



Nutrition Review Article

Assessment of a Novel Bioflavonoids and Phytonutrient Formulation in Enhancing Cellular Aerobic Glycolysis, Immunity, Sports Performance, and Mitigating Inflammation

Bernard W Downs¹, Samudra P. Banik², Manashi Bagchi³, Bruce S. Morrison⁴, Matt Piacentino⁵, Steve W. Kushner⁶, Debasis Bagchi⁷

¹Department of R and D, VNI Inc., Bonita Springs, Florida, United States, ²Department of Microbiology, Maulana Azad College, Kolkata, West Bengal, India, ³Department of R and D, Dr. Herbs LLC, Concord, California, United States, ⁴Department of R and D, Morrison Family and Sports Medicine, Huntingdon Valley, Pennsylvania, United States, ⁵Department of R and D, MP Sports Performance, Lansdale, Pennsylvania, United States, ⁶Department of R and D, ALM R and D, Oldsmar, Florida, United States, ⁷Department of Pharmaceutical Sciences, College of Pharmacy and Health Sciences, Texas Southern University, Houston, Texas, United States.



***Corresponding author:**

Debasis Bagchi,
College of Pharmacy and
Health Sciences, Texas
Southern University, Houston,
Texas, United States.

debasisbagchi@gmail.com

Received : 15 June 2021

Accepted : 11 July 2021

Published : 08 November 2021

DOI

10.25259/AJBPS_4_2021

Quick Response Code:



ABSTRACT

Metabolic competence in conjunction with well-balanced nutritional support is extremely important for normal biochemical and physiological functions, as well as for enhanced athletic performance. Research-affirmed nutraceuticals enriched in structurally diverse phytonutrients including bioflavonoids may help to boost athletic, functional, and biophysiological competence. Occurrence of chronic degenerative disorders is associated with an increase in anaerobic events, namely, the inability to effectively use oxygen and water, and inability to use nutrients for cellular energy production and management, metabolic homeostasis, and waste removal. Earlier clinical studies in our laboratories using the WADA compliant bioflavonoid-enriched Prodosomed VMP35 Multinutrient Complex (“Prodovite”) demonstrated that it boosted aerobic metabolic competence and provided protection against diverse chronic degenerative anaerobic disorders. We hypothesized that Prodosomed VMP35 may serve as a novel supplement to boost athletic performance. The objective of the study was to conduct selected focused pilot studies to demonstrate the efficacy of a WADA compliant Prodosomed VMP35 to improve athletic competence and performance in a variety of sports activities. The efficacy of VMP35 was assessed in different models of sports performance/athletic competence including power lifting, resistance training, cycling, and selected case studies. VMP35 supplementation restored aerobic metabolic events, minimized oxidative stress, and improved athletic performance, recovery, and immune competence. These pilot clinical studies demonstrate that iron-free VMP35 restores aerobic metabolism by restoring iron-dependent hemoglobin to red blood cells, bolstering neutrophils in the blood (immune support), and significantly improving performance output in a diverse range of athletic activities.

Keywords: VMP35, Bioflavonoids, Prodosome®, Aerobic Metabolism, Athletic performance, Power Lifters, cyclists, Athletes, Case studies

This is an open-access article distributed under the terms of the Creative Commons Attribution-Non Commercial-Share Alike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as the author is credited and the new creations are licensed under the identical terms.

©2021 Published by Scientific Scholar on behalf of American Journal of Biopharmacy and Pharmaceutical Sciences

INTRODUCTION

An ideal sports nutrition formulation can be designed by applying a novel nutrition strategy to boost physical activity; tissue, blood, and cellular oxygenation and hydration; and facilitate the repair, regrowth, and rebuilding of damaged tissues for optimal functioning.^[1-3] Such a formulation should supplement fuel to the muscles and optimize athletic performance; boost endurance, vitality, and vigor; as well as promote overall health and wellness.^[1,4] The term “athlete” refers to a person who is proficient in sports and other forms of physical exercise; that is, an individual that engages in more intense exercise activities than a casual manner; including more extreme amateur and professional individuals.^[1,2,5] A great deal of differences exists in specific nutrient requirements for diverse athletes, restructuring and revitalizing the exciting challenge of individualizing sports nutrition plans. Thus, proper nutrition concepts and strategies are required by intertwining the understanding of physical training and dietary requirements, which are interdependent on each other, to produce optimal performance for diverse amateur and professional athletes in a wide range of sports or fitness endeavors.^[5-8] It is important to provide a solid nutritional foundation along with additional nutritional customization strategies specific for individual athletes participating in a particular sport, exercise, or physical activity. To keep up with the specific physical requirements of diverse sports, athletes need to fuel their bodies adequately on a regular basis. However, this fueling procedure, in conjunction with regular physical activities, requires a strategic and specialized approach, and accordingly, sports nutrition and exercise trainers are required to develop individualized plans based on the specific requirements of the athlete.^[5-8]

