Sports Nutrition Support Through Concentrated Bioactive Whey Protein

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A Sports nutrition ingredient opens an opportunity for growth

Recover faster Perform better Mobilize strength

Training the body to be faster, better and stronger can be beneficial. With over 20 million participants and gaining serious mainstream traction, the rise of high-intensity interval training from fitness pros, elite coaches to beach-body boot camps are upping intensity and shortening workouts to get consumers better health and fitness results.

Athletic activity and exercise is typically associated with muscle stress and immune depletion. Such exercise related fatigue can be reduced by nutritional factors such as whey proteins. However, immune related fatigue cannot be adequately addressed by dietary factors alone. RPM Factors™ is a colostrum based whey protein concentrate which is not only rich in whey proteins but it is also rich in immune bioactives such as Immunoglobulin, Lactoferrin and Proline Rich Peptides.

The related stress of high-intensity exercise, along with competitive training can produce inflammatory immune cascade which may result in respiratory symptoms such as sore throat, fatigue and longer recovery times after strenuous workouts. This is mainly due to inadequate anti-inflammatory response by the host immune system against the inflammatory cascade initiated by stressor events (including intense exercise sessions). High intensity training regimens can set-off upper respiratory tract infections. Research has reported that 17.8% of athletes miss a practice and 5.1% miss a competition due
to illness associated with increased bouts of intense strength and endurance training.\(^{(2)}\)

In addition to immune health being a concern, gastrointestinal problems are more likely to occur with the increase of exercise intensity.\(^{(3)}\) It is estimated that incidence rates of gastrointestinal issues can range from 20-50% among endurance athletes.

RPM Factors™ is a unique whey protein that has been micro-filtered to be specifically rich in concentrated peptides and growth factors researched for their health and fitness benefits.

<table>
<thead>
<tr>
<th>Bioactive</th>
<th>Purpose</th>
<th>RPM Factors™</th>
<th>Whey Protein Concentrate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Immunoglobulin G</td>
<td>Immune and gastrointestinal support</td>
<td>40%</td>
<td>5%</td>
</tr>
<tr>
<td>Immunoglobulin A</td>
<td></td>
<td>1.1%</td>
<td>0.2%</td>
</tr>
<tr>
<td>TGF-β2</td>
<td>Cell growth, proliferation and differentiation</td>
<td>140μg/100g</td>
<td>8μg/100g</td>
</tr>
<tr>
<td>IGF-1</td>
<td>Anabolic effects</td>
<td>120μg/100g</td>
<td>5μg/100g</td>
</tr>
<tr>
<td>Proline Rich Peptides</td>
<td>Main regulator of cell systems</td>
<td>3%</td>
<td>1%</td>
</tr>
<tr>
<td>Lactoferrin</td>
<td>Binding and transport of iron ions, antibacterial functions</td>
<td>500-700mg/100g</td>
<td>30mg/100g</td>
</tr>
<tr>
<td>Sialic Acid</td>
<td>Viral inactivation, cognitive function, immune activation</td>
<td>1000-1200mg/100g</td>
<td>150-300mg/100g</td>
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</tbody>
</table>
RPM Factors™ is an ideal solution for reducing discomfort and negative effects associated with intense strength and endurance building.

Specific immunoglobulin and peptide concentrations in RPM Factors™ are shown to increase migration and repair of challenged epithelial cells and stimulate mucous production on the gut lining thereby building a stronger barrier against pathogens. (4)-(8)

RPM Factors™ also contains a substance known as proline-rich polypeptides that have the ability to modulate the immune response by either turning up an underactive immune system or turning down and overactive one. (9)-(11)

### Biological Effects of Proline-Rich Polypeptides (12)

<table>
<thead>
<tr>
<th>Effect</th>
<th>Reference(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Promotion of T cell maturation</td>
<td>(13)-(15)</td>
</tr>
<tr>
<td>Helper activity in T cell-dependent immune response</td>
<td>(13)</td>
</tr>
<tr>
<td>Induction of suppressor cells in T cell-independent immune response</td>
<td>(17)</td>
</tr>
<tr>
<td>Mitogenic activity</td>
<td>(17)</td>
</tr>
<tr>
<td>Suppression of the autoimmune response</td>
<td>(17)</td>
</tr>
<tr>
<td>Regulation of cytokine production in vitro and in vivo in humans</td>
<td>(17)</td>
</tr>
<tr>
<td>Antimutagenic properties</td>
<td>(19)</td>
</tr>
<tr>
<td>Antioxidant properties</td>
<td>(20)</td>
</tr>
<tr>
<td>Enhancement of cognitive processes in animals</td>
<td>(22)</td>
</tr>
<tr>
<td>Prevention of pathological processes in the central nervous system</td>
<td>(26)</td>
</tr>
<tr>
<td>Clinical Trials</td>
<td>(5)-(7)</td>
</tr>
</tbody>
</table>
There are over 30 published studies demonstrating performance and strength attributes associated with the consumption of bovine colostrum by athletes:

