@gmail.com



production as they offer a unique composition of minerals, amino acids, proteins, and lipids. In a dispersed state, these biologically active components become a valuable source of important

nutrients for the regulation and maintenance of essential physiological functions (**Tables 1 and 2**).

Table 1. Deer antlers: Biochemical composition

Indicator	Antlers (antler powder)		
	The Sika Deer	The Altai wapiti	The Tundra Reindeer
Water, %	11.18	17.05	9.11
Fat, %	5.38	1.68	2.33
Protein, %	48.25	43.65	57.07
Ash, %	40.57	40.45	36.76
Calcium, %	9.5	11.0	4.9
Phosphorus, %	5.70	4.44	2.7
Macro and micro elements			
Potassium, g/kg	5.00	5.25	4.5
Sodium, g/kg	2.50	5.00	4.25
Magnesium, g/kg	1.03	2.27	1.75
Iron, mg/kg	370.3	465.0	420.0
Manganese, mg/kg	1.5	6.0	5.0
Copper, mg/kg	6.2	6.2	5.0
Zink, mg/kg	40.0	52.5	37.5

Table 2. Deer antlers: amino acids and vitamins

Indicator	Antlers (antler powder)		
	The Sika Deer	The Altai wapiti	The Tundra Reindeer
Amino acids, %			
Tryptophan	0.68	0.20	0.39
Hydroxyproline	0.029	0.02	0.038
Isoleucine	1.56	2.24	2.76
Threonine	2.95	1.28	1.93
Serine	1.32	0.89	0.82
Glycine	1.39	0.97	0.88
Alanine	1.79	1.16	1.04
Valine	1.56	0.96	0.84
Methionine	1.26	0.52	0.81
Methionine + cysteine	2.35	0.81	1.45
Leucine	2.35	4.16	5.14
Glutamine	5.11	2.93	2.5
Proline	2.52	0.34	0.00
Phenylalanine	1.28	0.70	0.64
Lysine	4.38	2.06	2.95
Arginine	2.48	1.49	1.11
Vitamins, mg/kg			
E	6.25	4.83	6.15
B1	0.62	0.48	0.61
B2	1.82	1.44	1.85
B3	5.78	4.46	5.41
B5	49.27	38.00	46.00
B6	2.5	1.92	2.47
B12	31.25	19.32	30.82

The biologically active components, which are found in antlers, lower blood pressure, prevent lipid accumulation, boost the immune system, and improve fertility; they demonstrate antimutagenic activity and enhance metabolic processes, including increased oxygen metabolism, have a beneficial effect on thyroid function, and can be used as detoxicants.

The wide range of beneficial properties and the application versatility make antlers extremely useful for functional food producers and provide the opportunity to develop new dietary compositions to meet the needs of different age groups for good nutrition.

Results and Discussion

One example of a nutritional product is a liquid dietary supplement that was developed using antler extract. The active ingredients include deer blood (the Altai wapiti, the Tundra Reindeer) and Yakutian blood (the Yakutian is a native horse breed from the Sakha Republic, Siberia, Russia). The Yakutians and deer graze in a high-altitude environment that is full of plants rich in bioactive compounds. Additionally, the dietary supplement contains flower honey and ascorbic acid (Table 3).

The biochemical composition of animal blood and active components are presented in Tables 4 and 5.

Table 3. The composition of liquid dietary supplement

	Ingredients	Mass fraction, %
1	Stabilised blood (Federal Standard 42-0885-89)	55
2	Antler extract (70% ethanol extract)	10
3	Flower honey dissolved (30% solution)	35
4	Ascorbic acid (Federal Standard 42-2668-83)	0.1

