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SPORTS NUTRITION: CHARACTERISTICS, CURRENT RESEARCH STATUS AND AREAS OF PATENTING OF INVENTIONS AND UTILITY MODELS

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ABSTRACT---*This article presents the research that indicated the growing interest in Russia to healthy lifestyle and healthy functional nutrition, including sports nutrition. Meanwhile, despite the serious scientific research taking place in Russia, imported food products prevail on the markets of sports nutrition, while Russian producers of such production are poorly introduced on the foreign markets. Russian researchers, developers and producers of sport food products do not pay enough attention to the production of patentable intellectual property objects and protection of results of their intellectual activity. It follows from the above, this article presents the analysis of the Russia's current state of the research, characteristics and areas of development of new intellectual properties objects related to functional sports nutrition.*

Keywords--- *vitamins, nutrients, sports nutrition, intellectual property, patent, patent-information search, athlete, nutrition strategies, training and competition process, functional foods.*

I. INTRODUCTION

This work develops the research in the field of scientifically-based formation of cross-cutting strategies and technologies for procurement and transportation of agricultural food raw materials and production of functional foods (21, 75, 76). Among such strategies and technologies, the development and implementation of functional foods for athletes and people engaged in intensive physical labor, including under the adverse conditions of the North and the Arctic, should now occupy an important place in research. The conducted research helped to reveal that on the one hand, Russia is currently increasing attention to a healthy lifestyle using health-promoting technologies and healthy functional nutrition, including sports nutrition. On the other hand, despite serious scientific research in this area, the markets for sports nutrition are dominated by imported food products, while Russian producers of such products are poorly represented in foreign markets. One of the important reasons for this situation is that Russian researchers, developers and producers of sports nutrition give little attention to creating patentable intellectual property objects and protecting the results of their intellectual activity. All this necessitated

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the analysis of the state of research and development of new intellectual property, patenting inventions and utility models in the field of functional sports nutrition, the results of which are presented in this paper.

II. LITERATURE REVIEW

The use of competent nutrition strategies is the most important factor in the implementation of the scientifically-based organization of the training and competition process and the recovery of athletes of various sports, ages, residence, and improves the effectiveness of this process (74).

The strategy of rationally-organized nutrition in the process of purposeful long-term training of athletes, tailored to specific sports, athletes' age, stages of training and competitive process and regional characteristics of the areas where training and competition take place, is required in implementation of a whole range of tasks. These include: strengthening the health of athletes with the achievement of high sports results, improving their speed and strength indicators for intensive training, serious physical and emotional loads, regulation of the athlete's body weight; rapid recovery after physical activity; filling the deficit of essential nutrients, micro- and macronutrients, to compensate for energy costs, and to restore the athletes after the end of the sports season. It is known that the deficit of micro- and macronutrients in the process of training and competition cycles of athletes can weaken the health, worsen the performance of athletes. Conversely, scientifically-based nutrition of athletes using specialized functional foods corresponding to specific training, competition and recovery stages of their life can increase athletic performance with the achievement of high sports results.

Currently, the development of a strategy for rationally-organized nutrition of athletes is a serious element of strategies that are currently actively implemented for high-quality and health-improving nutrition to ensure a healthy lifestyle of the population living and working in various regions of the country.

The above explains why many dissertation research works study the relations between strategies of sports nutrition and health state, indicators of physical training and performance of athletes, achievement of high sports results.

In the dissertation of Doctor of Technical Sciences Shterman (2013), it is noted that sports food nutrition is a special food group among food products. The author of this work proposed a definition of the term "Modern sports nutrition" defining it as "a complex of macro- and micronutrients of increased biological value and efficiency, produced using complex innovative technologies." This term is quite controversial, since sports nutrition involves not only good macro- and micronutrient content, and the innovative technologies used in the production of functional foods refer to the methods of their production, and not to the food product itself, that is sent to the market.

Given the above, it is worthwhile to give a variant of the more appropriate definition of the term "Sports nutrition": it is a set of functional foods enriched with vitamins and nutrients for use by athletes at all stages of training and competition process, which increase the effectiveness of measures aimed at achieving high sports results while performing health-promoting functions.