- **Faster runs**
  - Increased peak running speed
  - Improved running performance
  - Enhanced sprint performance
  (34) - (36)

- **Better jumps**
  - Increased peak vertical jump
  - Improved jump performance
  (36) (37)

- **Faster times**
  - Improved time-trial performance, intensity and peak cycle power
  (38) - (40)

- **Elevated mass and strength**
  - Increased lean body mass, resistance exercise and repetitions
  (37) (41) - (43)

The review of this research led to examination of whether oral consumption of RPM Factors™ could support enhanced athletic performance among athletes in the face of exercise induced stress. In a consumer study, RPM Factors™ was ingested by 92 athletes over a period of 3 months during which self reported outcomes were recorded. Study participants reported a significant improvement in athletic performance. RPM Factors™ is safe, well-tolerated, and improves athletic outcomes in exercise-stressed individuals.
Study Design

RPM Factors™ was supplied to Sports Performance Group, at Rockville Center, New York. The consumers included high school and professional athletes (36 Male, 55 Female ages 17 - 25) from a variety of disciplines including soccer, softball, volleyball, track and field, basketball, baseball and lacrosse. RPM Factors™ was provided in a capsule form and the athletes were given instructions to consume two capsules daily, which is equivalent to 1 gram of RPM Factors™ per day. Results of the three monthly time-points were compared either to baseline or considering zero day as internal control. Body fat was also monitored throughout the study.

Health Questionnaire

A self reporting questionnaire was administered as per protocol developed by Jude Massillon Group. The questions included how each athlete felt their energy level, alertness and focus at day zero and up to 6 weeks. The questions also included feeling of fatigue at day zero and up to 6 weeks. The ratings were from 1 to 5 with 1 being very low and 5 being very high with 2, 3 and 4 as low, average and high, respectively.
Results and Discussion

The role of colostrum and colostrum based bioactives has attained increased attention due to their perceived role in positive health outcomes. Many experts believe that positive health is heavily influenced by how our body tackles immune related inadequacies triggered by varieties of stresses including life style and exercise induced stress. Bioactives that can provide anti-inflammatory effect can nullify stress related inflammatory negative health consequences.\(^{(42)}\) RPM Factors™ was tested among young athletes to measure exercise related positive health improvements. Results of the study demonstrated general improvement in energy level, alertness and focus among all the athletes after intense exercise. All the athletes experienced a reduction in body fat as well.

Metabolic endpoints were not included in this consumer trial, however, meta analysis of similar studies performed on athletes coupled with known effects of colostral bioactives on immune balancing (from an inflammatory state to an anti-inflammatory state) indicates a positive correlation of RPM Factors™ consumption with improved athletic performance. It is known that exercise related stress could lead to depressed immune system due to an inflammatory immune cascade ensuing stress activity. Bioactives such as Immunoglobulin G, Immunoglobulin A, Lactoferrin, IGF-1 and TGF-B2 have functionality, as shown in a multitude of other studies, to tilt the immune balance
in favor of anti-inflammatory from inflammatory immune stress environment.

**Conclusion**

**RPM Factors™** is a promising bioactive for intended sports performance applications. The fact that athletes experienced marked improvement in alertness, focus and energy level across all the genders and across all the sports groups is remarkable. Improvement in lean body and body fat reduction even among professional athletes is also quite noteworthy. **RPM Factors™** is an efficacious bioactive and its application in sports nutrition, athletic performance would be beneficial.
References


APPENDIX:

RPM Factor Components

**Immunoglobulins (Igs)**

Bovine serum and lacteal secretions contain three major classes of Igs: IgG, IgM and IgA. The basic structure of all Igs is similar, and is composed of two identical light chains (23 kDa) and two identical heavy chains (53 kDa). These four chains are joined together with disulphide bonds. The complete Ig or 'antibody' molecule has a molecular weight of about 180 kDa. Monomeric IgM and IgA have a similar basic structure to IgG except for the addition of a C-terminal octapeptide to the heavy chains. IgA occurs as a monomer or dimer, the latter comprising two IgA molecules joined together by a J-chain and a secretory component. This complex is called secretory IgA (SIgA) and has a molecular weight of about 380 kDa. Except for ruminant lacteal secretions, IgA is the dominating Ig in all external secretions of the body. IgM consists of five subunits, similar to monomeric IgA, which are linked together in a circular mode by disulphide bonds and a J chain; the molecular weight of pentameric IgM is approximately 900 kDa. The concentration of the various bovine Igs in serum and in lacteal secretions varies according to the breed, age, health status, and stage of lactation of the animal. In colostrum, Igs make up 70±80 % of the total protein content, whereas in mature milk, immunoglobulins account for only 1±2 % of the protein. The Igs are produced by β-lymphocytes. All Igs exhibit one or more effector function in addition to antigen binding. Whereas one part of an antibody (Fab) binds to antigen, other parts (mostly the Fc region) interact with other elements. In effect, antibodies function as flexible adaptors linking various parts of the immune system. The immunological function mediated by the Igs depends on the Ig class. Sero conversion of IgG to IgA is
possible in humans. Secretory IgA is associated with beneficial effects on mucosal tissues (gastrointestinal tract and respiratory tract) after immune fatigue induced by exercise. IgG antibodies have other functions such as complement-mediated immunity and bacterial/viral phagocytosis.

