

**OPTIMIZING DIETARY SUPPLEMENT SELECTION FOR ENHANCED PHYSICAL HEALTH: A VIKOR ANALYSIS APPROACH****Dr. Nirupama. E and Ms. Sinduja A**

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**ABSTRACT**

*In recent years, the prevalence of dietary supplement consumption has increased significantly, driven by the pursuit of enhanced physical health and well-being. The dietary supplement foods market has witnessed substantial growth and displays promising prospects within the country. This growth trajectory can be attributed to several influential factors stemming from demographic, economic, and social changes. The convergence of these diverse changes has notably shaped and transformed the lifestyles of individuals.*

*This study aims to optimize the selection of dietary supplements in improving physical health through the application of Vikor (ViseKriterijumska Optimizacija I Kompromisno Resenje) analysis. Vikor analysis is employed as a multi-criteria decision-making method to evaluate and rank various dietary supplements based on their effectiveness in promoting physical health. The findings aim to identify supplements that exhibit optimal characteristics across the established criteria, thereby offering insights into selecting supplements that may have the most significant impact on improving physical health.*

*Keywords: Dietary supplements, Physical health, Vikor analysis, Multi-criteria decision-making, Health promotion.*

**INTRODUCTION**

In contemporary society, the consumption of dietary supplements has surged, fueled by a growing pursuit of enhanced physical health and overall well-being. This escalating interest reflects a trend among health-conscious individuals seeking to augment nutritional intake through a diverse range of available supplements, including vitamins, minerals, herbal extracts, and bioactive compounds. The country's dietary supplement food market is experiencing substantial growth, attributed to demographic, economic, and social changes impacting lifestyles. Factors like an aging population, urbanization, altered dietary preferences, increased disposable incomes, and a rising middle class have collectively propelled the demand for dietary supplements. With a heightened social emphasis on health and wellness, individuals across various age groups are actively seeking proactive health management, fostering an environment where supplements are seen as part of a holistic approach to well-being. These societal shifts significantly influence how dietary supplements are perceived, accessed, and integrated into daily life, contributing to a thriving market that caters to evolving consumer needs and preferences.

**DIETARY SUPPLEMENTS**

Dietary supplements refer to products consumed orally that contain dietary ingredients intended to supplement one's diet. These supplements can include vitamins, minerals, amino acids, herbs or botanicals, enzymes, probiotics, and other substances. They come in various forms such as pills, capsules, tablets, powders, liquids, or even in the form of energy bars.

The primary purpose of dietary supplements is to provide nutrients that may be insufficiently obtained from the diet alone. They are not meant to replace a balanced diet but rather to complement it by supplying additional nutrients or bioactive compounds that support overall health and well-being.

The following are some commonly consumed dietary supplements along with a brief overview of their benefits:

**1. Multivitamins**

Multivitamins contain a combination of essential vitamins and minerals. They are widely consumed to supplement nutrients that may be lacking in one's diet. Benefits include support for overall health, filling nutrient gaps, and aiding in the maintenance of proper bodily functions.

## 2. Vitamin D

Known as the "sunshine vitamin," vitamin D supports bone health by aiding in the absorption of calcium and phosphorus. It also plays a role in immune function, mood regulation, and reducing the risk of certain diseases.

## 3. Calcium

Essential for maintaining strong bones and teeth, calcium supplementation is common, especially among individuals at risk of osteoporosis or those with insufficient dietary calcium intake. It also supports muscle function and nerve transmission.

## 4. Omega-3 Fatty Acids

These include EPA (eicosapentaenoic acid) and DHA (docosahexaenoic acid) found in fish oil supplements. Omega-3s are beneficial for heart health, reducing inflammation, supporting brain function, and promoting healthy skin.

## 5. Probiotics

Probiotic supplements contain beneficial bacteria that support gut health by maintaining a healthy balance of microorganisms in the digestive tract. They may aid in digestion, boost the immune system, and help manage certain digestive issues.