Many specialists in the field of physical culture and sports, health-promotion technology and medicine focus their attention on assessing the state of and the solution to the problem of development of strategies of sports

nutrition (10, 15, 23, 26, 39, 64, 66, 19, 73, 78, 109). Medico-biological bases of nutrition strategy formation for women and men – members of the Russian weightlifting team – were considered as well (2, 7).

The selection of pharmacological products, nutrients and vitamins as pharmacologic support for athletes at various stages of the training cycle is discussed in numerous works (102, 104, 14, 16, 46, 61, 67, 68).

As shown in the work by Nevskaya and colleagues (2013), the carbohydrate-protein balance in the diet of athletes depends on the type of sport. The athletes engaged in strength (weightlifting, powerlifting, bodybuilding) and speed-strength sports (throwing, jumping, sprinting) require a significant amount of protein (about 18-20 % in the daily diet), in sports aimed at developing endurance (running, swimming, skiing) – require the increased amount of carbohydrates (about 70-75 %). The percentage of carbohydrates, protein and fat in the diet of athletes should be: 12-15 % of daily calories from protein; 25-30 % of daily calories from fat; 55-65 % of daily calories from carbohydrates.

The specificity of the nutrition in different types of sports is considered in many research works related to the martial arts (62, 79, 87, 88), to the team sports (52, 77), to the stayers (35), to the cyclic sports (37), to the winter sports (55) to the skiing (51, 106), to the luge (105), to the water polo (45), to the mountaineering (60).

There are known works that studied strategies for nutrition of young athletes (24, 87, 88), pre-school athletes (33), students and cadets (103, 8, 48), highly qualified athletes (4, 57, 89, 13). Questions of producing and using functional foods for athletes are considered in the works by Vassel and Ponomareva (2019), Novokshanova (2019), Chernopolskaya and Gavrilova (2019), Shustov (2019). The effect of probiotics on respiratory infections and gastrointestinal symptoms during training in marathon runners is discussed in the paper by Kekkonen (2007). Studies are caused by the fact that with significant loads, there is a risk of upper respiratory tract infections and gastrointestinal symptoms. Research by the authors showed that probiotics reduced respiratory tract infections and gastrointestinal symptoms in the general population, including children, adults, and the elderly. Numerous studies are devoted to the research on current issue of sports nutrition market (1, 25, 50, 18, 40).

As noted in the doctoral dissertation of Shterman (2013), the quality and quantity of products consumed during the training and competition cycle, the balance of diet depends on the energy capabilities, performance and duration of the athletes' recovery process after extreme physical and emotional loads. The author provides a categorization of sports nutrition products: a) by the area of the tasks being solved; b) by the content of their main component; c) by the period of use in the training and competition process, etc.

To achieve high sports results, various nutrition strategies and various food products, including functional products, are used in the training of highly qualified athletes (107). In the process of intensive sports training of athletes, physical overexertion and disruption of the body functioning occur inevitably. As a result, these factors cause decline in immunity and development of autoimmune diseases. The implementation of strategies and technologies of rational sports nutrition contributes to the improvement of sports results in many ways. In this regard, a special place is occupied by the use of specialized food products by athletes with a given nutritional and energy value with food additives (sometimes the term "sports supplements" is used) (23).

As noted in the work (9), in strength and speed-strength sports, athletes have additional needs for carbohydrates, easily digestible proteins and basic micronutrients, which are not provided by traditional nutrition. To solve this problem, it is proposed to include functional carbohydrate-protein products of high biological value in the diet of athletes.

Currently, the sports nutrition markets offer a variety of functional foods including proteins, creatine, amino acids, vitamins and glutamine. At the same time, with strength sports, functional food (proteins, amino acids) with 40 % or more protein is used. High-carbohydrate foods maintain energy levels during intense training and competition. Athletes use high-calorie carbohydrate-protein products (gainers, bars) during training and competitions, when it is necessary to compensate for significant energy costs. To maintain the physical potential and water-salt balance of athletes during prolonged physical activity, isotonic or slightly hypotonic carbohydrate-mineral drinks are used. This element of nutrition, so-called "fat burners", stimulate the metabolism in the athlete's body, reduce the absorption of fat and carbohydrates from the digestive tract, blocking the synthesis of fat in adipose tissue and removing excess fluid. Functional foods of athletes are usually enriched with vitamins and minerals (31).

