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Research Article

Gymnasium Exercises: Types, Benefits, Dietary Requirements and Adequacy of Intake

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ABSTRACT

Having a balanced diet has become a necessity for many people, nowadays. An ideal balanced diet is the one which contains all the major food groups including adequate protein, carbohydrates, high quality fats, vitamins and minerals. Healthy dietary habits are the pillars of good and nutritious lifestyle. Likewise, there are the ideal dietary requirements for persons going to gym or who are involved in sports. Going to gym has been trending among people, especially youth, since few years. Their specific dietary guidelines are classified on the basis of an individual's age group, gender, type of workout and the desired outcome. Beverages composed of electrolytes play a vital role in their diet. Combination of nutritious foods and gym/exercise can make a person; live a healthy and better life.

INTRODUCTION

A gymnasium also known as a 'gym' is a fitness center. This word is derived from ancient Greece word gymnasium [Partridge, 1984]. The first record of gymnasiums dates back to over 3000 years ago in ancient Persia, where these places were known as Zurkhaneh. In USA, first gym was opened in 1827 by John Neal of Portland, Maine. The first indoor gymnasium in Germany was probably the one built in Hesse in 1852 by Adolph Spiess. The concept of gymnasium is not very old in India but there are few games like Kabaddi, Akhadas, Mallakhamba etc. which includes motor skills and muscular power. The origin of kabbadi dates back to times when men used to shield themselves from the attack of wild animals. It requires both skill and power [Gulia and Dhauta, 2019]. The akhara is training hall for professional fighters. Its origin dated back to 400BCE. Parashurama and Agastya are credited as the founders of the early martial akhara in certain regions of India [James G. Lochtefeld, 2002]. Mallakhamba origin goes back to 12th century and it is a reference for wrestlers exercising on woods. [Ahsan Jan Qaisar, Som Prakash Verma, 2002].

The fitness and wellness sector in India has come a long way from the days of the local 'akhadas' to wrestling now being a part of the international Olympics, with India actively taking part in it and winning medals for the country. In India, the total retail market for fitness sector category is valued at Rs. 4,579 Cr (US$ 0.76 billion). Modern retail is estimated at 28% of total market and is expected to grow by 22-27%. Resistance training increased amongst men and so did aerobics and strength training amongst women. This industry is unstructured but will be leading soon [Amaresh ojha, 2017].

Gyms have never lost their popularity since their opening and are still favorite place of health conscious people. Gym helps to improve muscle strength and boost endurance [NIN, 2011]. Exercise delivers oxygen and nutrients to tissues and helps cardiovascular system work efficiently. The healthy heart and lung improves the body energy and helps to tackle daily chores. It also help in controlling weight, reducing risk of diseases [like cardio-vascular, diabetes, lowers level of LDL, osteoporosis], improves mood, boosts energy, promotes better sleep, boost happy hormones, improve muscle strength, balance and flexibility [NIN, 2011]. Diet plays an important role in getting the desired results of exercise. A proper diet and the adequate knowledge of the time of intake are very important. In this review we have discussed the various types of exercises, dietary requirements as per the type of exercise and the adequate time for taking the diets.

CLASSIFICATION OF EXERCISES

Depending on the overall effect on human body the physical exercises can be generally grouped into aerobic exercise and

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anaerobic exercise. Aerobic exercise is any physical activity that uses large muscle groups and causes the body to use more oxygen while resting. The goal of aerobic exercise is to increase cardiovascular endurance [Wilmore and Knuttgen, 2003]. Examples of aerobic exercise include cycling, swimming, brisk walking, skipping rope, rowing, hiking, playing tennis, continuous training, and long slow distance training. The second type of exercise is anaerobic exercise which includes strength and resistance training. They firm strengthen and tone muscles, improve bone strength and helps in improving balance and coordination. Examples of strength moves are push-ups, lungs and bicep curls using dumbbells. Anaerobic exercise also include weight training, functional training, eccentric training, interval training, sprinting, and high-intensity interval training increase short-term muscle strength [Nathan J. de Vos N et al, 2005]

Depending on the intensities exercise can be divided into three categories i.e. light exercise, moderate exercise and vigorous exercise. Heart Rate is typically used as a measure of exercise intensity [Benjamin d levine, 2007]. Light exercise does not induce sweating unless it's a hot, humid day. There is no obvious change in breathing patterns, sleeping, writing, desk work. Very slow walking is example for this category. The moderate exercise raise heart rate, make breathe faster and feel warmer enough to start sweating after performing the activity for about 10 minutes. Breathing becomes deeper and more frequent. Bicycling, very light effort, calisthenics, home exercise, light or moderate efforts are some examples. The third category is of vigorous exercise that makes breathing hard, increases heart rate significantly and make hot enough to sweat profusely after 3-5 minutes. Breathing is deep and rapid. Examples for this type of exercise include running, jogging, jogging in place, calisthenics [e.g. pushups, sit-ups, pullups, jumping jacks], heavy vigorous effort, rope jumping etc.

Benefits of exercise

A regular exercise is very beneficial for good health. The various benefits of the health exercise are endurance, strength, balance and flexibility. Endurance, or aerobic, activities increase breathing and heart rate. They keep heart, lungs, and circulatory system healthy and improve overall fitness. For example walking or jogging, mowing, raking, digging. Strength

exercises make muscles stronger. This type of exercise includes lifting weights, using a resistance band with body weight. The lower-body strength exercises like standing on one foot improve balance. The flexibility exercise gives more freedom of movement for other exercises as well as for everyday activities. Some examples for that are shoulder and upper arm stretch, calf stretch and yoga [Mohammed Abou Elmagd, 2016].