A human body requires six essential nutrients, namely, carbohydrates, proteins, fats, vitamins, minerals, and water to boost energy, contributing to the growth, repair, regulation, revitalizing and optimization of gene expression, cellular and tissue functions, metabolic homeostasis, and prevention of degenerative diseases.^[1,2,4] However, it is quite impossible to derive all the essential nutrients from diet alone. Macronutrients including carbohydrates, proteins, and fats have a caloric value, which are essential in larger quantities, while micronutrients including vitamins, antioxidants, and essential minerals are required in comparatively smaller amounts.^[1,2,4] To maintain metabolic homeostasis, carbohydrate, proteins, and fats release energy during metabolic events in the cellular system that breaks down the ingested foods into their molecular components, carbon dioxide, and water. However, part of this energy is conserved and utilized to produce adenosine triphosphate, the direct source of cellular energy; the remaining “unused” portions are “wasted” as heat.^[1,2,5-7]

Major minerals including calcium, sodium, potassium, chloride, phosphorus, magnesium, and sulfur, and trace minerals such as iron, zinc, copper, selenium, iodine, fluoride, molybdenum, and manganese are required daily.^[1,8-10] However, water or cellular hydration, essential for cellular biochemical transactions, falls into its own unique category, and its requirements greatly vary among individuals. Several nutrients/supplements are available, which are well established to retain and maintain hydration status.^[1,9-11]

In athletes, hydration is important for temperature control, lubrication of joints and tissues, transportation of nutrients to different cellular sites, and providing an aqueous environment to facilitate biochemical reactions.^[10-12] In addition, appropriate oxygenation of tissues and organs is essential for normal biochemical and physiological functions.^[12,13]

Proper integration of all these elements is essential to promote optimal exercise performance and recovery after exercise. Dietary sources of bioflavonoids and antioxidants are even more important to strengthen connective tissues and assist in the reduction of oxidative stress, damage, and inflammatory sequelae.^[14-17]

Our earlier research studies emphasized the clinical efficacy of a patent pending VMP35 Multinutrient Complex (“ProdoVite”), a bioflavonoid-based phytochemical formulation rich in structurally diverse bioflavonoids, polyphenols, stilbenes, nutritionally valuable saccharides (and phenolic glycosides), etc. [Table 1]. This iron-free liquid formulation is valuable for antioxidant protection, immune support, blood and tissue oxygenation, and hydration to boost sports performance, endurance, vitality, and vigor. A diverse range of water-extracted nano-emulsified VMP35 phytonutrient ingredients fortified with vitamins and minerals is encapsulated in a complex concentric configuration of proprietary SK713 SLP multi-lamellar phospholipid envelopes (Prodosomes) to yield a highly stable and rapidly bioavailable formulation. This patent pending iron-free formulation was shown to be absorbed and bioavailable within 5 min, rapidly restoring iron-dependent hemoglobin (Hb) (and its oxygen-carrying capabilities) and cellular hydration.^[18-21]

MANUFACTURING TECHNOLOGY: NOVEL VMP35 MNC FORMULATION

The Prodosome-fortified liquid nutraceutical formulation is manufactured by incorporating a novel proprietary SK713 SLP multi-lamellar clustoidal non-GMO phospholipid Prodosome nutrient absorption/delivery technology, which is biodegradable and biocompatible, in a multistep cGMP and NSF-certified manufacturing facility. The first step involves manufacturing the SK713 SLP, which was performed using

Table 1: Phytonutrients, vitamins, and micro and macronutrients, in novel VMP35 formulation.