Table 4. Animal blood biochemical composition

	Indicators	The Tundra Reindeer	The Altai wapiti	the Yakutian
1	ASAT, units/l	97.05 \pm 2.125	108.51 \pm 2.73	85.14 \pm 1.27
2	ALAT, units/l	47.055 \pm 0.871	42.01 \pm 0.303	45.93 \pm 0.561
3	alkaline phosphatase units/l	25.147 \pm 2.540	35.48 \pm 3.41	66.95 \pm 2.14
4	creatin kinase, units/l	158.134 \pm 4.124	129.71 \pm 3.99	102.14 \pm 3.41
5	Cholesterol, mmol/l	3.629 \pm 0.091	4.200 \pm 0.080	2.843 \pm 0.113
6	Urea, mmol/l	5.226 \pm 0.303	6.784 \pm 0.250	5.457 \pm 1.296

Table 5. Animal blood components

	Indicators	The Tundra Reindeer	The Altai wapiti	the Yakutian
1	Circulating immune complexes, cu	147.890 \pm 2.670	135.314 \pm 1.918	118.93 \pm 4.23
2	Total proteins %	5.438 \pm 0.148	6.241 \pm 0.219	8.673 \pm 0.119
3	Sugar, mg/%	110.064 \pm 2.726	87.213 \pm 3.48	97.35 \pm 3.972
4	Lipids, mg/%	347.68 \pm 10.75	401.77 \pm 10.91	317.63 \pm 6.79
5	Blood bactericidal activity, %	60.565 \pm 3.271	44.028 \pm 1.973	69 \pm 373 \pm 4.144
6	Albumin, %	51.095 \pm 1.231	43.704 \pm 0.590	47.202 \pm 1.333
7	α -globulin, %	15.675 \pm 0.745	15.795 \pm 0.601	14.285 \pm 0.708
8	β -globulin, %	14.066 \pm 1.412	17.021 \pm 0.776	15.843 \pm 1.304
9	γ -globulin, %	19.164 \pm 0.853	22.071 \pm 0.744	22.686 \pm 0.730

As can be seen from the data on antler composition and functional properties, antlers can be used as a tonic, therefore, it is possible to employ antler supplements to assist healthy growth and help children flourish mentally. Since children all around the world are fond of confectionery products, 'Pantoshka' dietary supplements for children are produced in a dragee form (small candies with a hard outer shell). The active ingredients include pantothenic acid, extracts of native plants, and cacao powder. To help children

consume the daily recommended amount of essential vitamins and minerals, the 'Pantoshka' range offers an iron supplement ('Pantoshka-Fe'), iodine supplement ('Pantoshka-Iod'), calcium and vitamin D3 supplement ('Pantoshka-Ca'), vitamin C supplement ('Pantoshka'), vitamins A and C supplement ('Pantoshka-A').

When developing the 'Pantoshka' range, experimental work together with the method of mathematical modeling was applied to

ensure that the content of the active ingredients is finely balanced. Each 'Pantoshka-Fe' dragee contains 0.5 mg of iron, 'Pantoshka-Iod' - 0.0075 mg of iodine, 'Pantoshka-Ca' - 16.65 mg of calcium, and 0.0003 mg of vitamin D3, 'Pantoshka' - 5 mg of vitamin C and 'Pantoshka-A' - 0.046 mg of vitamin A and 5.0 mg of vitamin C. The daily intake of 4-6 dragees is sufficient to meet 30-50% of daily nutrient requirements. When the 'Pantoshka' range dragees are prescribed to adults, then the recommended daily dose is 6-10 dragees.

Combined with herbs, antler products can be used as dietary supplements for adults. 'Vitaminii Balsam' dietary supplement (a thick vitamin drink) is produced to help improve the immune system and functioning of the autonomic nervous system in adults, boost metabolism and prevent infections in cold seasons, avoid vitamin deficiency.