## 6. Iron

Iron supplements are commonly used to prevent or treat iron-deficiency anemia, especially in individuals with inadequate dietary iron intake or those with increased iron needs (such as pregnant women).

## 7. Vitamin C

Well-known for its immune-boosting properties, vitamin C also acts as an antioxidant, supporting skin health, aiding in wound healing, and enhancing the absorption of iron.

### Choice of Dietary Supplements

The dietary supplement food market has experienced consistent growth globally, attributed to various factors such as heightened consumer health awareness, the increasing aging population seeking health solutions, and the prevalence of lifestyle-related diseases prompting interest in preventive healthcare. Changing dietary habits, higher disposable incomes, and the demand for convenient nutritional solutions have further amplified the market's expansion. Commonly sought-after supplements encompass vitamins, minerals, herbal extracts, protein supplements, omega-3 fatty acids, and probiotics, with multivitamins ranking among the top-selling supplements worldwide. Regulatory frameworks, consumer preferences, health professionals' recommendations, and considerations of health claims, safety, quality, and marketing strategies significantly influence consumer choices and market development. Technological innovations, novel product formulations, and a growing preference for natural and organic supplements are driving consumer demand for transparent and cleaner label products, reshaping the market landscape.

Consumers consider several factors when choosing and consuming dietary supplement foods in today's market. Some key factors include:

- i. **Health and Wellness Goals:** Consumers often select supplements aligned with their health goals, such as improving overall health, boosting immunity, supporting specific bodily functions (e.g., heart health, joint health), or addressing deficiencies identified by healthcare professionals.
- ii. **Ingredient Transparency and Purity:** Transparency in ingredient sourcing and purity is crucial. Consumers look for supplements free from artificial additives, allergens, GMOs, and unnecessary fillers, preferring products with clearly labeled, high-quality ingredients.
- iii. **Cost and Value:** Balancing cost and perceived value is important. Consumers evaluate the cost-effectiveness of supplements concerning the benefits they offer and compare prices across different brands or formulations.

- iv. **Personalized and Tailored Solutions:** Increasingly, consumers are seeking personalized supplement solutions catering to individual health needs, preferences, and dietary restrictions, sometimes guided by genetic testing or consultations with healthcare professionals.
- v. **Regulatory Compliance and Safety:** Concerns for product safety, potential side effects, and compliance with regulatory standards are paramount. Consumers look for supplements manufactured in facilities adhering to Good Manufacturing Practices (GMP) and meeting safety standards.

Consumers' evolving preferences and increased awareness of health and wellness contribute to a more discerning approach when selecting dietary supplements, emphasizing quality, effectiveness, transparency, and personal health needs.

### **RATIONALE FOR RESEARCH**

Amidst the multitude of available dietary supplements, there exists a crucial need to navigate the diverse options based on empirical evidence regarding their impact on physical health. While the market is replete with claims about the benefits of these supplements, a systematic and evidence-based evaluation of their efficacy is vital. This research seeks to address this gap by employing a structured analytical approach, utilizing Vikor (ViseKriterijumska Optimizacija I Kompromisno Resenje) analysis to optimize the selection of dietary supplements aimed at enhancing physical health.

### **OBJECTIVES FOR RESEARCH**

This study is guided by several specific objectives:

- A. Conducting a primary study and a comprehensive review of existing literature to identify commonly used dietary supplements and their purported benefits, along with the preference of consumers regarding their selection.
- B. Establishing a set of evaluative criteria to assess the impact of dietary supplements on physical health.
- C. Applying Vikor Analysis to systematically evaluate and rank selected supplements based on their potential to enhance physical health.
- D. Providing evidence-based recommendations for optimizing dietary supplement selection to improve physical health outcomes.