Dietary requirements

A perfect diet is one that is healthy and provides adequate amount of water, carbohydrates, proteins, fats, dietary fiber, vitamin and minerals. Having a balanced and proper diet is very important for the persons indulged in exercises to get desired results in terms of physical fitness. According to World Health Organization [WHO] a person needs to get at least 60– 75% of total energy from carbohydrates, 10-15 % from protein and 15-20% from fats. The gym going person needs more energy to fuel exercise and training. The dietary needs include more complex carbohydrates, increase in dietary fiber, decrease saturated fat, adequate protein intake, decreased salt intake and increased fluid intake [Gulamhusein, 2020]. Whole cereal grains are a good source of carbohydrates, minerals and B-complex vitamins. In addition to the cereals the milk and milk based products and fruits are a good source of carbohydrates. The major sugar present in milk is lactose and the sugar present in fruits is fructose. Cereals and fruit and vegetables are also rich in dietary fiber. Milk and milk products, pulses, eggs and meat products are rich in proteins. Plant based oils are rich source of healthy fats i.e. unsaturated fatty acids. Saturated fats and the excess of proteins- should be avoided [Gulamhusein, 2020]. These types of fuels digest slower in your stomach and take away oxygen and energy-delivering blood from your muscles. The amount of calories and protein to be taken also depend on the gender, weight and height of the individual. Especially for carbohydrates the selection of the food source depends on whether the person wants to lose or gain weight. The selection of protein source depends on the aim of individual i.e. muscle growth or just muscle and skin toning.

When the stored glucose is inadequate in the individual's body, fat and muscle proteins, are consumed to produce energy. On taking the carbohydrates in enough quantity, protein is spared for repairing and rebuilding muscle tissues, which increases the muscle gain [Why You Need Carbs to Build Muscle, 2019]. For the gym going persons or the persons who are indulged in hard exercise their 35-45% of total energy should come from complex carbohydrates and 15-20% should come from simple carbohydrates. Simple Carbohydrates are needed after workout for quick recovery of glycogen stores, while complex are required before exercise. Near about 10-15% of the total calories should come from lean proteins for e.g. lean meats, fish, eggs and skim milk etc. The fat should contribute at least 25-30% of total calories intake and the majority of the dietary fat should come from unsaturated fatty acids and the intake of saturated fatty acids should be limited i.e. below 10% of total energy requirement.

Consumption pattern

Carbohydrates are the main source of energy and act as a fuel for the muscles. A lot of carbohydrates are consumed during the exercise. It is advised to maintain the adequate amount of energy balance during the exercise. Therefore, it is advised to eat a piece of fruit such as an apple or banana, or drink juice to provide the adequate amount of carbohydrates. A daily water intake of 3.7 L is recommended for adult men and 2.7 L is recommended for adult women [Sawka, Cheuvront & Carter, 2005]. This intake of water should be distributed in several small parts i.e. 15-20 ounce fluid 2-3 hours before exercise, 8-10 ounce fluid 10-15 minutes before exercise, 8-10 ounce fluid every 10-15 min during exercise and if exercising longer than 90 minutes, drink 8-10 ounce fluid of a sports drink [with no more than 8 percent carbohydrate] every 15 - 30 minutes [Quinn,

2019]. It is also advised to drink 20-24 ounce fluid water for every 1 libra/323 g lost after the exercise [Quinn, 2019]

FOOD CHOICES

Pre-workout foods

Several foods can be considered as pre-workout foods. These food choices are boiled sweet potatoes, oats and skim milk with nuts and raisins, peanut butter sandwich, fruits like banana etc. Sweet potatoes help in stabilizing blood glucose levels, provide sustained release of energy, and are rich in antioxidants and magnesium. Oat, milk and nuts are good sources of protein and also have low glycemic index. Banana is a sustained source of energy with low to medium glycemic index. It is also rich in potassium and plays an important role in maintaining nerve and muscle function.

Table 1: Energy Requirements for sports and gym going people.

Sl.no.	Type of activity	Average body weight [Kg]	Energy Kcal/Day	Total energy requirement [Kcal/day]
	Power events of higher weight category:			
1	Heavy weight lifting, Boxing, Wrestling, Judo, etc.	80-90	70	6000
2	Endurance events: Marathon, Road cycling, etc.	60-70	80	5200
3	Team events and power events of middle weight categories: Hockey, Football,Sprint running, etc.	60-70	70	4500
4	Events of light weight categories: Gymnastics, Table Tennis,etc.	60	60	3600

[National Institute of Nutrition, 2020]

Selection of the foods

The food pyramid is depicted in Figure 1. It is the pictorial explanation of nutritional approach showing guidelines of the foods to be consumed in appropriate quantities by athletes [Mettler, 2010]. Following the integration of volume and depth of a range of workouts, the additional power requirements are divided into the different meals corporations of the pyramid [Melinda M. Manore, 2009].

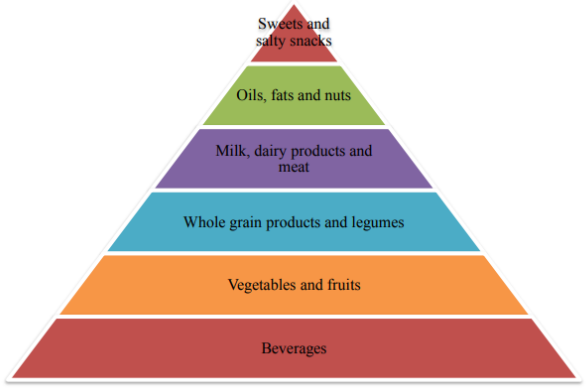


Figure 1: Food pyramid for athletes [Swiss Society for Nutrition, 2005].

Energy requirements before and after exercise

Larger meal ought to be taken 3-4 hours earlier than exercise, whilst smaller snack must be given 30 min in advance. Then, top up inside 15-60 min following exercise for desirable restoration and repair of muscle tissues [Guide to Exercise Nutrition, 2015].The carbohydrate requirement before and after exercise has been depicted in Table 2.

Table 2: Carbohydrate requirement before and after exercise

Duration	Carbohydrate intake
Pre-workout / before exercise	6-10 grams / kg of body weight
Post-workout / after exercise	1-1.5 grams / kg of body weight

[Pre- and Post-workout Nutrition for strength training, 2015]
Carbohydrate loading

The phenomenon of dietary moderation to increase glycogen storage in muscle fibers that can be approximately 3- 4 times the normal levels. Carbohydrate load is required in high intensity endurance exercise where there is great demand for glycogen in the body. It is also a type of supplementation that is carried out by endurance athletes. The procedure starts six days before the competition. For the 1st three days the athletes takes very less carbohydrate and does work out to use up the glycogen in the body. In the last three days – the athlete takes extra carbohydrates, the body will replenish the glycogen stores and top them up with a little bit extra [Carbohydrate Loading, 2020].