Another example of an adult dietary supplement with antler products is the 'Ferropan' dietary supplement which is intended to prevent and treat iron-deficiency anemia, stimulate blood production and circulation, increase the production of hemoglobin, and sharpen mental performance. Vitamin C which is an active ingredient of the 'Ferropan' dietary supplement helps to increase iron absorption 10-20 times (which is of great significance for female health). Discussing female health, the 'Kaltsepan' dietary supplement should also be noted. The active ingredients of this supplement include pantothenic acid, Kuril Tea extract (made with fresh Kuril tea shoots), Hypericum perforatum (St. John's wort), Red Rowan fruits, Shrub cinquefoil extract, tricalcium phosphate, vitamins D3 and C. Pantothenic acid helps calcium metabolism, and thus, this dietary supplement is recommended for prevention and treatment of osteoporosis, for stronger teeth and bones, as well as for the overall better appearance of nails, skin, and hair. One more herbal combination with pantothenic acid is the 'Alpiiskii Aromat' (Alpine Plants Aroma) dietary supplement. Other active ingredients include Kuril Tea extract (made with fresh Kuril tea shoots), Hypericum perforatum (St. John's wort), vitamin C, and honey. This dietary supplement is used as a part of hormone therapy, helps treat menopause problems (improves sleep, tackles excessive sweating, counters stress), and reduces inflammation.

Pantothenic acid is also used as a dietary supplement for males. Combined with Rhodiola rosea extract, Rhaponticum carthamoides, and vitamin C, it is used as a tonic for treating male sexual performance problems, enhancing physical performance, improving the functioning of the autonomic nervous system, and strengthening mental skills. Moreover, this dietary supplement is administered as part of complex therapy when treating alcohol and tobacco dependence.

Modern technologies allow antler producers to offer concentrated syrups which enable producers of dietary supplements to provide the market with different finished products. Therefore, dietary teas with antler products are currently experiencing growing popularity. For example, active ingredients of a popular dietary tea include antler powder, Rhodiola Rosea, Bergenia, and Hawthorn berries. Dietary teas with antler powder can be prescribed to the general public as a tonic that can help restore and strengthen the immune system, protect from common diseases as well as a way to

maintain the health and well-being of people living in radioactively contaminated areas.

One more finished product, which is becoming increasingly popular nowadays, is artificial mineral water. Natural mineral waters have been traditionally used in the Russian Federation to treat respiratory and skin disorders, and with the advances in the production of fortified foods, it is now possible to widen the range of enhanced beverages and target different health conditions. Additionally, an increasing number of producers apply new processing technologies and combine antler products with bee products and herbs to introduce new products.

The biggest antler processing companies based in Western Siberia include 'ArtLife' and 'Biolit' from Tomsk city, 'Altaivitamini', 'Evalar', and 'UG' from Biisk town. These companies produce a wide range of dietary supplements in different forms and for different purposes using ingredients of animal origin, native plants, and minerals. However, although Russian producers of antler products are found in the vast territories of Western Siberia, the Urals, the Altai Republic, Krasnoyarsk Krai, Primorsky Krai, the Far East, and Yakutia; there is still an evident shortage of antler processing companies, as most antlers are exported to China, Korea, and the USA as raw material.

Conclusion

The analysis of the antler market indicates that there is huge market potential, thus, there is a need to rethink the way antler production is organized in the Russian Federation. New production technologies should be deployed in order to improve antler processing and marketing and enable the development of new antler supplements. At the same time, it is very important to carefully follow all the safety requirements and fully comply with international standards to ensure the production of high-quality dietary supplements.

Acknowledgments: The team of authors thanks the administration of the 'Yug' company for the opportunity to research its basis.

Conflict of interest: None

Financial support: None

Ethics statement: The study was conducted according to the guidelines of the Declaration of Helsinki.