### **REVIEW OF LITERATURE**

**Shermila Stella Jeyaraja (2023)** in her study on “**A study to assess the dietary pattern and to compare the effectiveness of dietary supplementation and educational intervention with selected glycemic markers among patients with type 2 diabetes mellitus in selected rural areas at Thoothukudi district**” aimed to assess dietary patterns and evaluate the effectiveness of fenugreek supplementation and educational interventions among 210 individuals aged 30-60 with type 2 diabetes mellitus in Thoothukudi district and results highlighted the positive impact of educational interventions on knowledge enhancement and application, alongside fenugreek's potential in reducing blood sugar levels. The study also suggested fenugreek's cost-effectiveness in managing diabetes and underscored the significance of education in improving diabetes management practices.

**Parul Yadav's (2018)** study on “**Demographic and lifestyle characteristics associated with dietary supplement use**” aimed to understand dietary supplement consumption patterns in the Delhi-NCR region, driven primarily by health and dietary considerations. By examining the interplay between demographic and lifestyle factors, the study sought to uncover motives driving supplement purchases and characterize non-users.

**Supriya Patil (2018)** “**A Study of Factors Influencing Acceptance of Dietary Supplements by Adults in Pune City**” made an attempt to enhance understanding regarding individuals' health-related habits, focusing on factors influencing the choice of dietary supplements over conventional food consumption and concluded that proximity of health information sources is a major influence in consumption of dietary supplements and information

proliferation of right use of dietary supplements through trusted sources can bring about appropriate use of dietary supplements.

**R. Sivaprakasam (2017)** in his study titled “**Analysis and selection of suppliers in a green supply chain environment**” focusing on the highly polluting Textile Industry in Southern India, employed an Interpretive Structural Modeling (ISM) framework to analyze criteria and sub-criteria in Green Supply Chain Management (GSCM). The aim was to narrow the gap between perceived and actual supplier choices. Analytic Hierarchy Process (AHP) determined criterion weights, while fuzzy TOPSIS and fuzzy VIKOR methodologies were utilized to select the most suitable supplier, addressing the complexity and uncertainties of the green supplier selection problem. Comparing results from both methodologies helped justify the final supplier selection in this Textile Industry case study.

**RESEARCH DESIGN**

This study employs a mixed-methods research design to comprehensively analyze and optimize dietary supplement selection for enhanced physical health.

**POPULATION AND SAMPLING:**

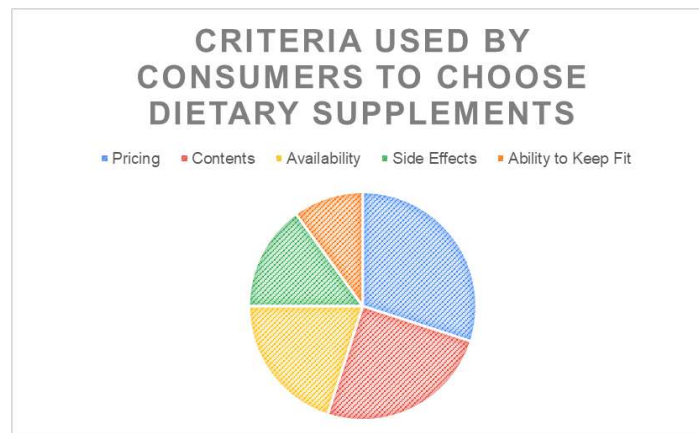
A convenience sampling technique is used across different demographics, including age groups, genders, and geographical locations. A sample size of about 100 respondents were taken for statistical power and precision for robust analysis.

**RESULT ANALYSIS METHODS**

In this study, the optimum choice of dietary supplements for physical health is assessed and ranked using VISEKRITERIJUMSKA OPTIMIZACIJA KOMPROMISNO RESENJE (VIKOR) analysis method, which is a MULTIPLE CRITERIA DECISION MAKING TECHNIQUES (MCDM).

**ANALYSIS AND INTERPRETATION**

The initial primary study consisted of respondents ranking various criteria to choose the right dietary supplement on a 5-point scale from “Least Important” to “Most Important”.



**Fig 1:** Criteria chosen for evaluation from Primary Study

Keeping the above criteria, 5 dietary supplement alternatives were chosen that are ranked based on VIKOR method. The table below shows the type of criterion and weight assigned to each criterion.