Major VMP35 constituents	Ingredients	Chemical constituents	Physiological benefits
Phytonutrients ^[18-21]	<p><i>Astragalus membranaceus</i> (Fabaceae)</p> <p><i>Polygonum multiflorum</i> (Asparagaceae)</p> <p>Fo-Ti</p> <p><i>Camellia sinensis</i> (Theaceae)</p> <p><i>Matricaria chamomilla</i> (Asteraceae)</p> <p><i>Rosa canina</i> (Rosaceae)</p> <p><i>Eleutherococcus senticosus</i> (Araliaceae)</p> <p><i>Crataegus oxyacantha</i> (Rosaceae)</p> <p><i>Centella asiatica</i> (Apiaceae)</p> <p><i>Zingiber officinale</i> (Zingiberaceae)</p> <p><i>Sambucus nigra</i> (Adoxaceae)</p> <p>Organic BiAloe® DSR0114</p> <p>Aloe barbadensis (inner leaf water extracted freeze-dried gel powder)</p> <p>Pinus sylvestris LPC 108</p> <p>Proligna® Freeze Dried Scotch Pine Cone freeze dried powder</p>	<p>Structurally diverse polyphenols including catechins,</p> <p>(-)-epigallocatechin gallate, flavonoids, isoflavan glycosides, oligomeric proanthocyanidins, and polyacetylenes, citrus bioflavonoids, triterpenoids, and phytosterols, glycosides, triterpene acids, and phenolic acids, chlorogenic acid, triterpenoids, triterpenoid glycosides, stilbenes, saponins, phytosaccharides, amino acids and alkaloids, and quinones, sesquiterpenes, polyacetylenes, Vitamin K, Mg₂₊, Ca₂₊, K⁺, Na⁺, gingerols, shogaols, and paradols, acemannan (acetylated mannans, monoacetyl mannose polymers with β-[1,4]-D-linkage) polyphenylpropanoid polysaccharide complex</p>	<p>Adaptogen, antioxidant, immune enhancer, anti-aging, anti-inflammatory, cardioprotectant, neuroprotectant, enhances cognition and mood alleviator, regulate metabolic homeostasis, energy metabolism, regeneration and revitalization of tissue, inhibits anaerobic events and organisms, helps protect DNA and prevent cell mutations, supports proper blood lipid levels, healthy blood sugar, and protects the structure of cells in the endothelium, reducing scarring, fortify muscles, reduces muscle damage and delayed onset to muscle soreness, overall sports performance, enhance detoxification, anti-photoaging and autophagy, repair, restructure, regenerate, re-vitalize and rebuild tissues, reduces tissue fragility and promotes connective tissue repair, improves muscle tone, reduces the potential for spasms, improves connective tissue strength, calming and stress relieving, promotes restful restorative sleep, promotes joint health and function, enhances endurance, boosts stamina and energy, strengthens bones, reduces fatigue, promotes cardiovascular functions, supports digestion, reduces fatigue, strengthen adrenals, exerts calming effect and support restful sleep, promotes blood circulation, digestive health, promotes improved tissue structural strength and functional competence, protecting against viral insult, allergic vulnerability and damage from trauma, supports respiratory health, protect against viral insult, promotes aerobic cellular metabolism creating an adverse environment for anaerobes, that is, yeasts, parasites, as well as aerobic cellular environment to protect DNA and promote normal cell structure and function, preventing cell mutations.</p> <p>Promotes ocular health and vision, cellular integrity, cell metabolism, growth and viability of red blood cells, cardiovascular health, neuronal functions, metabolism and digestive health, hormones and normal cholesterol production, bone growth and integrity, organize and restructure the osteoblast and osteoclast cells, dermal health, reproductive</p>
Vitamins ^[18-21]	Vitamins A, B Complex, C, D, and E	Vitamin A (retinyl palmitate), Vitamin B complex (Vitamin B1 thiamin hydrochloride, Vitamin B2 riboflavin, Vitamin B3 niacin, niacinamide, Vitamin B5 pantothenic acid, d-calcium	

(Contd...)

Table 1: (Continued).

Major VMP35 constituents	Ingredients	Chemical constituents	Physiological benefits
		pantothenate, vitamin B6 pyridoxine hydrochloride, Vitamin B7 biotin, Vitamin B9 Origen-FA, food-form folate organic orange peel, Vitamin B12 cyanocobalamin, Vitamin C ascorbic acid, Vitamin D cholecalciferol, and Vitamin E alpha-tocopheryl succinate	health, wound healing, energy levels, muscle strength and tones, exercise performance, help women during pregnancy, immune competence, synthesis of collagen, formation of elastin and connective tissues, skins, cartilage, bones and tendons, metabolic health and well-being, work synergistically with carnitine for diverse biochemical functions, protects mucosal barriers in the lungs, eyes, gut and genitals from infections, and inflammatory pathologies, normalizes healthy blood pressure, boosts energy, mood, and mental clarity, promotes healthy glucose, classic regulator of plasma calcium concentration and skeleton mineralization, prevents hardening of arteries, and diverse environmental stressors including UV radiation, cigarette smoke, and environmental pollutants
Macro and Micronutrients ^[18-21]	Calcium, Iodine, Selenium, Potassium, Copper, Magnesium, Chromium (III), Potassium, Zinc	Calcium lactate, potassium iodide, sodium selenite, copper gluconate, magnesium lactate, chromium (III) chloride, potassium citrate, zinc sulfate	Strengthens bones and teeth, mobilizes skeletal muscle, boosts muscle performances including muscle contraction, functioning and relaxation, stabilizes blood pressure, acts as a pH buffer in the ion pool, promotes disinfections in brain and other tissues, promotes cardiovascular functions, immune competence, anti-inflammatory, and thyroid health, boosts metabolism and energy, enhances neuronal development during pregnancy, neuronal functions, scavenges oxygen-free radicals, reduces DNA damage, prevents cellular injury and neuronal injuries, promotes cellular respiration and antioxidant defense, enhances production of red blood cells, maintains neuronal health and neurotransmitter functions, helps synthesizing collagen, promotes energy homeostasis, builds and repairs connective tissues, promotes bone and dental health, boosts glucose and lipid metabolism, enhances insulin sensitivity, promotes lean body mass, boosts metabolism and lipid, fat and carbohydrate metabolism, lowers blood cholesterol, metabolizes sugar, maintains structural integrity, acts as a membrane stabilizer, boosts sexual competence and reproductive health, and promotes wound healing.

