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AN OPTIMUM NUTRITIONAL DIET FOR ATHLETES BY USING LINEAR PROGRAMMING MODEL

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ABSTRACT

The present work achieves the goal of providing an engineering tool to the service of non-public health, associate degree optimized diet in terms of prices and quantities of rations that must be consumed to fulfil the diet of a superior athlete, and caloric requirements in terms of the kind of physical activity. the strategy used consisted of choosing a sample of athletes United Nations agency follow a four-hour daily coaching regimen; the results embody the application of the applied mathematics Model of research, which is a mathematical matrix model of settled kind for the improvement of resources at the lowest price with the best utility. This model was accustomed produce a perfect biological process formulation that satisfies the technical necessities and therefore the minimum, maximum, or fixed nutritional necessities (restrictions = rows) for the biological process diet for athletes. These nutritional wants should be compared to or happy by a mix of a particular range of readily offered dietary ingredients or inputs (decision variables = columns), every of that has its own set of technical properties, biological process elements, and contents. Due to the numerous choices for daily formulation for the contestant, this matrix structuring of the model and its corresponding process mistreatment the questionable Simplex technique, permits the creation of a best biological process diet for athletes. As associate degree example, the formulation of the perfect diet for breakfast following that, mistreatment on-line tools that turn out correct findings, the results area unit

acquired and displayed through a link with software system and an applied mathematics application used for the improvement of the diet. These results area unit then analyzed and valid before being place into practice.

Keywords: Operative research models, Calories consumed, Linear programming, Optimizing diet

INTRODUCTION:

For athletes, proper nutrition is essential to maintaining excellent physical health, avoiding muscular injury, and boosting performance and quality of work. In simple words, an athlete's diet should differ from a typical person's diet. In addition to the necessities of training and competition, athletes need nourishment for daily activities. Every athlete should adhere to this general rule when aiming to maintaining a healthy level of fitness requires a balanced diet. In order to maintain a healthy weight the input energy and output energy need to be equal. Consequently, athletes who calories must be consumed during workouts. Overall, an athlete's stability and strength depend on a diet high in carbohydrates to allow the body to store carbohydrates in the best possible way. We therefore set out to develop an ideal diet for athletes based on calorie maximization and fat intake in this study. Additionally, the athlete following this diet will obtain a variety of nutrients, such as vitamins, minerals, and macronutrients their physical requirements. We employed a linear programming approach with multi objective decision criteria to achieve this. Being a vegetarian has advantages for performance and recovery as well as lowering the risk of chronic diseases. But the research on vegetarianism is contentious and confusing. There is a question that arises in this research: Is a vegetarian diet beneficial for athletes when compared to non-vegetarian diets? Is this true or not? Both the literature research approach and the empirical research method were used in the study. Vegetarianism can improve people's health. Vegetarianism is helpful in lessening the demand for animals since it helps to counteract the rapid population rise and development of modern society. The number of people will likely increase in the future; however, they might not get enough SHAO protein **[1]**. It's crucial for everyone to eat and drink in moderation. Despite the fact that they often participate in active sports, it is important to understand that their performance may also be impacted. For instance, the typical person consumes more calories than they should. So if you only have one choice, become an athlete or start exercising frequently—a solid diet plan shouldn't be the last thing on your list of priorities. Protein, fat, and carbohydrates give your body the fuel it needs to stay energetic. Working muscles primarily burn carbohydrates for fuel. Intake must be sufficient to prevent muscle exhaustion.

While keeping an eye on your intake of fat, you should simply cut it out of your diet. Fat supplies vital fatty acids, which can be used as an energy source during an activity session that lasts more than an hour, especially if. Additionally, fat offers the building blocks needed to create hormones and cell walls. The importance of protein in constructing new muscle tissue and as an energy source cannot be overstated. Your body requires more protein if you are engaging in a resistance workout **[2]**. According to expert Matt Dwyer, the main difference between the diets of Indian and Australian athletes is that the Indian athlete takes proportionally more fat and carbohydrates and less protein. These are his findings after working with a large number of Indian athletes. Unfortunately, there hasn't been much scientific research done on Indian athlete's diets. However, the study conducted so far indicates that Indian athletes have a poor knowledge of nutrition, with low protein intake, iron intake, calcium intake, and B-complex vitamin intake **[3]**. In conclusion, the younger teams' higher energy intake and more well-balanced intake of macronutrients may be related to physiological growth adaptations or the fact that young athletes eat at home or school, where their diet is better regulated and balanced. Our findings imply that athletes' diets degrade when they enroll in college or begin working. Because it has been shown that a sports nutrition education programmer can enhance nutrition knowledge and practices, we think the results presented here can be utilized to create a baseline from which a nutrition intervention can be built **[4]**. Intermittent high-intensity activity patterns are a typical element of team sports, although there is significant variation in game features between sports, between positions and playing styles within a single sport, and from one game to the next. For athletes in team sports, this results in a variety of physiological issues and dietary requirements. Obtaining an ideal body composition, the philosophy of nutritional support for training, strategies for meeting fluid and fuel requirements during competition, and the advantages of supplements and cryogenic aids for team sports are the four main areas in which nutrition can optimize performance in team sports **[5]**. The only acceptable paths to progress are those that are maintained by firms through ethical business practices and suitable government restrictions regarding supplement manufacturing and marketing. Consumers must be aware of all food products marketed as dietary supplements or nutraceuticals, which must fulfill standards for quality and safety and be taken under the supervision of medical professionals. Regarding the nutritional definition, the word "supplement" is self-explanatory; it signifies that an individual must be given an additional food material in accordance with a doctor's or