**Table 1:** Characteristics of Criteria

	Name	type	Weight
1	Contents	+	0.3
2	Ability to keep fit	+	0.25
3	Side effects	+	0.2

4	Availability	-	0.15
5	Pricing	-	0.1

The following table shows the decision matrix.

**Table 2:** Decision Matrix

	Contents	Ability to keep fit	Side effects	Availability	Pricing
Multivitamins	5	5	3	2	500
Calcium	4	1	1	5	250
Omega-3 fatty acids	3	4	5	1	750
Iron	2	3	4	3	350
Vitamin C	1	2	2	4	150

The VIKOR method involves the following steps:

**STEP 1: Normalize the decision matrix**

The following formula can be used to normalize.

$$f_{ij}(x) = \frac{x_{ij}}{\sqrt{\sum_{i=1}^m x_{ij}^2}} \quad i = 1, \dots, m \quad ; j = 1, \dots, n$$

The table below shows the normalized decision matrix.

**Table 3:** Normalized Decision Matrix

	Contents	Ability to keep fit	Side effects	Availability	Pricing
Multivitamins	0.674	0.674	0.405	0.27	0.495
Calcium	0.539	0.135	0.135	0.674	0.248
Omega-3 fatty acids	0.405	0.539	0.674	0.135	0.743
Iron	0.27	0.405	0.539	0.405	0.347
Vitamin C	0.135	0.27	0.27	0.539	0.149

**STEP 2: Determine the best  $f_i^*$  and worst  $f_i^-$  benefits of each criterion**

The best and worse benefits can be determined by the following formula:

If the criterion is positive, then

$$f_j^* = \text{Max}_i f_{ij} \quad , \quad f_j^- = \text{Min}_i f_{ij} \quad ; \quad j = 1, 2, \dots, n$$

If the criterion is negative, then

$$f_j^* = \text{Min}_i f_{ij} \quad , \quad f_j^- = \text{Max}_i f_{ij} \quad ; \quad j = 1, 2, \dots, n$$

**STEP 3: Calculate the  $S_i$  and  $R_i$  values**

The values  $S_i$  and  $R_i$ , representing the group utility and individual regret, respectively, can be calculated by the formulas below:

$$S_i = \sum_{j=1}^n w_j \frac{(f_j^* - f_{ij})}{(f_j^* - f_j^-)}$$

$$R_i = \text{Max}_j \left[ w_j \frac{(f_j^* - f_{ij})}{(f_j^* - f_j^-)} \right]$$

Where  $w_j$  denotes the weight of the criteria.

The following table shows the values  $S_i$  and  $R_i$ .

**Table 4:** The values **S** and **R**

	<b>R</b>	<b>S</b>
Multivitamins	0.1	0.196
Calcium	0.25	0.692
Omega-3 fatty acids	0.15	0.312
Iron	0.225	0.508
Vitamin C	0.3	0.75

**STEP 4:** Calculate the value  $Q_i$

The value  $Q_i$ , representing the VIKOR index for each alternative can be calculated by the following formula:

$$Q_i = \gamma \frac{(S_i - S^*)}{(S^- - S^*)} + (1 - \gamma) \frac{(R_i - R^*)}{(R^- - R^*)}$$

Where

$$S^* = \text{Min}_i\{S_i\} ; S^- = \text{Max}_i\{S_i\} ; R^* = \text{Min}_i\{R_i\} ; R^- = \text{Max}_i\{R_i\}$$

And  $\gamma$  is the maximum group utility represented by value 0.7.

**Table 5:** The values **Q**

	<b>Q</b>
Multivitamins	0
Calcium	0.851
Omega-3 fatty acids	0.222
Iron	0.582
Vitamin C	1

**STEP 5: Rank the Alternatives, Sorting by the S, R and Q values**

Alternatives are ranked by sorting the S, R, and Q, values in decreasing order such that the best rank is assigned to the alternative with the smallest VIKOR value. The results are three ranking lists.