Analysis of the problem has shown that Russian researchers and ordinary residents are showing growing attention to a healthy lifestyle using health-promoting technologies and healthy functional nutrition, including sports nutrition.

III. MATERIALS AND METHODS

This work aims to analyze the status of research and development of new intellectual property, patenting of inventions and utility models in the field of functional sports nutrition.

According to the research methodology, the research materials are based on the results of an extended patent-information search, which involved the wide use of the knowledge bases of the Russian Science Citation Index and the Federal Institute of Industrial Property for 2012-2019.

Special attention is paid to the analysis of the results of dissertation works in the related research field, including works of the following authors:

- Garmashov (2018), who works in the field of development of technology for obtaining curd mass by its enrichment with protein-vitamin complex of high nutritional and biological value from cedar nut cake intended for people with increased physical activity.

- Bastrikov (2009), whose work is devoted to the influence of technologies of the use of functional carbohydrate-protein products that support the nutritional status of athletes on the metabolic changes in the athlete's body occurred due to intense speed and strength loadings;

- Velichko (2017), who studied means to increase the supply of athletes with essential components (vitamins and minerals) by including snacking functional foods in their diet;

- Gavrilyeva (2017), who performed original research on the development of young athletes of Yakutia, paying special attention to non-invasive methods of restoring the organisms of the athletes;

- Zharkova (2017), who justified the technology of correction of the nutrient composition by using plant raw materials that are non-traditional for baking and confectionery production;

- Ivanova (2005), who justified the technology of producing the specialized functional bakery and flour confectionery;

- Ignatyev (2009), who developed the technology of producing the fermented milk product for sports nutrition;

- Lopatnikova (2003), whose work is aimed at developing special endurance of wrestlers by increasing their nutritional status;

- Mezenova (2017), whose research is devoted to developing a bio-product for sports nutrition of athletes, engaged in speed and strength sports, using bio-modified collagen-containing fish raw materials, including bio-modified fish scales and bee products;

- Statsenko (2013), who justified the methods of preventing the development of professional diseases of highly qualified athletes with early detection of risks of athletes' failure to adapt to loads of modern sports and by the use of treatment and rehabilitation methods;

- Topanova (2009), who studied the specifics of nutrition of young wrestlers, cyclists, rowers providing the necessary consumption of energy, macro- and micronutrients to meet the physiological needs depending on the sport type;

- Fedotova (2010), who studied the issues of medical and social adaptation of highly qualified athletes after completing sports;

- Khasanova (2011), who studied the development of sports products and diets for athletes' nutrition that focus on metabolic changes and their consequences;

- Shterman (2013), who justified the rational food recipes for athletes' nutrition, providing their intensive training.

The methodology of the study provided for the assessment of the state of production of functional sports foods and identification of the reasons why, with serious ongoing research in this field, the markets of sports nutrition are dominated by imported food products, with Russian producers of such products being poorly represented in foreign markets.

The objectives of the research are:

- to define the main areas of patenting intellectual property objects in Russia in the development of new competitive domestic food products for nutrition of athletes at all stages of the training and competition process aimed at achieving high sports results and their recovery to prepare them for the subsequent training and competition cycles;

- to identify the universities, research organizations, and individuals who are patenting the intellectual property objects developed by them;

- to build a knowledge base on Russian patents for inventions and utility models in the development of functional foods for sports nutrition so that the researchers, developers and producers could use it to select analogues and prototypes in the development and patenting of new intellectual property objects.