a minimum of 85% non-GMO phosphatidylcholine, and subsequently impregnated and saturated the phospholipids with solar-dried electrolytes to ensure the enhanced availability of free ions, which will amplify the ionic properties of the multi-lamellar clustoidal phospholipid

spheres, resulting in a net negative charge. The second step consists of thorough blending of a combination of research-affirmed botanicals containing structurally diverse natural polyphenolic antioxidants, multivitamins, micro- and macronutrients, and naturally occurring phytonutrients,

utilizing an advanced wet milling technology to create a nano-emulsion. The final step consists of a combination of a specific blending sequence and an encapsulation technology to obtain the patent pending multi-lamellar energetically fortified clustoidal “Prodosomal” liposome-type encapsulated supplement (VMP35 Prodivite®).^[18-22]

Concept validation study

A concept validation open-label pilot study was conducted using VMP35 in conjunction with L-Lysine in a small population of volunteers infected with various herpetic infections including HSV-1, HSV-2, and cytomegalovirus. This investigation exhibited promising and favorable efficacy, as demonstrated by reductions in symptoms,^[23] which justified and motivated us to conduct further research studies in human volunteers.

A randomized controlled one-way crossover clinical investigation

A randomized controlled one-way crossover study was performed in a total of 38 male and female subjects (male: 11 subjects; female: 27 subjects; age: 22–82 years) to assess the clinical efficacy of an iron-free VMP35 MNC (1 oz dose) on blood oxygenation and hydration in the treatment group as compared to the water-control subjects at baseline (0 min), 5 min, and 30 min post-treatment, respectively. An Institutional Review Board approval was obtained (Path Foundation in New York, NY [#13-009 April 25, 2013]) and all subjects signed an informed consent form. Adverse event monitoring was strictly enforced.

This study evaluated the absorption rate of the iron-free VMP35 and its effects by assessing the changes in peripheral blood smears from baseline (0 min), incorporating live blood cell imaging using phase contrast microscopy (Olympus BX-30 light microscope equipped with a phase contrast condenser [Tokyo, Japan] in conjunction with a 150 W lightbox and fiber-optic cable assembly) at 5 min post-control and post-VMP35 intake and 30 min post-VMP35 intake, respectively. It is important to indicate that the lens configuration was adjusted using a $\times 10$ eyepiece and $\times 100$ oil immersion objective magnification to approximate a $\times 1000$. Specifically, the lighting generated a superior level of cell definition, brightness, and clearly showed the presence, morphology, and rheology of RBCs and neutrophils in the blood.

Significant efficacy of the iron-free VMP35 was observed on hemoglobinization, blood oxygenation, hydration, and neutrophil morphology at 5 and 30 min evaluations following VMP35 intake, respectively [Figures 1-3]. In fact, VMP35 instantly enhanced the morphological, hematological, and rheological properties of live human blood, which indicates

that the iron-free VMP35 produced adequate nutritional benefits to restore intracellular iron-dependent RBC Hb within 5 min of intake, which was further sustained for an extended period. In addition, neutrophils demonstrated

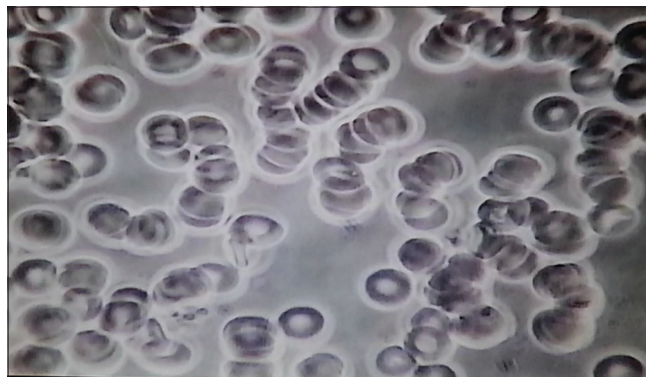


Figure 1: A representative baseline live blood cell imaging before consuming water.

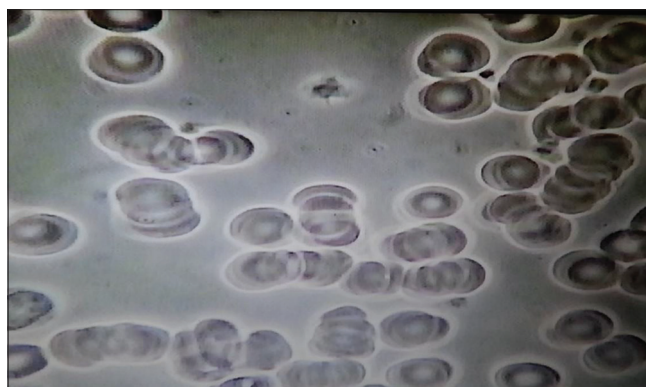


Figure 2: A representative live blood cell imaging of the same subject 5 min after consuming water.

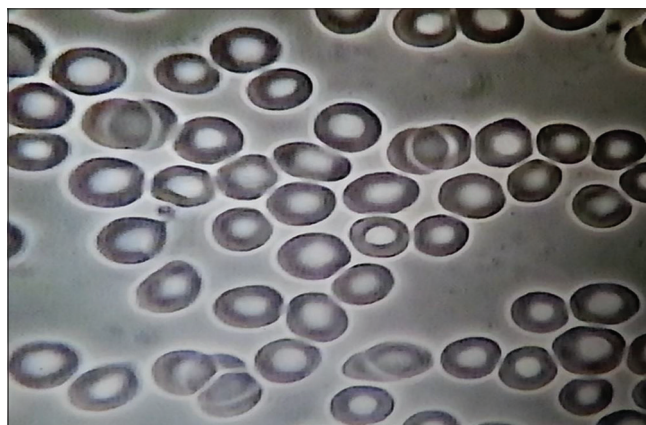


Figure 3: A representative live blood cell imaging of the same subject 30 min after VMP35 consumption.

dramatic improvement in numbers and morphology. No adverse events were observed.