Food choices for carbohydrate loading

Energy bars

Energy bars, also recognized as snack bars, are healthy, suitable and ready-to-eat formulated snacks to supply nutrition in sufficient quantity [Ho et al., 2016]. These are dense and high quality cereal-based snacks which are instant energy providers with a good amount of fat, protein and carbohydrates [Gill and Singh, 2020]. The studies have reported that it contributes about 3-9 g of fat, 7-15 g of protein, 20-40 g of carbohydrates and 200-300 kcal energy per 100g [Tiwari et al, 2016]. The energy content of some of the energy bars is given in Table 3.

Table 3: Nutritional composition of some existing energy bars in the Indian market (per 100g.

S. NO.	Brands	Energy [Kcal]	Source
1	Rine on-the-go blueberry bolt granola bars	506.04	[Neulife]
2	On the run oats & apricot energy bars	447	[Wizbiker]
3	Clif chocolate chip energy Bars	367.6	[Calorieking, 2019]
4	Nourish vitals Granola snack bar [Cranberry & black Ccrrant]	388.91	[Amazon]
5	ASAP almond & dark chocolate granola bars	436.2	[Bigbasket]
6	Clif mojo bars	422.2	[Eat This Much]
7	Bar a day hearty bite standard energy bars	481.2	[BarADay, 2020]
8	Yoga bar multigrain energy Bars	436.8	[Fatsecret, 18]
9	Quest nutrition protein bars	316.6	[Indian BodyBuilding, 2018]
10	Probite energy bars	424	[Gill and Singh, 2020]

Protein requirements

Proteins are the building blocks of body which used to make muscles, tendons, organs and skin. They also act as enzymes, hormones, neurotransmitters and various tiny molecules that serve many important functions [Hoffman & Flavo, 2005]. They are the major structural component of muscle and other tissues in the body. Proteins are available in a variety of dietary sources. These include foods of animal and plant origins as well as the highly marketed sport supplement industry. Different animal sources of protein are egg, meat, fish and poultry. The protein obtained from animal sources is known as complete protein as it contains all the essential amino acids. The plant foods rich in proteins are soya, nuts, legumes, lentils and beans. A mixture of plant proteins from different sources can also serve as a complete and well balanced source of amino acid in the human diet [Rosen & Schweiggert-weisz, 2016].

Comparison of protein intake between normal persons and gym going persons

The recommended daily amount of protein for a healthy but sedentary person is 0.83 grams r kilogram of body weight [RDA, 2020]. Persons who don't eat meat may need 10% to 15% more protein intake to get same benefits as meat intakers can get [ICMR, 2020]. For gym going persons, the protein intake number is a little higher, depending on what type of exercise they are doing, and how much they are working out. If a person want to build muscle mass, increase strength, and boost power or want to lose weight, then that person require protein closer to 2.0 grams per kg body weight. A person indulged in running, cycling and swimming falls in the middle category at requires protein in-between 1.2-1.6 grams/kg body weight [Peter, 2015]. Generally, the recommendation for gym going person is 1.2 grams of protein per kilogram of bodyweight and can be increased to 2 grams per kilogram of bodyweight depending on the exercise [Gunnars, 2018].

What is the right time to take the proteins?

Protein supplements are some of the most popular supplements on the planet. People use them for a variety of reasons, including building muscles, losing weight or simply improving their overall health and wellness. However, many people wonder about the best time to take them [Ryan, 2018]. The best time for the intake of proteins can be decided on the basis of the specific goals. Some of these are discussed in detail in the under given heads.

WEIGHT LOSS

Consuming protein rich food between meals is ideal for fat loss. It may help curb hunger, which could leads to fewer calories later in the day. During weight loss high protein foods are recommended For example boiled meat, oats, chicken soup, soya chunks, boiled pulses, boiled eggs etc. High protein food fills the stomach of a person due to which losing weight is easy. Mostly protein intake for losing weight is between the meals so that calories can be maintained. Protein promotes greater satiety than either carbohydrates or fat, making people feel fuller and more satisfied for a longer period of time. As a result, they can better control their appetite and eat less [American journal of clinical nutrition, 2015].

Building muscle

Two studies of building muscles in the International journal of sport nutrition and exercise metabolism and the journal of the International society of sports nutrition suggest there is no relation between building muscle and the timing of consuming protein [Marengo, 2019]

Preventing muscle loss

To help prevent muscle loss at least 25–30 grams of proteins must be consumed per meal [Ryan, 2018].

Exercise performance and recovery

Endurance athletes may see improved performance and recovery from taking protein with a source of carbohydrates during and after exercise. Resistance-training athletes can benefit from taking protein either immediately before or after a workout [Ryan, 2018].

Specific amino acids requirements

Both animal and plant based protein is made up of about 20 common amino acids. The proportion of these amino acids varies as per characteristic of a given protein, but all food proteins—contain some of each. Amino acids are required for the synthesis of body protein and other important nitrogen-containing compounds such as creatine, peptide hormones, and some neurotransmitters [Dreu wrest, 2005]. Plant or animal proteins we eat once digested release the amino acids, our cells reassemble them to produce human proteins such as hair, skin, muscle etc.

Amino acid: ergogenic theory

Amino acids are theorized to enhance performance in a variety of ways, such as increasing the secretion of anabolic hormones, modifying fuel use during exercise, preventing adverse effects of overtraining, and preventing mental fatigue. The following discussion highlights research regarding the ergogenic effects of individual amino acids, various combinations of amino acids, and several special protein dietary supplements [Mihaela Apostu, 2014].