The following table presents the ranking list for the alternatives based on the S, R, and Q values

**Table 6:** The ranking list for the alternatives

	<b>R value</b>	<b>Rank in R</b>	<b>S value</b>	<b>Rank in S</b>	<b>Q value</b>	<b>Rank in Q</b>
Multivitamins	0.1	1	0.196	1	0	1
Calcium	0.25	4	0.692	4	0.851	4
Omega-3 fatty acids	0.15	2	0.312	2	0.222	2
Iron	0.225	3	0.508	3	0.582	3
Vitamin C	0.3	5	0.75	5	1	5

**STEP 6:** Propose a Compromise Solution

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The alternative ( $A^{(1)}$ ), which is the best ranked by the measure Q (minimum) if the following two conditions are satisfied:

**Condition 1.** Acceptable advantage:  $Q(A^{(2)}) - Q(A^{(1)}) \geq 1/(m - 1)$  where  $A^{(1)}$  is the alternative with first position and  $A^{(2)}$  is the alternative with second position in the ranking list by Q. m is number of alternatives.

**Condition 2.** Acceptable stability in decision making: The alternative  $A^{(1)}$  must also be the best ranked by S or/and R.

**Table 7:** Result of the conditions survey

Condition 1	Non acceptance
Condition 2	-
Selected solution	Solution 1

.Therefore, **Multivitamins, Omega-3 fatty acids**, are selected as the final alternatives

### FINDINGS

- A primary study was conducted to identify the ranking criteria for choice of dietary supplements namely, Contents, Ability to keep fit, Side effects, Availability and Pricing.
- With respect to dietary supplements: -
  - Pricing and Availability were found to be the Non-Beneficial Criteria.
  - Contents, Ability to keep fit and Side effects, on the other hand, were classified as the Beneficial Criteria.
- With respect to weightage of various selection criteria, the contents of the supplement had the highest weightage of 0.3 whereas the lowest weightage was given to pricing of the product as per the primary study conducted.
- As per the Vikor Analysis conducted, Multivitamins and Omega-3 fatty acids demonstrated characteristics that aligned closely with the established criteria, making them the recommended choices for dietary supplement selection aimed at enhancing physical health.

### SUGGESTIONS

The following are some suggestions based on the findings derived from the conducted Vikor Analysis for optimizing dietary supplement selection:

1. **Clinical Trials and Validation:** Conduct robust clinical trials to validate the safety and efficacy of Multivitamins and Omega-3 fatty acids.
2. **Expert Recommendations:** Expert endorsements can provide credibility and guidance to consumers.
3. **Consumer Education:** Empowering consumers with knowledge about these supplements can promote better incorporation into daily routines.
4. **Quality Assurance:** Encourage transparency in labelling, sourcing, and production practices to instil trust and confidence in consumers regarding supplement quality.
5. **Healthcare Provider Guidance:** Encourage healthcare providers to recommend these supplements based on individual health assessments.
6. **Continuous Monitoring:** Establish frameworks for continuous monitoring and evaluation of individuals using these supplements.
7. **Personalized Regimens:** Promote personalized dietary supplement regimens tailored to individual health profiles and specific needs.

**8. Regulatory Compliance:** Advocate for strict adherence to regulatory standards and quality control measures within the supplement industry.

#### **CONCLUSION**

In conclusion, Multivitamins and Omega-3 fatty acids, as identified through the Vikor Analysis, stand as compelling choices for dietary supplementation to support and enhance physical health. Integrating these findings into personalized health plans and promoting evidence-based supplement usage can significantly contribute to individual well-being and overall public health initiatives.

However, while these supplements showed promising results, further research, validation, and continuous monitoring are necessary to solidify their role in promoting physical health. Implementing expert recommendations, ensuring transparency, and fostering consumer education will be pivotal in maximizing the benefits of these supplements and promoting informed decision-making regarding their usage.