IV. RESULTS AND DISCUSSION

Nizhny Novgorod Research Institute of Hygiene and Occupational Pathology has patented inventions for the methods described in the patents (Patents RU2521324; RU2540915). According to the invention, the basic diet of athletes includes natural functional foods with an increased content of biologically active substances from plant (protein-plant) raw materials. These substances provide athletes from various sports with nutritional support for their bodies at specific stages of the training and competition cycle. The composition of the sports nutrition product

invented by this Institute (Patent RU2533002), which positively affects the training of the cardiovascular system of the athlete and ensures the preservation of performance, contains natural concentrated food products: watermelon seed, rosehip, oats, spinach, laminaria and egg white. This Institute also proposed a method for producing a sports nutrition product that includes an algorithm for determining the doses and types of natural concentrated food products, the ingredients needed for the product's formulation (Patent RU2524550).

The use of bakery products made from flour mixtures for athletes' nutrition increases the antioxidant activity, which is an indicator of the effectiveness of such products that reduce the aftereffects of strength training by inactivating the free radicals. In this regard, the Research Institute of the Baking Industry has patented two versions of flour mixture compositions for bakery products intended for the nutrition of athletes in strength sports, including strength combats (Patent RU2698670). The first contains wheat flour, oat bran, chickpea flour, salt, sugar, gluten, sesame, ascorbic acid and dihydroquercetin; the second comprises wheat flour, wheat whole grain flour, salt, sugar, dry gluten, milk powder, flax seeds, ascorbic acid and dihydroquercetin. Research has indicated that the product increases exercise tolerance by 20-30 % and performance by 40-50 %. According to this invention, bread consumption increases the rate of hematopoiesis, normalizing liver function, toning the heart muscle and reducing cholesterol.

OOO "Mobilny Doktor" ("Mobile Doctor") has patented a complex of biologically active substances to protect athletes from overtraining (Patent RU2614881). The complex includes L-arginine alpha-ketoglutarate, vitamin PP, glutamine and additionally contains lecithin, taurine, L-tyrosine, carnosine, L-citrulline and dihydroquercetin. This complex helps to increase muscle strength and endurance, protecting athletes from overtraining symptoms.

Ogarev Mordovia State University and OOO "Zdorovye" ("Health") has patented a dietary supplement to improve overall performance (Patent RU2635373). The dietary supplement includes arginine alpha-ketoglutarate, taurine, and additionally, vitamin P, vitamin PP and water-alcohol extract from the aboveground parts and roots of *Echinacea purpurea*, containing 5 % echinacoside.

Amur State University has patented a method for producing Zefir for systematic use by people who are in autonomous conditions of existence – cosmonauts, residents of the Far North, athletes etc. (Patent RU2685950). The resulting product is designed to improve the performance and endurance of the body after heavy loads, by introducing physiologically valuable ingredients (flavonoids, polysaccharides, glycosides, etc.) into the recipe. Zefir is created from natural raw materials and a biologically active additive with a wide range of minerals, proteins, polyunsaturated fatty acids and others, presented by a freeze-dehydrated defibrinated blood of reindeer. Zefir, created according to the invention, produces an adaptogenic and tonic effect due to its natural ingredients.

Kemerovo State University has patented a method for producing protein bars for athletes and people who lead an active lifestyle (Patent RU2687450). The method includes preparing a syrup-bundle of caramel syrup and glucose-fructose syrup, introducing additional components to the syrup, mixing, forming, cutting into separate bars and coating them with chocolate glaze. The novelty of the method is that a protein-vitamin complex obtained from cedar cake by alkaline extraction is used as additional component. Research has shown that the use of this method will contribute to the athletes' positive dynamics of the strength index, strength endurance and overall physical performance of athletes. According to the inventors, the developed bars are characterized by a high content of protein, essential amino acids, vitamins B and E, and phosphorus. At the same time, the dynamics of the strength

index exceeds this indicator for the known bar (Patent RU2595455) by 83.3-89.7 %: the dynamics of strength endurance – by 51.8-55.8 %, the dynamics of overall physical performance – by 27.6-37.3 %.

Kemerovo State University has developed a carbohydrate-protein product (gainer) containing maltodextrin intended for sports nutrition (Patent RU2592573). The novelty of the product is that it additionally contains dehydrated oatmeal broth, hawthorn, flower pollen (pollen load), rosehip. Carbohydrate-protein product (gainer) supplies half of the daily requirement for vitamins A, B2, B5 and minerals – calcium, phosphorus, copper. For the better achievement of sports results, the authors recommend that athletes take two servings of gainer a day.