Tryptophan

Tryptophan (TRYP), is a precursor for serotonin, a brain neurotransmitter theorized to suppress pain. Free tryptophan (fTRYP) enters the brain cells to form serotonin. Thus, tryptophan supplementation has been used to increase serotonin production in attempts to increase tolerance to pain during intense exercise [Williams, 2005]. The recommended dietary TRYP daily doses for human adults ranges from 250 to 425 mg/day, corresponding to 3.5–6 mg kg−1 [meanly 4 mg kg −1] body weight per day [Palego, Betti,Rossi and Giannaccini, 2016]. The various dietary sources of tryptophan are oats, bananas, milk, cottage cheese, meat, fish, turkey, peanuts etc.

Branched chain amino acids [BCAA]

Branched chain amino acids [BCAA]- leucine, isoleucine and valine are essential amino acids which are metabolized directly in muscles and offer energy fuel for the performance of the work. The minimum and maximum dose of BCAAs is not established, but the daily recommended amount of leucine: isoleucine: valine is in a ratio 40:20:20 mg/kg body weight [Brestensky, Nitrayova & Patras, 2015] . Some investigators believe that increased levels of serotonin may cause fatigue. During prolonged aerobic endurance exercise, muscle glycogen may become depleted and the muscle may increase its reliance on BCAA for fuel, decreasing the plasma BCAA: fTRYP ratio. Because BCAA compete with fTRYP for entry into the brain, a low BCAA: fTRYP ratio would facilitate the entry of fTRYP to the brain and the formation of serotonin [William, 2005]. The BCAAs serve as a substrate for protein synthesis either energy production and perform several metabolic and signaling functions as well, particularly via activation of the mammalian target of rapamycin [mTOR] signaling pathway [Holecek, 2018].

Glutamine

Glutamine is a five-carbon amino acid that is found in the human body at relatively high levels. In fact, glutamine is the most abundant non-essential amino acid in human plasma, with normal plasma concentrations ranging between 500 and 750 µmol/L [Jacobs, 2008]. The recommended dose of glutamine is 0.3-0.5g/kg bw/day [Wernerman, 2011]. Best time to take glutamine is just before or after training. It can also be taken before bedtime. It is good to take it with a small portion of food or mix it in the protein. Glutamine should also be taken during non-training days as it is important for muscle generation and to maintain metabolism. When taking glutamine, it is also recommended to consume vitamin B, which regulates its production in the body. After exercise, individuals must consume one of the three drinks i.e. 1.18.5% glucose polymer solution, 2.18.5% glucose polymer solution containing 8g of glutamine 3.A placebo containing 8 g of glutamine [Coqueiro, Rogero & Tirapegui, 2019].

Aspartates

Potassium and magnesium aspartates are salts of aspartic acid, an amino acid. They have been used as ergogenics, possibly by enhancing fatty acid metabolism and sparing muscle glycogen utilization or by mitigating the accumulation of ammonia during exercise [Williams, 2005].

Arginine

Arginine supplementation may be theorized to be ergogenic because it is a substrate for nitric oxide [NO] synthesis, a potent endogenous vasodilator that may benefit blood flow and endurance capacity [Williams, 2005]. Arginine, a semi-essential amino acid, it is involved in numerous areas of human biochemistry, including ammonia detoxification, hormone secretion, and immune modulation [Appleton, 2003].

Ornithine, Lysine and Arginine

Ornithine, lysine and arginine have been used in attempts to increase human growth hormone [HGH] production, the theory being to increase lean muscle mass and strength [Fogelhom, 1993; Wiiliams, 2005].

Tyrosine

Tyrosine is an amino acid that the body produces from phenylalanine. Supplementing with it is thought to increase important brain chemicals, which affect your mood and stress response [Walle, 2018].

Taurine

Taurine is classified as a conditionally essential amino acid. It serve various important functions in human body [Mawer, 2018]. Taurine exerts most of its benefits vicariously through other compounds in the body, but exerts some of its own on a cellular level [Patel, 2020].

Should protein be taken before bed or not?

Taking protein before bed may be an effective strategy to help build muscle, increase strength and improve exercise performance and recovery. Elderly people looking to preserve muscle mass may also benefit from taking protein before bed [Ryan, 2018].

Protein digestibility corrected amino acids score [PDCAAS] of some protein sources

The protein digestibility–corrected amino acid score [PDCAAS] has been adopted by FAO/WHO as the preferred method for the measurement of the protein value in human nutrition. The method is based on comparison of the concentration of the first limiting essential amino acid in the test protein with the concentration of that amino acid in a reference [scoring] pattern [Schaafsma, 2000]. The PDCAAS scores for some of the common food is provided in Table 4.

Table 4: PDCAAS Scores for some common protein rich foods.

S.no.	Protein sources	Protein content [per 100g]	PDCAAS value
1.	Meat	26g	0.92
2.	Beef	26g	0.92
3.	Soya	36g	1.00
4.	Lentil	9g	0.63
5.	Peanuts	26g	0.52
6.	Milk	3.4g	1.00
7.	Egg	13g	1.00
8.	Black beans	21g	0.75
9.	Seafood	29g	0.92
10.	Oats	13.15g	0.57

[Schaafsma, 2000; Vliet, burd & loon, 2015]

PROTEIN SOURCES

Whey protein

Whey is a dairy-based protein which contains all the essential amino acids and is absorbed easily in the body. It contains a higher proportion of indispensable amino acids [IAA] and has greater bioavailability, solubility and concentration of branched amino acids [BCAA] compared to other sources. Its high leucine concentration makes whey an optimal protein source to maximize muscle protein synthesis [MPS] [Naclerio & Seijo, 2019]. Primarly three types of whey proteins are available in the market. These are whey Protein Concentrate (WPC), whey protein isolate (WPI) and whey protein hydrolysate (WHP). WPC is rich in protein and contains low levels of fat and carbohydrates. Lower end concentrates contain around 30 percent and higher end concentrates include up to 90 percent protein. WPI is further refined to remove fat and lactose. This type of whey protein usually contains 90 percent protein content. WHP is a predigested form of whey protein as it undergoes a process, called partial hydrolyzes, which helps absorb it faster in the body [Gangurde, Patil, Chordiya & Baste, 2020].