**Lactoferrin**
Lactoferrin is an iron binding, globular protein found in abundance in human milk. Its molecular weight is 77 kD. Lactoferrin is found in leukocytes and various other body fluids. The principal role of lactoferrin is defense against bacterial pathogens and viruses. Recently, the role of lactoferrin is recognized in immune modulation. Lactoferrin causes significant induction of anti-inflammatory cytokines such as IL-4 and IL-10 and significant reduction in pro-inflammatory cytokines such as IL-1β and TNF-α. This along with intracellular antioxidant activity is associated with beneficial effect in exercise induced immune fatigue.

**Sialic acid**
Sialic acid is a generic term for the N- or O-substituted derivatives of neuraminic acid, a monosaccharide with a nine-carbon backbone. Sialic acids are found widely distributed in animal tissues and to a lesser extent in other species ranging from plants and fungi to yeasts and bacteria, mostly in glycoproteins and gangliosides. The amino group generally has either an acetyl or glycolyl group but other modifications have been described. The hydroxyl substituents may vary considerably: acetyl, lactyl, methyl, sulfate, and phosphate groups have been found. The role of sialic acid is important in viral inactivation, cognitive function and immune activation.
Proline Rich Polypeptides

Proline rich peptides are found in colostrum in abundance. They are a group of peptides with a molecular weight in the range 16,000 to 26,000 Daltons. They are called proline rich because the amount of proline is greater than the amount of any other single amino acid. These peptides are associated with immune balancing effect through their effect thymus gland (T lymphocytes). Research has demonstrated that beyond cognitive function by this neuropeptide family, they have a role in balancing the immune system. When the immune system is depressed, proline peptides upregulate the immune cascade. The inflammatory immune cascade (as in exercise induced immune imbalance) is reversed to bring back proper immune balance.

Insulin like Growth Factor (IGF-1)

Insulin like growth factor1 protein is a 7649 dalton protein containing 70 amino acids in a single chain with three intramolecular disulfide bridges. IGF-1 is produced primarily by the liver as an endocrine hormone as well as in target tissues in a paracrine/autocrine fashion. Production is stimulated by growth hormones and can be retarded by poor nutrition, growth hormone insensitivity, lack of growth hormone receptors, or failures of the downstream signaling pathway post GH receptor. IGF-1 is beneficially associated with growth and muscle building. Beyond body building and metabolic growth, IGF is also associated with immune modulation. IGF activates weak immune system to more active state. Role of IGF may be important in immunonutrition where exercise or other stress events tend to depress immune system.

Transforming Growth Factor-β (TGF-β)

The TGF-β family is part of a family of proteins known as the transforming growth factor beta superfamily, which
includes inhibins, activin and bone morphogenetic protein. The peptide structures of the three members of the TGF-β family are highly similar. They are all encoded as large protein precursors; TGF-β1 contains 390 amino acids and TGF-β2 and TGF-β3 each contain 412 amino acids. They each have an N-terminal signal peptide of 20-30 amino acids that they require for secretion from a cell, a pro-region (called latency associated peptide or LAP), and a 112-114 amino acid C-terminal region that becomes the mature TGF-β molecule following its release from the pro-region by proteolytic cleavage. The mature TGF-β protein dimerizes to produce a 25 KDa active molecule with many conserved structural motifs. TGF-β has nine cysteine residues that are conserved among its family; eight form disulfide bonds within the molecule to create a cysteine knot structure characteristic of the TGF-β superfamily while the ninth cysteine forms a bond with the ninth cysteine of another TGF-β molecule to produce the dimer. Many other conserved residues in TGF-β are thought to form secondary structures through hydrophobic interactions. The region between the fifth and sixth conserved cysteines houses the most divergent area of TGF-β molecules that is exposed at the surface of the molecule and is implicated in receptor binding and specificity of TGF-β. The role of TGF-β is apparent in immune modulation. TGF-β upregulates mucosal secretion of immunoglobulin from blood plasma in what is known as mucosal immunity generation. TGF-B regulates both arms of immunity and its role is most pronounced in B cell activation and reversing inflammatory cascade (leading to anti-inflammatory outcomes) to provide health benefits. Athletic stress or disease related stress usually results into inflammatory reaction cascade and TGF-β could be useful in mitigating such stress.