dietician's prescription. Dietary supplements (DSs) are frequently needed for the body's general physical demands, as well as for therapeutic purposes. Additionally, sportsmen and fitness enthusiasts frequently use supplements to build muscle mass and improve performance **[6]**. Vitamins and supplements can be a risk-free option for athletes to try to increase their performance, although more research is required to determine the efficacy of specific supplements. Before beginning to use any new vitamins or other supplements, it is imperative to consult a doctor. These chemicals may interact with other drugs a person may be taking. Some supplements, such as iron, might have negative side effects if taken in excess. Additionally, unless a person already has a deficiency, some vitamins could be ineffective. Vitamin deficiencies can be tested by a doctor, who can also offer advice on how to remedy them if necessary. Before taking supplements, people who routinely exercise but still feel short on energy might want to think about other areas of their habits. Athletic performance might also be improved by eating a healthy, balanced diet and obtaining enough sleep. It's especially important for athletes who eat vegetarian or vegan diets to make sure they're getting enough of the aforementioned nutrients **[7]**. Nutrition is crucial for any athletic activity or fitness plan. The primary nutritional objective for active individuals is to consume enough food to maximize performance in sports or physical fitness. These are not only crucial to aid in performance improvement but also to encourage good eating habits in the long term. Therefore, an appropriate strength and conditioning regimen and a balanced diet must be promoted as an intelligent choice an alternative to a hasty, risky mindset. When compared to parents, researchers have discovered the attitude was more influenced by instructors, subjectively adolescents' expectations and intentions with reference to use of supplements **[8]**.

Literature Review: The study of optimizing solutions to mathematically determined problems, which could be models of physical reality, human behavior, or systems for manufacturing and management, is known as optimization. It calls for the subsequent elements, a necessary objective function that a numerical scalar piece measurement must be reduced or increased. These processes may result in system profit, yield, price, etc. For the purpose of describing the effectiveness of the system. These restrictions include a suitable portion of the search area. It outlines limitations on performance for the programmer. Adjusting some variables to satisfy the constrictions are required. These are typically attained through several instances of varying values, producing a workable zone that a subspace of these determines variables **[9]**. The energy

consumption of female athletes, expressed relative to body mass, is roughly 70% of that of their male counterparts after reviewing the energy intake of male and female competitors in various sports. The lower intensity, frequency, and duration of the majority of female athletes' training regimens can be used to explain this. However, a number of studies indicate that certain athletes appear to be in a negative energy balance; these results appear to apply more frequently to female athletes than to their male counterparts. Analyze the observations and the potential explanations in great length **[10]**. The main conclusion of this study was that professional youth soccer players who competed for a Championship team headquartered in the UK did not follow nutritional habits that were sufficient to satisfy the demands of their training and competition. In particular, a discrepancy between mean daily energy intake and expenditure was found, and the amount of energy derived from carbohydrate sources was reduced as a result of a higher intake of fats. Additionally, despite the fact that the majority of micronutrients were consumed at levels that complied with recommendations, fiber intake **[11]**. This study provided a broad view of athletes' attitudes regarding nutrition understanding. It was determined that the student-athletes in the Physical Education Department at Aligarh Muslim University know more about sports nutrition than the student-athletes in the other departments. The competent instructors from the Department of Physical Education are teaching the pupils a sports nutrition curriculum, which is the cause of this **[12, 13]**. The variety of reported dietary practices reported across sports and cultures has been highlighted by this study, which highlights the necessity for specific food and adequate nutrition assistance in this setting. Even though there are evidence-based recommendations for eating before, during, and after competition, it is clear that athletes sometimes favour foods that are familiar to them culturally and that adhere to their personal and religious preferences. Although the vast majority of diets described in this study were nutrient-based, it is clear that a growing number adhere to a specialized diet based on religion (most commonly Halal), the avoidance of meat, or certain allergens **[14]**. There is no doubt that the foods and food components that are consumed have some sort of direct or indirect impact on the human DNA. The reaction to food components can be significantly influenced by both genetic and epigenetic events. This can happen via altering the molecular target's activity or by altering how the dietary component is absorbed, digested, metabolized, and excreted. Identification of those who would benefit most from intervention techniques will become easier as genomics knowledge improves **[15]**.