Casein protein

Casein is the main proteinaceous component of milk, where it accounts for 80% of protein inventory. The amount of casein protein varies from cow's breed and stage of lactation but is generally in the range of 24-29g/L [Petrotos, Tsakali & D'alessandro, 2014]. Similar to whey casein is the complete protein and also contains the minerals and phosphorus. Casein has PDCAAS rating of 1.23 [Hoffman & flavo. 2004]. As it is a dairy-based protein and also contains all the essential amino acids and is absorbed slowly, due which people prefer to eat before going to bed at night.

Soy protein

It is a plant based protein which contains all essential amino acids. It has various health benefits. Soy protein products are used as ingredients formulated with foods. They mainly consist of four broad categories. Many soy proteins are derived from "white flakes" which is made by dehulling, flaking, and defatting soybeans by hexane extraction. The defatted flours or grits contains 50-54% protein [Lusas & Riaz, 1995]. Full fat products are made in enzymes-active and in toasted forms. Various dried soy foods, including soy milk and tofu, are produced and the mixture of soy proteins with cereals, dried milk, stabilizers and emulsifiers are offered for specific baking, whipping, breading etc. [Lusas & Riaz, 1995]. Pea protein

It is a plant-based protein. Pea protein shows promise in filling this niche because it is gluten-free, nutritious, and has low allergenicity [Lam, karaca, tyler & Nickerson, 2016]. Pea protein is derived from ground yellow split peas by the mechanical process. This allows the pea protein to also retain soluble fiber, which is known to provide many benefits to both cardiovascular and gastrointestinal health [Krefting, 2020].

Rice protein

It is also a plant-based protein. Although cereal proteins are deficient in lysine, rice protein has the highest lysine content among cereals. The amino acid score of milled rice is 65% [Hoogenkamp, Kumagai & Wanasundara, 2017] .

Hemp protein

A plant-based protein made from hemp seeds that have high levels of fiber and essential omega-3 and omega-6 fats. Hemp protein is low in the amino acid lysine [Malomo, Rong & Aluko, 2014].

FAT REQUIREMENTS

Healthy fats are needed in diet as they help in metabolism and increase testosterone levels. Some of the lipids are also responsible for building muscles. They also help internal health and are good for the brain and other organs. Bodybuilding diet should include 20 to 30% calories from fat [Ann G. Liu et al, 2017]. Fats provide 9 kilocalories of energy per gram.

Fat classification

The fats are divided into the saturated fatty acids and unsaturated fatty acids. Body can produce saturated fats on its own, so, there are no dietary requirements for saturated fat. Saturated fat tend to be solid at room temperature and can be found in animal, dairy and packaged food products in addition to coconut and palm kernel oils. A diet high in saturated fats could be a risk factor for heart disease, therefore only 5-6% saturated fat is recommended. Unsaturated fats contain double carbon bonds with fewer hydrogen molecules. Unsaturated fats are liquid at room temperature. Fatty acids with one double carbon bond are called monounsaturated, while fatty acids with two or more carbon bonds are polyunsaturated.

Sources of healthy fats

Monounsaturated fats are found in olive, peanut and canola oils. Polyunsaturated fats include the essential [meaning they must be consumed in the diet] omega-3 fatty acids found in many types of cold water fish and omega-6 fatty acids which are found in soybean, corn and safflower oils [and foods made with those oils]. Other foods that contain poly and monounsaturated fats include avocados, flax and chia seeds, almonds, olives, walnuts, almonds, and flax seeds.

Fats before exercise

Fats before exercise don't appear to improve nor diminish sport performance. And they don't seem to fuel performance. Help to slow digestion, which maintains blood glucose and insulin levels and keeps on an even keel. Provide some vitamins and minerals, and they're important in everyone's diet. But an individual should try to avoid eating fats during exercise. Because fats can be more difficult to digest during training [B St. Pierre, 2014].

Essential fatty acids

Essential fatty acids [EFAs]: cis-linoleic acid [LA] and alpha-linolenic acid [ALA] are essential for humans but their deficiency is rare in humans due to their easy availability in diet. Essential fatty acids are metabolized to their respective long-chain metabolites: dihomo-gamma-linolenic acid [DGLA], arachidonic acid [AA] from cis-linolenic acid [LA], and eicosapentaenoic acid [EPA], docosahexaenoic acid [DHA] from alpha-linolenic acid [ALA] [Undurti Das, 2007].

Sources

Cereals, eggs, poultry, most vegetable oils, whole-grain breads, baked goods, margarine, sunflower, saffola, and corn oils are good sources of linolenic acid. Canola oil, flaxseed oil, linseed, rapeseed oils, walnuts, and leafy green vegetables are good in alpha-linolenic acid. Human milk is rich in EFAs, GLA, DGLA, AA, EPA, and DHA. Olive oil is rich in Omega acids, whereas palm and coconut oils contain virtually none. The average daily intake of EFAs, in general, is around 7-15 g/day in Europe and USA. Human milk contains 0.3-1.0% of its fat as GLA. Thus, breast fed babies get significant amounts of GLA. Evening primrose oil [EPO], borage oil, black currant oil, and hemp seed oil contain substantial amounts of GLA. GLA is present in Evening primrose oil at concentrations of 7-14% of total fatty acids, in borage seed oil it is 20-27% and in black currant seed oil at 15-20%. GLA is also found in some fungal sources. Moderate amounts of dihomo-gamma-linolenic acid are found in human milk, liver, testes, adrenals and kidneys [Das, 2006].

Fat consumption for normal and gym going people

The total fat [visible + invisible] in the diet should provide atleast 20-30% of total calories. Visible fat intake in the diets can vary up to 50g/person/day based on physical activity and physiological status. Adults with sedentary lifestyle should consume about 25 g of visible fat, while individuals involved in heavy workout require around 30-40g of visible fat [NIN, 2011].