The task of regulating body weight, reducing the athlete's weight for a short period of time is especially important in martial arts and other sports. It is no accident that a group of authors (93) has a development in progress in the field of body weight loss, regulating the ratio between strength and body weight, improving coordination of movements and increasing the attractiveness of appearance. The authors refer to the work by James (2008) and note that a number of studies have shown that the excessive fat deposits lead to the risk of a number of serious diseases (myocardial infarction, stroke, diabetes, hypertension, chololithiasis and others), which are a real threat to person's life. According to James (2008), the cost of medical care for people who are obese is 40 % higher than for ordinary people. The work by Mateev et al. (2017) was also mentioned, showing that safflower oil, which helps the body burn excess fat, is among the nutrients that have an effective positive effect on weight loss.

Another group of authors (Patent RU2686632) has patented an invention for a nutritional mixture. This mixture includes components (per 1000 mg of the composition / mg): safflower oil (*Carthamus tinctorius*) – 870-920, defatted soy lecithin – 35-45, caffeine – 26-32, yohimbe bark extract (*Pausinystalia johimbe*) – 16-20, red pepper oil extract (*Capsicum annuum* L) – 5-8, green tea extract (*Camellia sinensis*) – 12-16, ginger root extract (*Zingiber officinale* Rosc.) – 1-2, and chromium picolinate – 0.4-0.6. The authors' research has shown that the use of the invention makes it possible to effectively and safely reduce body weight as a result of fat metabolism acceleration and increased use of fat for bioenergy production instead of forming fat deposits with regular use of the mixture. The threshold of athlete's physical and psychological fatigue is shifted back.

Petrozavodsk State University has patented variants of a functional product formed using the plants from Northern latitudes (Patents RU2681676; RU2705782; RU2709764; RU2709747).

It is known that insufficient protein intake causes a rapid feeling of fatigue even with small physical exertion, while there might be an unacceptable loss of muscle mass for athletes and even the diseases. According to data provided by Jager and colleagues (2017), men should consume 65-117 g protein intake per day, women – 58-87 g per day. With high physical activity, the rate of protein consumption is even higher. One way to solve this problem is to use cereals, since the protein content in grain products is 10.1 % for oats, 11.3 % for buckwheat, 6.6 % for rice. Based on this position, the team of authors patented a composition for high-protein instant porridge (Patent RU2694580). This composition contains cereal grains or flakes, whey and milk protein concentrates, inulin, isomaltulose, xanthan gum, potassium chloride, sucralose, flavoring and food coloring. Regular consumption of high-protein porridge contributes to the rapid growth and recovery of athletes' muscle tissues, facilitating the energy boost.

The above group of authors (Patent RU2662774) has developed a composition for the preparation of a sports drink called "Morning protein with coffee" for use by athletes during the period of accelerated muscle mass gain and ordinary people when performing hard physical work to strengthen the protein component of the food they

consume. The composition contains a mixture including whey protein concentrate, egg white, a plant-based substitute for dry cream, natural instant coffee, caffeine, xanthan gum, lecithin, sucralose and flavorings. The composition contains whey protein, which makes up 20 % of the entire protein share of milk. The technology of membrane filtration of milk whey (a by-product in cheese making) allows obtaining high-purity whey protein. The use of a sports drink in combination with training provides a rapid build-up of fat-free muscle mass and its effective recovery after intense physical activity. The reduced caloric content of the product eliminates the possibility of developing obesity processes with its regular use.

During intensive training and competitions, an invention (Patent RU2609813) named "Amino Jam" can be used as an addition to the main diet of athletes. According to the patented invention, the functional food product contains a mixture including collagen hydrolysate, amino acids (leucine, isoleucine, valine), vitamin C, L-carnitine, inulin, agar-agar, erythritol, sucralose, citric acid, food coloring, flavoring, potassium sorbate and water.