Example and Method

The number of calories you need depends on how energetic you are. The body's nutrient requirements are determined in part by characteristics like age, sex, physical activity, and others. As a result, we reasoned that an analysis of a 24-year-old young male who spends around 2 hours each day swimming in the pool and has a body mass index of 22.27 kg/m (74 kg, 180 cm tall) was warranted. Let's first identify the dos and don'ts of this athlete's healthy nutrition using library resources, data from the medical record, and other numbers. It is now time to divide this energy among the macronutrients after providing the necessary energy (at least 3000 kcal). The ideal amount of energy to come from carbohydrates is between 60% and 70%. It is recommended that an athlete ingest no less than 50% of their entire daily energy from carbohydrates. Fats should make up 20 to 30 percent of your energy. This ratio can be decreased to 15% of total energy, but not less, if you wish to study fat tissue. The amount of protein needed varies greatly from person to person and is largely influenced by body size. The amount of protein that an athlete's body needs can range from 1.2 to 1.7 gm per kg of body weight. According to opinions on other minerals and vitamins, a healthy eating pattern can satisfy all of these requirements. The amount of RDA that the body needs is shown in **Table 1** (Appendix), along with the maximum permitted UL intake of nutrients. The linear programming model solution's suggested eating plan must take these restrictions into account requirements. The amount of RDA that the body needs is shown in **Table 1** (Appendix), along with the maximum permitted UL intake of nutrients. The linear programming model solution's suggested eating plan must take these restrictions into account. For instance, a healthy diet should contain between 20 and 35 gm of fiber per day and between 47 and 124 gm of sugar. The athlete's body is given the vitamins and minerals it needs by following the diet mentioned above. Utilizing the data in Table 1, determine the LP problem and take into account the decision variables associated with the diet plan's meal choices.

Table 1: Nutritional and Energy requirements for each day

Sr. No.	Nutrient	Maximum Limit	Minimum Limit
1.	Carbohydrate (g)	525	375
2.	Energy (Kcal)	4000	3000
3.	Protein (g)	133.2	88.8
4.	Fat (g)	100	66.6
5.	Fiber (g)	35	20
6.	Calcium (mg)	2500	1000
7.	Iron (mg)	200	150

Table 2: Ingredients of the Planned Diet

Sr. No.	Food stuff	Serving (gm)	Price (Rs)	Carbohydrate (gm)	Energy (Kcal)	Protein (gm)	Fat (gm)	Calcium (mg)	Iron (mg)
1.	Low fat milk/X1	165	6.60	8.23	69	5.56	1.6	196	0.05
2.	Egg/X2	60	15	0.46	88	7.55	5.96	32	1.1
3.	Rice/X3	80	3.20	22.11	108	2.11	0.86	8	0.94
4.	Chicken breast/X4	525	210	0	578	121.22	6.51	58	3.78
5.	Bread/X5	25	2.5	12.65	66	1.91	0.82	38	0.94
6.	Low fat cheese/X6	145	58	1.86	584	36.1	48.05	1045	0.99
7.	Spinach/X7	10	0.5	0.36	2	0.29	0.04	10	0.27
8.	Apple/X8	35	2.45	4.83	18	0.09	0.06	2	0.04
9.	Honey/X9	600	125	494.4	1824	1.8	0	36	2.52
10.	Sugar/X10	130	5.2	129.9	503	0	0	1	0.01