An additional athletic case study and two concept validation pilot studies have been conducted in a diverse population of well-trained athletes to assess and confirm the effects of the World Anti-Doping Association (“WADA”) compliant iron-free VMP35 on athletic performance.

ATHLETIC CASE STUDY IN A POWER LIFTER

This case study was undertaken by researchers and an extreme athlete (power lifter) to test the hypothesis that improving properties of the blood (i.e. oxygenation, hemoglobinization, hydration, energy enhancement, and immunity) could improve athletic performance. The athlete signed an affidavit regarding the results of the power lifting experiment. He has used a very extensive supplement regimen to support his intense power lifting workouts over the previous 12 months of serious strength training. His personal best in squat weightlifting was 395 lbs. He was attempting to achieve a new personal record of 405 lbs. Before supplementing with VMP35, to ensure his system was totally clean from any supplement influence, he did a 6-week washout and stopped taking the 20 other supplements his research indicated that he should be using up to that time.

Shortly before starting an intense powerlifting workout session, he took 1 ounce of iron-free liquid VMP35, swishing it in his mouth 30 s before swallowing. He also added 1 ounce of VMP35 to his regular workout beverage and sipped on it between his sets of squats, swishing it each time briefly before swallowing. He ended his first workout session by achieving a squat lift of 515 lbs! (Contrary to peer warnings, the following day he had no muscle pain). In the following 2 weeks, with continued use of the WADA compliant VMP35 as previously indicated, he continued to experience strength increases in squat training exercises ranging from 545 lbs to 575 lbs; a 180 lb increase over the 395 lb personal best at baseline.

A CONCEPT VALIDATION PILOT INVESTIGATION

To confirm the validity of the previous athletic case study, we conducted a 15-day concept validation pilot clinical investigation in three healthy young male high-level resistance-trained athletes (age: 32–36 years), on the effects of VMP35 on athletic performance. Duly signed informed consent forms were obtained from the study participants. Regulatory approvals were obtained, and adverse events were critically monitored. The daily dose was 1 ounce BID and swished in mouth for 30 s before swallowing. The first dose was about 20–30 min before engaging in a rigorous exercise regimen. The second dose was consumed in the afternoon.

Over the course of the 15-day study, the most significant improvements were experienced within the first 2 days.

Case #1

Before VMP35 supplementation, the first subject (male 36 years old) was struggling with 270 lbs for 4 reps on the Hack Squat. After VMP35 supplementation, subject achieved 270 lbs for 10 reps; rested, then the very next set increased to 320 lbs for 10 reps. The third and final set of that exercise, he increased the weight again to 360 lbs for 8 reps.

Furthermore, another increase in strength was experienced in banded hammer strength incline press. Pre-VMP35, subject was doing 180 lbs for 10 reps, which, after taking the VMP35, was increased to 230 lbs for 10 reps. Moreover, following VMP35 supplementation, respiratory capacity significantly increased.

Case #2

On the banded reverse hack squat, Subject #2 (male, 32 years old) experienced a significant increase in strength. Pre-VMP35, he achieved a weight of 160 lbs for one set of 8 reps. Post-VMP35 intake, he increased to 180 lbs for 2 sets of 10 reps.

On the Hammer Strength banded incline chest press, pre-VMP35, subject’s working weight sets were 160 lbs. Post-VMP35, his sets increased to 180 lbs. On side lateral dumbbell raises, subject’s working weight increased from 20 lbs pre-VMP35 to 25 lbs post-VMP35.

Case #3

Pre-VMP35 supplementation, the basic squat result for Subject #3 (male, 36 years old), was 405 lbs for 10 reps. Post-VMP35, his squat weight increased significantly to 455 for 6 reps. He experienced an increase in muscle mass after the 15 days of VMP35 supplementation: A shorter recovery time between sets and after workout. Over the course of the 15-day study, Subject #3 also reported enhanced sleep quality, increased appetite, and consistently increased overall energy levels.

ATHLETIC CYCLISTS CASE STUDY

We also did a pilot study evaluating the effects of VMP35 in trained cyclists to confirm the beneficial effects across a range of athletic endeavors.

A 47-year-old male cyclist consumed 1 oz bid of VMP35 for 2 consecutive weeks. His power output (W) improved from 317 to 325.5 (a 2.7% increase), and his heart rate increased by only 1%.

In another 52-year-old male cyclist who consumed 1 oz bid of VMP35 for 2 consecutive weeks, power output (W) improved

from 225 to 241.5 (7.3% increase), while the heart rate decreased by 0.3%, demonstrating increased cardiovascular strength and output.