A functional food product patented by OOO "Academiya-T", which contains fir extract, limonene, a mixture of grape and apple extracts, superoxide dismutase and choline bitartrate has been invented for use by athletes with high physical loads (Patent RU2656544). During preclinical tests of a functional food product containing a biologically active composition of components taken in the weight ratio specified in the claim, it was found that the developed composition has a protective effect against stress hypertrophy of the adrenal glands.

OOO "Academiya-T" patented a food product named "Antistress" (Patent RU2637211). The product contains lemon, a mixture of apple and grape extracts, glycine, inosite, griffonia extract and pyridoxine hydrochloride. The developed product mobilizes the athlete's organism to achieve high sports results.

For sports and dietary nutrition, the All-Russian Research Institute of Starch Products has patented a method for obtaining a honey product in a dry, free-flowing crystalline form with a ratio of carbohydrate components inherent in honey, preserving its biologically active substances (Patent RU2613491). A mixture of carbohydrates – glucose, fructose, sucrose in their ratio specific to natural honey is used as an additive to produce a dry powdery crystalline honey product with a moisture content of 4-6 %, excluding the stage of additional moisture removal.

A specialized food product that contributes to the protection, nutrition and restoration of elements of the musculoskeletal system, prevention and additional treatment of disorders and diseases of the musculoskeletal system of athletes is patented by ZAO "Academiya-T" (Patent RU2463811). It contains collagen hydrolysate, such minerals as finely ground calcium phosphate coated with soy lecithin, magnesium, manganese, copper, glucosamine sulfate, biologically active milk proteins, chondroitin sulfate, and such vitamins as ascorbic acid, pyridoxine, biotin, tocopherol, calciferol.

Voronezh State University of engineering technologies for sports nutrition has patented a method for producing protein snacks (Patent RU2642465). According to this method, whey powder is used as a protein raw material. The snack is developed on the basis of whey protein without adding the fat components, which increases the protein content.

OOO "Makaron-Sevris" has proposed an invention for sports nutrition, which represents a composition of egg substitute and egg powder, including carbohydrates, thickener, lecithin, salt, food coloring and flavoring (Patent RU2536135). As a source of carbohydrates, a mixture of corn starch with acetylated distarch phosphate was used, a mixture of Kappa-Carrageenan with pectin was used as a thickener, Riboflavin – as a food dye, and "egg" flavoring – as a flavoring agent.

OOO "Giprobiosintez" has patented biologically active additive of protective effect. The additive is a denuclearized bacterial biomass of the strain of methane-oxidizing bacteria – *Methylococcus capsulatus* GBS-15 (Patent RU2681791). The invention is aimed at increasing the functional reserves of the organism, increasing its resistance to stress, and most importantly – the rapid recovery of the athletes and their mental and emotional state. The research has shown that the use of a protein product (working name "Drimfud" or "Dream food") contributes to improving the functional state of athletes-wrestlers.

Moscow State University of Food Production has patented crystal sugar for sports nutrition (Patent RU2560984). Sugar contains iron, zinc, manganese, copper, selenium, chromium, and fluorine. Sugar, enriched with mineral micronutrients that are justified in the proposed invention, helps to protect the body of athletes from the undesirable effects of intense exercise, ensure its recovery, maintain athletic and physical shape.

Another patent of the above university for sports nutrition proposed a chocolate composition named "Shokosport" (Patent RU2529155), which contains cocoa mass and cocoa butter, dry whey concentrate, L-carnitine, creatine and isomaltulose and contributes to the effective generation of bioenergy, mobilizing the internal resources of the body, primarily due to fat reserves.

For sports nutrition, carbohydrate bar containing a carbohydrate fraction, glucose and fructose has been patented (Patent RU2466549).

For athletes and people engaged in sports, the Finnish company "Valio Ltd." has patented in Russia a food product based on whey protein. It has a protein-to-casein ratio of 25: 75 - 50: 50, a protein content of about 20 % by dry matter, and a protein content of 2.5 % - 8 % of the total weight of the product (Patent RU2607382).