Important points for fat selection

Use fats and oils in moderation and consume varieties of foods to get good proportion of all fatty acids for optimal health benefits. Animal foods rich in fat, saturated fatty acids and cholesterol should be taken in moderate amount. Limit the use of ghee, butter, especially vanaspati as cooking oil. Always choose low fat dairy foods instead of regular whole fat dairy foods. Eat foods rich in alpha-linolenic [ALA] acid such as legumes, green leafy vegetables, fenugreek and mustard seeds.

Eat fish more frequently [at least 100-200g /week], prefer meat, poultry and limit organ meats such as liver, kidney, brain etc. The consumption of eggs should be limited to 3 eggs/week as they are high in cholesterol. However, egg white may be consumed in good amounts. Minimize consumption of ready-to-eat fast foods, bakery foods and processed foods prepared in hydrogenated fat [NIN, 2011].

The amount of fat present in different food items is tabulated below in Table 5.

Table 5: Alpha- linolenic acid [Omega-3] content in foods [g/100g].

S No.	Foods	Alpha-linolenic acid [gram]
1	Cereal, Millet, Wheat, Bajra	0.14
2	Pulses and Blackgram, kidney beans, cowpea	0.5 and 0.16
3	Vegetables and Green leafy, other vegetables	0.16 and 0.025
4	Fruits	0.025
5	Spices and Fenugreek seed, mustard	2.0 and 10.0
6	Unconventional and Flaxseed, perilla seeds	20.0 and 33.0

[National Institute of Nutrition, 2011]

VITAMIN REQUIREMENTS FOR SPORTS AND GYM GOING PERSONS

Nutritional vitamins are one of the key micronutrients required to execute many critical characters in the human body. It has been established that nutritional vitamins have really helpful consequences on the people working in a warm environment [Clarkson, 1993]. Vitamins play a key feature in the body like enhancing performance, keeping bones healthy and turning foods into energy [Academy of Nutrition and Dietetics, 2018]. The functions of various vitamins are discussed in Table 6.

Table 6: Role of vitamins in performance.

Vitamins	Role in performance	Sources	References
Fat-soluble vitamins			
Vitamin A [Retinol, Retinal or Retinoic acid]	Besides role in vision, vitamin A also act as an antioxidant, particularly during endurance training. Intense physical activity puts stress on bones and joints, and this vitamin promotes bone health	Animal sources – Eggs, liver, fish and cream. Plant sources – Red palm oil, non-citrus fruits [yellow, orange and red] like, bananas, root crops, carrots, squash, pumpkin and dark green leafy vegetables [GLV].	[Greiner, 2013] [Englberger et al., 2003] [Klemm, 2018]
Vitamin D [Calciferol]	This vitamin plays a vital role in maintaining the good health of bones, and extra skeletal functions, including skeletal muscle growth and inflammatory modulation, to influence athletic performance.	Fatty fish – Salmon and tuna. Egg yolk, beef liver, cheese, mushrooms. Fortified – Soymilk, almond milk, icecream, cheese, yogurt, etc.	[Vitamin D Fact Sheet for Consumers, 2020] [Yagüe et al., 2020]
Vitamin E [Alpha To copherol]	This vitamin is vital for athletes as it prevents oxidative damage resulting from exercise. It aids in promoting a healthy immune system right after exercise and also helps to ease muscle cramps.	Sprouts, meat, sunflower oil, fruits vegetables.	[Vitamins, 2020] [PeaceHealth, 2015]
Vitamin K [Phylloquinone]	It is essential for blood clotting, bone mineralization, cell growth, and metabolism of blood vessel walls.	Milk and green leafy vegetables [Kale, broccoli, parsley, spinach, asparagus, lettuce] kiwi, avocado, pork liver and sausages.	[Food Sources of Vitamin K, 2014] [Volpe & Lucia, 2016, p. xx]
Water soluble vitamins			
Vitamin B [Complex]	Required for energy production for fueling and retrieving from workouts, and also aids in production of sufficient blood		[Graham, 2020, p.xx]

	cells for transporting oxygen to working muscles.		
VitaminB1 [Thiamine]		Dried brewer's yeast, tuna, pork, ham, nuts, pulses, whole grain cereals and potatoes.	[Vitamin B1, n.d.]
VitaminB2 [Riboflavin]		Chicken, eggs, turkey, cow's milk, yeast, whole grain cereals, cheese and beef.	[Rivlin and Pinto, 2001]
VitaminB3 [Niacin]		Organic [chicken, turkey and eggs] , nuts, legumes and cheese.	[Vitamin B3 and Stroke, 2010]
VitaminB5 [Pantothenic acid]		Beans, peas, mushrooms, nuts, broccoli, cabbage, lentils, potatoes, meats, poultry and dairy products.	[Vitamin B5 [Pantothenic Acid] , n.d.]
VitaminB6 [Pyridoxine]		Fish, legumes, fortified cereals, avocados, bananas and potatoes.	[Stover and Field, 2015]
VitaminB7 [Biotin]		Peanut,buttermilk, condensed milk, dried whole milk, soybean and oat flakes.	[Nohr, Biesalski and Back, 2011]
VitaminB9 [Folic acid]		Beetroot, avocado, fenugreek, spinach, kale, beans, seafood, poultry, dairy, fruits and their juices.	[Vitamin9 [Folicacid] , 2020]
VitminB12 [Cobalamine]		Salmon, chicken breast, eggs, ham, fortified cereals, skim milk, low fat yogurt and tuna.	[The A list of B12 foods - Harvard Health, 2018]
VitaminC [Ascorbic acid]	This vitamin is vital for athletes as it prevents oxidative damage resulting from exercise.	Black current, baobab, orange, berries, pomegranate, apple and banana.	[Devaki and Raveendran, 2017] [PeaceHealth, 2015]

Table 7: Role of vitamins in TCA cycle.