In another 39-year-old male cyclist who consumed 1 oz bid of VMP35 for 2 consecutive weeks, his power output (W) improved from 262 to 286.5 (9.4% increase), while the heart rate increased by only 1.4%.

These effects of VMP35 supplementation in male cyclists are shown in Table 2.

Subjects reported that increased performance results also increased their enthusiasm levels significantly. No adverse events were reported by these well-trained athletic cyclists. It is evident that the power output (W) increased quite a bit, while the heart rate (beats per minute) increased only slightly in two of the subjects and decreased slightly in one subject that also experienced an increase in power output.

Individual case study reports

All case study reports obtained necessary permission from both the patients and supervising physicians.

Case study #1 (An anemic stroke patient)

A 56-year-old Caucasian male stroke patient (Norwich, NY) suffering from cerebral ischemia and anemia with an extremely low Hb level of 2.8 gm/dL consumed 2–3 oz of VMP35/day over a period of 6 consecutive months. Following VMP35 supplementation over the 6-month period, Hb levels increased to 15.6 g/dL, while significant increases were observed in other parameters including RBCs to 5.01, hematocrit to 45.9, platelet count to 202, and RDW to 12.9. An evaluation of brain MRI exhibited no signs of brain infarction, and a magnetic resonance angiogram showed no signs of occlusion or hemodynamically significant stenosis of major intercranial arteries. These results strengthen the notion that VMP35 can enhance hematological properties.

Case study #2 (A motorcycle accident victim)

A 33-year-old male subject (Lititz, PA) was the victim of a motorcycle accident with a car collision on October 10,

2018. He was air-lifted and admitted to the ICU of Jefferson University Hospital (Phila., PA) with life-threatening injuries, such as profuse bleeding between the lungs and chest wall, collapsed lung, flail chest (i.e. two or more contiguous rib fractures with two or more breaks per rib – one of the most serious chest injuries often associated with considerable morbidity and mortality), fracture in the left acetabulum (i.e. the socket of the hipbone into which the head of the femur fits), and weakness. Clear signs of blood loss-induced anemia were evident from the hematological counts including hematocrit and Hb levels; and he had dangerously altered platelet, RBC, and white blood cell counts. Subject received 5 pints of plasma infusion shortly after admission to the ICU. It was initially determined that the subject's injuries were too severe and his health too fragile to undergo corrective surgery. Subject was put on a ventilator and unable to consume food or beverages by mouth; the family was contacted due to the critical nature of the injuries. Two days after hospital admission, the liquid VMP35 was applied topically to each foot (top and bottom) to achieve transdermal absorption. The subject began to respond and on the 3rd day following admission was able to take the VMP35 orally. Subject received 6 oz of VMP35/day. Two days after beginning the oral VMP35 supplementation, subjects blood properties were in the normal range, gaining approval from physicians to undergo extensive surgical procedures. Subject started consuming 6 ounces of VMP35 per day from October 13 (3 days after admission into the Jefferson ICU) until October 25 the day the subject was released from hospital. He subsequently continued taking 4 ounces of VMP35 per day until January 31, 2019, and later continued taking a maintenance dose of 2 ounces/day. Along with physical therapy, he continued the daily intake of the VMP35. The recovery process was predicted by physicians and physical therapists to be extremely slow and his ability to walk would require crutches and subsequently a cane for assistance until late spring to early summer of 2019.

However, VMP35 significantly accelerated recovery far beyond medical predictions for regaining vitality and optimal functional capabilities. Moreover, both hematocrit and Hb levels remarkably improved including extensive repair of damaged blood vessels and injured tissues. Furthermore, platelet count was normalized. By early March 2019 (a little

Table 2: Effect of 2 weeks of oral supplementation of VMP35 formulation to male athlete cyclists.

Athlete (Age)	Heart rate (BPM)		% increase	Power output (W)		% increase	Mental clarity	Overall health	Adverse event
	Initial	Final		Initial	Final				
#1 (47 Y)	147.5	149	1%	317	325.5	2.7%	Focus enhanced	Good	None
#2 (52 Y)	168.5	168	-0.3%	225	241.5	7.3%	Focus enhanced	Good	None
#3 (39 Y)	183	185.5	1.4%	262	286.5	9.4%	Focus enhanced	Good	None

BPM: Beats per minute; W: Watts

over 4 months from surgery), the subject was able to walk without any mechanical assistance and resumed playing a rigorous game of ice hockey.