Formulation of the problem

Min Z = 6.60X1 + 15X2 + 3.20X3 + 210X4 + 2.5X5 + 58X6 + 0.5X7 + 2.45X8 + 125X9 + 5.2X10

Subject to,

8.23X1 + 0.46X2 + 22.11X3 + 12.65X5 + 1.86X6 + 0.36X7 + 4.83X8 + 494.4X9 + 129.9X10 ≥ 375

69X1 + 88X2 + 108X3 + 578X4 + 66X5 + 584X6 + 2X7 + 18X8 + 1824X9 + 503X10 ≥ 3000

5.56X1 + 7.55X2 + 2.11X3 + 121.22X4 + 1.91X5 + 36.1X6 + 0.29X7 + 0.09X8 + 1.8X9 ≥ 88.8

1.6X1 + 5.96X2 + 0.86X3 + 6.51X4 + 0.82X5 + 48.05X6+ 0.04X7 + 0.06X8 ≥ 66.6

196X1 + 32X2 + 8X3 + 58X4 + 38X5 + 1045X6 + 10X7 + 2X8 + 36X9 +X10 ≥ 1000

0.05X1 + 1.1X2 + 0.94X3 + 3.78X4 + 0.94X5 + 0.99X6 + 0.27X7 + 0.04X8 + 2.52X9 + 0.01X10 ≥ 150

LINGO Formulation

Min = 6.60*X1 + 15*X2 +3.20*X3 + 210*X4 + 2.5*X5 + 58*X6 + 0.5*X7 + 2.45*X8 + 125*X9 + 5.2*X10

8.23*X1 + 0.46*X2 + 22.11*X3 + 12.65*X5 + 1.86*X6 + 0.36*X7 + 4.83*X8 + 494.4*X9 + 129.9*X10 >= 375

69*X1 + 88*X2 + 108*X3 + 578*X4 + 66*X5 + 584*X6 + 2*X7 + 18*X8 + 1824*X9 + 503*X10 >= 3000

5.56*X1 +7.55*X2 + 2.11*X3 + 121.22*X4 + 1.91*X5 + 36.1*X6 + 0.29*X7 + 0.09*X8 + 1.8X9 >= 88.8

1.6*X1 + 5.96*X2 + 0.86*X3 + 6.51*X4 + 0.82*X5 + 48.05*X6 + 0.04*X7 + 0.06*X8 >= 66.6

196*X1 + 32*X2 + 8*X3 + 58*X4 + 38*X5 + 1045*X6 + 10*X7 + 2*X8 +36*X9 + X10 >= 1000

0.05*X1 + 1.1*X2 + 0.94*X3 + 3.78*X4 + 0.94*X5 + 0.99*X6 + 0.27*X7 + 0.04*X8 + 2.52*X9 + 0.01*X10 >= 150

LINGO Solution

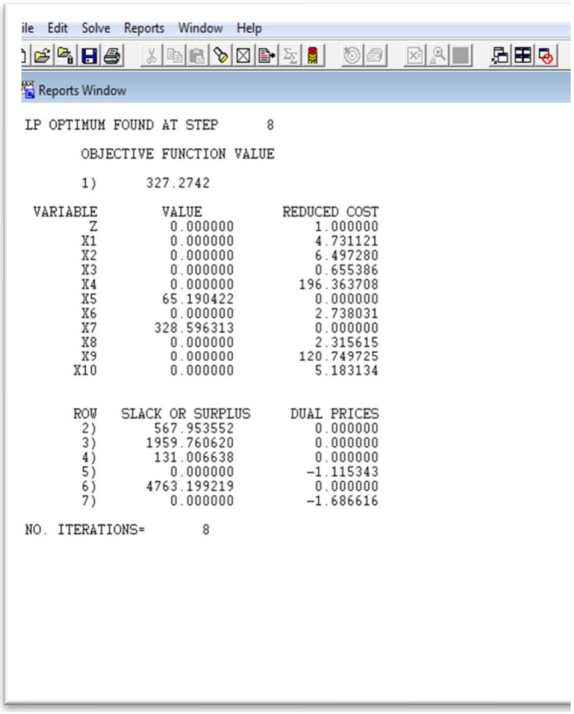
Global optimal solution

Objective value: 327.2742

Model Class: LP

Total variables: 10

Non linear varibles: 0



Variable	Value	Reduced Cost
Z	0.000000	1.000000
X1	0.000000	4.731121
X2	0.000000	6.497280
X3	0.000000	0.655386
X4	0.000000	196.363708
X5	65.190422	0.000000
X6	0.000000	2.738031
X7	328.596313	0.000000
X8	0.000000	2.315615
X9	0.000000	120.749725
X10	0.000000	5.183134

Row	Slack or Surplus	Dual Prices
2)	567.953552	0.000000
3)	1959.760620	0.000000
4)	131.006638	0.000000
5)	0.000000	-1.115343
6)	4763.199219	0.000000
7)	0.000000	-1.686616

CONCLUSION

Exercise undoubtedly has a significant positive impact on a person's quality of life, but in order to get the intended results, we must exercise correctly. Proper nutrition before and after exercise is one of the elements that can be crucial in exercise. Linear diet modeling just as an optimization strategy based on the intended objectives requires programming and then solving it with LINGO software, it is also necessary to take the dietary restrictions of the different types of nutrients into account. For optimization, linear programming is particularly efficient. Lingo is used to locate

here. The ideal solution and lowest price for the nutritional diet are Rs 327.2742.

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