According to the analysis, on the one hand, Russia is currently paying more attention to a healthy lifestyle using health-promoting technologies and healthy functional nutrition, including sports nutrition. On the other hand, the markets are dominated by imported sports food products, with Russian producers being poorly represented in foreign markets. Ivantsova in her paper (2019) expressed a tough opinion about the state of the Russian sports nutrition market, due to the following reason: producers of sports nutrition and supplements are dominated by foreign companies on this market, and all raw materials for the production of sports nutrition are of foreign origin.

One of the important factors for this situation is that Russian researchers, developers and producers of sports nutrition do not pay adequate attention to the production of patentable intellectual property objects and protecting the results of their intellectual activity. All this necessitated the analysis of the state of research and development of new intellectual property, patenting inventions and utility models in the field of functional sports nutrition, the results of which are presented in this paper.

The key factor of the scientifically-based organization of the training and competition process and the recovery of athletes of various sports, ages, residence and improvement of the effectiveness of this process is the use of competent nutrition strategies. The strategy of rationally organized nutrition in the process of purposeful long-term training of athletes, tailored to specific sports, athletes' age, stages of training and competitive process and regional characteristics of the areas where training and competition take place, is necessary to implement a whole range of tasks. Currently, the development of a strategy for rationally organized nutrition of athletes is a serious element of strategies that is currently being actively implemented for high-quality and health-promoting nutrition to ensure a healthy lifestyle of the population living and working in various regions of the country.

The conducted analysis helped to define the main areas of patenting intellectual property objects in the field of new competitive domestic food products for sports nutrition at all stages of the training and competition process, aimed at achieving high sports results and their recovery for subsequent training and competition cycles.

It is established that the largest number of patented inventions and utility models are accounted for universities (Amur State University, Voronezh State University of Engineering Technologies, Kemerovo State University, Ogarev Mordovia State University, Moscow State University of Food Production, Petrozavodsk State University) and research organizations (All-Russian Research Institute of Starch Products, Research Institute of the Baking Industry, Nizhny Novgorod Research Institute of Hygiene and Occupational Pathology). Intellectual property objects related to sports nutrition are also patented by innovative enterprises (OOO "Academiya-T", OOO "Giprobiosintez", OOO "Zdorovye", OOO "Mobilny Doctor"), as well as by individual authors. Entrance to the market of intellectual property of the Finnish company "Valio Ltd." deserves a special notice.

The results of the research helped to build a knowledge base on Russian patents for inventions and utility models in the development of functional foods for sports nutrition. This knowledge base can be used by researchers, developers and producers when selecting analogues and prototypes for the development and patenting of new intellectual property objects.

V. CONCLUSION

The conducted work develops the research in the field of scientifically-based formation of cross-cutting strategies and technologies for procurement and transportation of agricultural food raw materials and production of functional foods. Among these strategies and technologies, the development and implementation of functional foods for athletes and people engaged in intensive physical labor, including under the adverse conditions of the North and the Arctic, should now occupy an important place in research. The conducted research helped to reveal that on the one hand, Russia is currently increasing attention to a healthy lifestyle using health-promoting technologies and healthy functional nutrition, including sports nutrition. On the other hand, despite serious scientific research in this area, the markets for sports nutrition are dominated by imported food products, while Russian producers of such products are poorly represented in foreign markets. One of the important reasons for this situation is that Russian researchers, developers and producers of sports nutrition give little attention to creating patentable intellectual property objects and protecting the results of their intellectual activity.

It can be concluded that the use of competent nutrition strategies is the key factor of the scientifically-based organization of the training and competition process and the recovery of athletes of various sports, ages, residence, and improvement of the effectiveness of this process.

The conducted study provided the assessment of the research and areas of development of new intellectual property objects, utility model patenting in the field of functional sports nutrition. Universities, scientific organizations and individuals who are patenting intellectual property objects developed by them have been identified, giving a special notice to the entrance of intellectual property of foreign companies to the market.

The analysis revealed the need to increase the attention of researchers, developers and producers of functional sports food products to improvement of the competitiveness of their products by paying special attention to patenting intellectual property objects created by them and protecting the results of their intellectual activity.

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The knowledge base on Russian utility model patents related to functional foods for sports nutrition that was built during the research can be used by researchers, developers and producers when selecting analogues and prototypes for the development and patenting of new intellectual property objects.

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