DISCUSSION

Both people with serious health problems and extreme athletes have in common a need for increased nutritional support to provide nourishment for greater than routine health maintenance. Food sources for the masses include those provided by conventional agribusiness practices (i.e. using chemical fertilizers, pesticides, herbicides, fungicides, growth enhancers, GMO, gassing, irradiation, coloring agents, etc.), food processing (including blanching, preservatives, flavor enhancers, functional food additives, food colorings, etc.), snack food products, and fast food outlets.^[24-26] Food stuffs from these sources are not only generally inadequate to meet the special and increased metabolic needs of these special populations but also are to some extent implicated as a cause of nutritional inadequacies and chemical/toxic insults underlying the shortfalls in both health and enhanced physical performance needs.^[27,28] Dietary supplementation is becoming increasingly commonplace to augment the dietary practices and meet nutrition requirements to achieve even the minimal functional competence of human biology.^[29-33] It is practically mandatory that people with injuries or chronic disorders and people who engage in more advanced and/or extreme athletic activities increase their nutritional resources through consuming various dietary supplements.^[29-31] The primary etiological factor underlying chronic degenerative diseases is the increase in anaerobic events and pathologies; that is, the inability to effectively use oxygen and water, and therefore nutrients, for cellular energy production, management, and waste removal.^[18-21] Anaerobic pathologies are the consequence of an overburdened pH buffering capability and generate a significant increase in reactive oxygen species (ROS). Given this, in addition to making healthier food choices, supplementation should include ingredients/products that restore aerobic metabolic events, minimizing free radical generation, and provide additional antioxidants to neutralize ROS as well.^[29,32,33]

CONCLUSION

Clinical research, case studies, and concept validation pilot studies have demonstrated that a WADA compliant iron-free liquid VMP35 dietary supplement supplies an abundant reservoir of pH buffers to restore aerobic metabolism by restoring iron-dependent Hb to RBCs, bolstering neutrophils, and improving performance output in a diverse range of extreme athletes. VMP35 provides a highly bioavailable source of vitamins, macro and trace minerals, ions, phospholipids, and botanicals containing a wide range of flavonoids, stilbenes, alkaloids, quinones,

phytosaccharides, glycosides, sesquiterpenes, coumarins, polyacetylenes, and carotenoids. Overall, these data strengthen the antioxidant and physiological benefits of structurally diverse phytonutrients in VMP35 to achieve overall health maintenance for metabolic competence and athletic performance.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent.

Financial support and sponsorship

Nil.

Conflicts of interest

BW Downs is an employee of Victory Nutrition Inc., USA; Drs. D. Bagchi and M. Bagchi, and S Kushner are independent consultants; M. Piacentino is an independent Sports Nutritionist; Dr. BS Morrison is an independent physician and a renowned practitioner in sports medicine.

REFERENCES

1. Bagchi D, Nair S, Sen CK, editors. Nutrition and Enhanced Sports Performance: Muscle Building, Endurance, and Strength. 2nd ed. Amsterdam, Boston, United States: Elsevier, Academic Press; 2018. p. 3-47.
2. Datta S, Bagchi D, editors. Extreme and Rare Sports: Performance Demands, Drivers, Functional Foods, and Nutrition. Boca Raton, FL, United States: CRC Press, Taylor and Francis; 2019. p. 73-175.
3. Kerkick CM, Wilborn CD, Roberts MD, Smith-Ryan A, Kleiner SM, Jager R, et al. ISSN exercise and sports nutrition review update: Research and recommendations. J Int Soc Sports Nutr 2018;15:38.
4. Mujika I, Halson S, Burke LM, Balagué G, Farrow D. An integrated, multifactorial approach to periodization for optimal performance in individual and team sports. Int J Sports Physiol Perform 2018;13:538-61.
5. Terjung RL, Clarkson P, Eichner ER, Greenhaff PL, Hespel PJ, Israel RG, et al. American college of sports medicine roundtable. The physiological and health effects of oral creatine supplementation. Med Sci Sports Exerc 2000;32:706-17.
6. Thomas DT, Erdman KA, Burke LM. American college of sports medicine joint position statement. Nutrition and athletic performance. Med Sci Sports Exerc 2016;48:543-68.
7. American Dietetic Association, Dietitians of Canada, American College of Sports Medicine, Rodriguez NR, di Marco NM, Langley S. American college of sports medicine position stand. Nutrition and athletic performance. Med Sci Sports Exerc 2009;41:709-31.
8. Thomas DT, Erdman KA, Burke LM. Position of the academy of nutrition and dietetics, dietitians of Canada, and the American college of sports medicine: Nutrition and athletic