References

- Boks, M. P., de Jong, N. M., Kas, M. J., Vinkers, C. H., Fernandes, C., Kahn, R. S., Mill, J., & Ophoff, R. A. (2012). Current status and future prospects for epigenetic psychopharmacology. *Epigenetics*, 7(1), 20-28.
- Chelnakova, N. G. (2016). Healthy nutrition and its role in life quality assurance. Technologies of food and processing industry in agribusiness. *Healthy Nutrition Products*, 4(12), 52-57.
- Flodin, L., Cederholm, T., Säaf, M., Samnegård, E., Ekström, W., Al-Ani, A. N., & Hedström, M. (2015). Effects of protein-

- rich nutritional supplementation and bisphosphonates on body composition, handgrip strength and health-related quality of life after hip fracture: a 12-month randomized controlled study. *BMC Geriatrics*, 15(1), 1-10.
- Garthe, I., & Maughan, R. J. (2018). Athletes and supplements: prevalence and perspectives. *International Journal of Sport Nutrition and Exercise Metabolism*, 28(2), 126-138.
- Gervasi, T., Pellizzeri, V., Benameur, Q., Gervasi, C., Santini, A., Cicero, N., & Dugo, G. (2018). Valorization of raw materials from agricultural industry for astaxanthin and β -carotene production by *Xanthophyllomyces dendrorhous*. *Natural Product Research*, 32(13), 1554-1561.
- Institute of Medicine Food and Nutrition Board. (2000). Dietary reference intakes applications in dietary assessment. *Washington, DC: National Academy Press*.
- Lamas, A., Anton, X., Miranda, J. M., Roca-Saavedra, P., Cardelle-Cobas, A., Rodriguez, J. A., Franco, C. M., & Cepeda, A. (2016). Technological development of functional egg products by an addition of n-3 polyunsaturated-fatty-acid-enriched oil. *CyTA-Journal of Food*, 14(2), 289-295.
- Mirmiran, P., Bahadoran, Z., & Azizi, F. (2014). Functional foods-based diet as a novel dietary approach for management of type 2 diabetes and its complications: A review. *World Journal of Diabetes*, 5(3), 267-281.
- Olson, R., Gavin-Smith, B., Ferraboschi, C., & Kraemer, K. (2021). Food fortification: The advantages, disadvantages and lessons from sight and life programs. *Nutrients*, 13(4), 1118.
- Pokrovskij, V. I., Romanenko, G. A., Knyazhev, V. A., Gerasimenko, N. F., Onishchenko, G. G., Tutelyan, V. A., & Poznyakovsky, V. M. (2002). Healthy eating policy. Federal and regional levels. *Novosibirsk: Siberian University Publishing House*, 344.
- Poznyakovsky, V. M., Chugunova, A. A., & Tamova, M. Y. (2017). Nutrition ingredients and biologically active food supplements. *INFRA-M, Moscow*, 143.
- Rana, J., & Paul, J. (2017). Consumer behavior and purchase intention for organic food: A review and research agenda. *Journal of Retailing and Consumer Services*, 38, 157-165.
- Russia's health: Atlas. Edited by Bokeria L.A. 8th edition. (2012). Bakoulev Centre for Cardiovascular Surgery, Russian Academy of Medical Sciences, Moscow. pp. 408.
- Tokhiriyon, B., Poznyakovsky, V. M., & Andrievskikh S. S. (2020). Biologically active complex for multifactorial support of the central nervous system: new composition, efficacy. *Carpathian Journal of Food Science and Technology*, 12(1), 52-60. doi:10.34302/crpfjst/2020.12.1.5
- Tokhiriyon, B., Poznyakovsky, V., & Beliaev, N. (2019). Biologically Active Complex for the Functional Support of the Connective Tissues: Scientific Rationale, Clinical Evidence. *International Journal of Pharmaceutical Research & Allied Sciences*, 8(1), 115-122.
- Vekovtsev, A. A., Tokhiriyon, B., Chelnakov, A. A., & Poznyakovsky, V. M. (2017). Evidence for Effectiveness and Functional Properties of Specialized Product in Clinical Trial. *Human Sport Medicine*, 17(3), 94-101. doi:10.14529/hsm170310
- World Report on Noncommunicable Diseases 2010 Executive Summary. (2011). World Health Organization. - Geneva, pp. 21.
- Zia, F., & Sumbal, S. (2019). Physical performance and functional food. *Journal of Human Nutrition & Food Science*, 7, 1128.