Vitamins	Function in energy metabolism
VitaminB1 [Thiamine]	It acts as a cofactor to get energy from carbohydrates in the phenomenon of TCA cycle. It is needed for normal functioning of muscles, including the cardiac muscles.
VitaminB2 [Riboflavin]	It acts as a coenzyme in the chain reaction, to aid in releasing the energy from foods. It is also acts as an element of the principal coenzymes FAD and FMN in the Krebs cycle.
VitaminB3 [Niacin]	It also aids in releasing energy from foods by acting as cofactor in the respiratory chain reaction.
VitaminB5 [Pantothenic acid]	It also plays an essential role by acting as cofactor in the Krebs cycle.
VitaminB6 [Pyridoxine]	It is used as cofactor to release energy from foods, mainly in protein and amino acid metabolism.
VitaminB7 [Biotin]	As a cofactor, it is involved in the metabolism of fatty acids, amino acids and utilization of B vitamins.
VitaminB9 [Folic acid]	It is vital for metabolic pathways and acts as cofactor to carry one-carbon [C1] units for the synthesis of thymidylate, purines and methionine, and for other methylation reactions.
VitaminB12 [Cobalamine]	It is essential for the metabolism of fats and carbohydrates, and for the synthesis of proteins. As a cofactor, it also interacts with folic acid metabolism.
VitaminC [Ascorbic acid]	It is a potent antioxidant which transports long-chain fatty acids into mitochondria. It also facilitates transport and uptake of

non-haem iron, and the reduction of folic acid intermediates.

Hematopoietic vitamins

These include the vitamins needed for the formation of erythrocytes [RBCs] to transport carbon dioxide and oxygen in the body. The process of this production of red blood cells is known as Hemopoiesis. The vitamins involved in this phenomenon are as follows

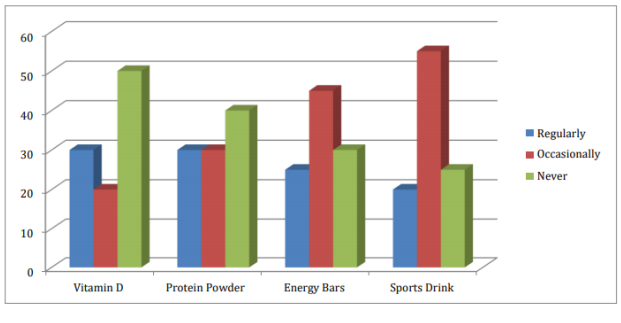
Table 8: Vitamin requirements for sports and gym going people.

S. NO.	GENDER	B1	B2	B3	B6	B9	B12	C	A	D
		[mg/d]	[mg/d]	[mg/d]	[mg/d]	[µg/d]	[µg/d]	[mg/d]	[µg/d]	[IU/d]
1	Men	2.43	3.6	25.3	3.42	315.3	2.83	85.4	1052	611.4
2	Women	2.32	3.41	19.4	2.6	234.3	2.76	69.4	892	606.3

[Madden, Shearer, & Parnell, 2017]

Supplement use

Gym going or sports people consume various supplements according to their needs, either regularly or occasionally. The graph given below shows the percentage of these people from [0-100] % on the basis of different supplements consumption.



[Madden, Shearer, & Parnell, 2017]

WHY MINERALS ARE NECESSARY FOR ATHLETES AND SPORT PERSON?

Minerals are the micronutrients required for various metabolic and physiological processes that occur in the body. They are of two types: macro minerals and micro minerals. These are important for athletes as they aid in muscle contraction, adequate oxygen transportation, maintenance of bone density, normal heart rhythm and pH of the blood. When we do certain type of physical activity our body parts goes in overusing phase to minimal the overuse of the certain mineral that helps the athlete to perform activity constantly.

Role of various minerals in sports and exercises

Calcium It help in good muscle contraction because nerve impulses stimulate muscles to contract by pumping calcium in and out of the cells — a process known as the calcium pump. Low calcium levels are often thought to contribute to cramps [saltstick.com, 2020] Zinc plays a cellular preservation role to maintain current muscle. Zinc also acts as antioxidant in body which helps in preventing breakdown of cells due to free radicals. It also boosts up immune system during illness which is responsible for stopping muscle loss. Hemoglobin grabs hold on the oxygen, as red blood cells transport the oxygen to muscles and other tissues during exercise. Hemoglobin also transports carbon dioxide back to the lungs. Too little iron in the diet can result in iron-deficiency anemia, as well as impaired oxygen and carbon dioxide transport. This, in turn will hamper the ability to train and compete [www.nestlenutrition-institute.org › publications › secured]. Magnesium is related to recovery and performance because magnesium regulates gamma amino-butyric acid [GABA]. This neurotransmitter relaxes the brain and gives calming effect to body. Potassium is helpful in maintaining pH.

Mineral Supplement

The need of supplement arises in the case of deficiency or in the case of diet management. Usually supplements are given in emergency situation, where food cannot fulfill the requirements.

Popular Mineral Supplements

ZMA

A study performed at Western Washington University (Bellingham) had NCAA football players take ZMA or a placebo every night during an eight-week spring training program. They reported that the athletes taking the ZMA supplement experienced more than a 30-percent increase in testosterone levels, and about a 5-percent increase in levels of the insulin-like growth factor 1 (IGF-1).* Those taking a placebo had a 10-percent decrease in testosterone levels and a greater than 20-percent decrease in levels of IGF-1.f zinc mono-methionine aspartate combined with magnesium-aspartate and Vitamin B6 [pyridoxine] when given to training athletes resulted in 43.7% higher testosterone levels and 25% greater IGF-1 levels, as well as a 2.5 times greater strength. Taking this supplement over a period of eight weeks gave the subjects higher testosterone levels and greater strength than the normal people not taking ZMA [www.bodybuilding.com › Nutrition › Supplementation].

Selenium

It exerts its beneficial effects by combining with proteins to make selenoproteins. These selenoproteins are essentially antioxidant enzymes (glutathione peroxidase specifically), with antioxidant properties, which help to prevent cellular damage resulting from free radical build-up.