- performance. *J Acad Nutr Diet* 2016;116:501-28.
9. van Dronkelaar C, van Velzen A, Abdelrazek M, van der Steen A, Weijs PJ, Tieland M. Minerals and sarcopenia; the role of calcium, iron, magnesium, phosphorus, potassium, selenium, sodium, and zinc on muscle mass, muscle strength, and physical performance in older adults: A systematic review. *J Am Med Dir Assoc* 2018;19:6-11.e3.
 10. Lukaski HC. Vitamin and mineral status: Effects on physical performance. *Nutrition* 2004;20:632-44.
 11. Liska D, Mah E, Brisbois T, Barrios PL, Baker LB, Spriet LL. Narrative review of hydration and selected health outcomes in the general population. *Nutrients* 2019;11:70.
 12. von Duvillard SP, Braun WA, Markofski M, Beneke R, Leithäuser R. Fluids and hydration in prolonged endurance performance. *Nutrition* 2004;20:651-6.
 13. Hawley JA, Hargreaves M, Joyner MJ, Zierath JR. Integrative biology of exercise. *Cell* 2014;159:738-49.
 14. Braakhuis AJ, Hopkins WG. Impact of dietary antioxidants on sport performance: A review. *Sports Med* 2015;45:939-55.
 15. Meeusen R. Exercise, nutrition and the brain. *Sports Med* 2014;44 Suppl 1:S47-56.
 16. Myburgh KH. Polyphenol supplementation: Benefits for exercise performance or oxidative stress? *Sports Med* 2014;44 Suppl 1:S57-70.
 17. Somerville V, Bringans C, Braakhuis A. Polyphenols and performance: A systematic review and meta-analysis. *Sports Med* 2017;47:1589-99.
 18. Corbier JR, Downs BW, Kushner S, Aloisio T, Bagchi D, Bagchi M. VMP35 MNC, a novel iron-free supplement, enhances cytoprotection against anemia in human subjects: A novel hypothesis. *Food Nutr Res* 2019;63:1-10.
 19. Downs BW, Bagchi M, Morrison BS, Galvin J, Kushner S, Bagchi D. Development and utilization of a novel pro-dosed-electrolyte and phytochemical formulation technology to restore metabolic homeostasis. In: Bagchi D, Bagchi M, editors. *Metal Toxicology Handbook*. Ch. 5. Boca Raton, FL, United States: CRC Press, Taylor and Francis; 2021. p. 67-80.
 20. Blum K, Downs BW, Bagchi M, Kushner S, Morrison BS, Galvin J, *et al.* Induction of homeostatic biological parameters in reward deficiency as a function of an iron-free multinutrient complex: Promoting hemoglobinization, aerobic metabolism, viral immuno-competence, and neuroinflammatory regulation. *J Syst Integr Neurosci* 2020;7:1-15.
 21. Downs BW, Corbier JR, Speight N, Kushner S, Aloisio T, Bagchi M, *et al.* Anemia: Influence of dietary fat, sugar, and salt on hemoglobin and blood health. In: Preuss HG, Bagchi D, editors. *Dietary Sugar, Salt, and Fat in Human Health*. Amsterdam, Boston, United States: Elsevier, Academic Press; 2020. p. 103-28.
 22. Bagchi D, Downs BW, Bagchi M, Kushner S. Opinion: A novel strategy for processing, production and quality control of an iron-free nutraceutical supplement that rapidly restores iron-dependent hemoglobin in red blood cells. *Food Prod Proc Nutr* 2020;2:26.
 23. Downs BW, Bagchi M, Morrison BS, Galvin J, Kushner S, Bagchi D, *et al.* A treatise on the role of Herpesvirus in neurodegeneration. In: Kumar A, Bagchi D, editors. *Antioxidants and Functional Foods for Neurodegenerative Disorders: Uses in Prevention and Therapy*. Boca Raton, Florida, United States: CRC Press, Taylor and Francis; 2021. p. 85-99.
 24. Fitch K. Air pollution, athletic health and performance at the Olympic games. *J Sports Med Phys Fitness* 2016;56:922-32.
 25. Reche C, Viana M, van Drooge BL, Fernández FJ, Escribano M, Castaño-Vinyals G, *et al.* Athletes' exposure to air pollution during world athletics relays: A pilot study. *Sci Total Environ* 2020;717:137161.
 26. Endre L. Physical exercise and bronchial asthma. *Orv Hetil* 2016;157:1019-27.
 27. Barnard ND, Goldman DM, Loomis JF, Kahleova H, Levin SM, Neabore S, *et al.* Plant-based diets for cardiovascular safety and performance in endurance sports. *Nutrients* 2019;11:130.
 28. McClung JP. Iron, zinc, and physical performance. *Biol Trace Elem Res* 2019;188:135-9.
 29. Bescós R, Sureda A, Tur JA, Pons A. The effect of nitric-oxide-related supplements on human performance. *Sports Med* 2012;42:99-117.
 30. Roy S, Bagchi D, Raychaudhuri SP, editors. *Chronic Inflammation: Molecular Pathophysiology, Nutritional and Therapeutic Interventions*. Boca Raton, FL: CRC Press LLC, Taylor and Francis; 2013.
 31. Chatterjee S, Jungraithmayr W, Bagchi D, editors. *Immunity and Inflammation in Health and Disease: Emerging Roles of Nutraceuticals and Functional Foods in Emerging Support*. Amsterdam: Elsevier, Academic Press; 2018.
 32. Hussain T, Tan B, Yin Y, Blachier F, Tossou MC, Rahu N. Oxidative stress and inflammation: What polyphenols can do for us? *Oxid Med Cell Longev* 2016;2016:7432797.
 33. Pashkow FJ. Oxidative stress and inflammation in heart disease: Do antioxidants have a role in treatment and/or prevention? *Int J Inflam* 2011;2011:514623.

How to cite this article: Downs BW, Banik SP, Bagchi M, Morrison BS, Piacentino M, Kushner SW, *et al.* Assessment of a Novel Bioflavonoids and Phytonutrient Formulation in Enhancing Cellular Aerobic Glycolysis, Immunity, Sports Performance, and Mitigating Inflammation. *Am J Biopharm Pharm Sci* 2021;1:4.