Protection Against Arthritis

Sufferers of arthritis have been found to have reduced selenium levels in their blood. Arthritis, a chronic disease that causes

pain, stiffness, swelling, and loss of function in joints, often results from excessive free-radicals made by the immune system in response to invading organisms. 10 Thus, controlling free-radicals with the help of selenium might relieve the symptoms of arthritis (https://www.bodybuilding.com/fun/drobson82.htm)

Water requirement for gym going persons

Water is an important nutrient for all forms of life and the mechanisms by which fluid and electrolyte homeostasis is maintained in humans is well understood [Grandjean, 2005]. When we speak of water we are essentially focusing first and foremost on types of water, are they soft or hard, spring or well, carbonated or distilled water. Furthermore we get water not only directly as a beverage but from food and to a very small extent also from oxidation of macronutrients [metabolic water]. The proportion of water that comes from beverages and food varies with the proportion of fruits and vegetables in the diet [Popkin, D'anci & Rosenberg, 2011]

Every cell, tissue and organ in our body needs water to work properly, get rid of wastes through urination, perspiration and bowel movements, keep temperature normal, lubrication and cushioning of joints, protect sensitive tissues [Mayo, 2020].

Recommendations for water consumption

A daily water recommendation is 3.7 L for adult men and 2.7 L for adult women. However, strenuous physical exercise and heat stress can greatly increase daily water needs, and the individual variability between athletes can be substantial [Sawka, Cheuvront & Carter, 2005] However, there is no one universal hydration strategy that athletes can utilize to mitigate dehydration- associated performance declines because each individual sweats at a different rate and loses a unique amount of sodium through this sweat [Popkin, D'anci & Rosenberg, 2011] .

Water intake before, during and after exercise

During exercise, it is necessary to recover the fluid which is lost in sweat, because even a low dehydration, 2% of body weight, can significantly affect the trainer. The loss of every 0.5 kg of body weight as a result of exercise is a waste of about 500 ml of fluids and consumption of the same amount is required for the preservation of hydration. Thus, fluid intake during exercise should keep up with fluid loss through sweating [Okanović, lić-Udovičić, Džinić & Jokanović, 2014] .

Before training-Always start training at full hydration by drinking small amounts of liquid. For hydration before exercise one must drink about 15-20 fl oz, 2-3 hours before exercise and 8-10 fl oz 10-15 min before exercise. To keep the body hydrated during exercise the person must drink 8-10 fl oz water every 10-15 min during exercise. If exercising longer than 90 minutes, it is advised to drink 8-10 fl oz of a sports drink [with no more than 8 percent carbohydrates] every 15 - 30 minutes. For hydration after exercise the person must weigh him before and after exercise and replace fluid losses and should drink 20-24 fl oz of water for every 1 lb lost. Consume a 4:1 ratio of carbohydrate to protein within the 2 hours after exercise to replenish glycogen stores [Quinn, 2019]

WHAT KIND OF DRINKS CAN BE TAKEN DURING EXERCISE?

Pure and cold water for regulation is advised. Cold water is absorbed faster than the water at room temperature; it not only cools the blood but also controls the body from overheating. Almost all compounds added to the water slow its absorption. When there is an urgent need, then pure distilled water is best to drink. In endurance sports, often practice is to mix liquids which hydrate the body, such as in cycling where often two bottles are used, in former just pure water, whereas in the latter some other kind of liquid that fits best for the athlete [Okanović, lić-Udovičić, Džinić & Jokanović, 2014] .

Table 9: Some of the natural drinks to replace the water.

Natural drinks instead of water	
Coconut water for post-workout contains	High levels of potassium and magnesium, Lots of antioxidants and nutrients, Less sodium than sports drinks
Cherry juice for	Aids in anti-inflammatory response
post-workout	Decreases muscle damage, Prevents strength loss
Tea for post-workout	Is effective in fat oxidation, Reduces muscle soreness, Recovers muscle strength

Table 10: Some sport drinks available in the market

S.No.	**Best sports drinks sources that are available in the market**
1	BODYARMOR LYTE Sports Drink Low-Calorie Sports Beverage, Berry Punch, Natural Flavors With Vitamins, Potassium-Packed Electrolytes, No Preservatives, Perfect For Athletes, 16 Fl Oz. Amazon.com
2	POWERADE ZERO, Zero Calorie Electrolyte Enhanced Sports Drinks, Mixed Berry, 20 fluid once, Amazon.com
3	Tailwind Nutrition Lemon Endurance Amazon.com

	Fuel 30 Serving - Hydration Drink Mix with Electrolytes, Carbohydrates - Non-GMO, Gluten-Free, Vegan, No Soy or Dairy	
4	SKRATCH LABS Sport Hydration Drink Mix, Lemon Lime [20 single serving packets] - Natural, Electrolyte Powder Developed for Athletes and Sports Performance, Gluten Free, Vegan, Kosher	Amazon.com
5	Gatorade Classic Thirst Quencher, Variety Pack, 12 Fl Oz [Pack of 24]	Amazon.com

Sports drinks play an important role in hydrating, helps in improving athletic performance, and in preventing diseases. They are designed specifically to increase energy, to improve mental focus and to prevent bone and joint pain. The principal function of such drinks is to hydrate athletes and restore the electrolytes, carbohydrates [CHO] and other nutrients which can be reduced during exercise. Sports drinks are developed by essential electrolytes like sodium, potassium, chloride, calcium, phosphate, and magnesium, which are lost by sweating during training [Role of Functional Beverages on Sport Performance and Recovery, 2018].

During exercise, sports drinks also have a negative impact in few situations; it is generally because of gastrointestinal distress rather than via another physiological mechanism. Provided appropriate quantities are consumed, drinking plain water is generally better than drinking nothing at all, but drinking a properly formulated carbohydrate electrolyte sports drink may allow for an improved exercise performance with benefits being gained from both its carbohydrate content and the water and electrolyte content [Shirreffs, 2009]

TIPS TO STAY HYDRATED

Avoid exercising outdoors during the hottest hours of the day and carry water with you during your workout. The fluids lost must be replaced immediately and the drinks like caffeine which cause dehydration should be avoided.

CONCLUSION

Eat To Win: diet, physical activity, and weight control. It is particularly important to use physical activity in combination with dieting as a means of achieving and maintaining a healthy weight. Physical activity can impact on our appetite and diet, exercise can influence fat metabolism. Effective eating and drinking strategies to optimize sport and exercise performance.

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