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Development of gluten-free energy bars

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Abstract
Energy bar was prepared with dried fruits, seeds, oats, dates powder, and jaggery powder with varying levels of sweeteners (45, 50, and 55%) to deliver nutritious food to the consumer. The developed bars were evaluated for textural, color, nutritional quality, sensory attributes, and total microbial load. Different levels of flaxseed and sweeteners significantly affected the hue and chroma values of the energy bar. In general, the level of flaxseed in the energy bar did not affect the hardness but it was decreased with increasing levels of sweeteners except in the control sample. The total calories obtained from the energy bar showed a significant increase with the increasing levels of flaxseed, the maximum (397.95 kcal) being for bars with 20% flaxseed and 45% sweeteners. This energy bar sample also showed the maximum protein (12.41%), crude fat (11.86%), ash (1.65%), iron (3.77 mg/100 g), crude fiber (2.18, %) and omega-3 as alpha-linolenic acid (22.50%, fatty acid basis) content. The overall mean sensory score for overall acceptability for samples with 10% flaxseed and 55% sweeteners and 15% flaxseed and 45% sweeteners were at par but the omega-3 and other nutrients in the latter sample were higher than the former sample, hence, 15% flaxseed and 45% sweeteners along with other ingredients may be considered for the production of acceptable quality omega-3 fatty acid-rich energy bar at commercial scale, which also stored well at refrigerated condition.

Keywords: Sweeteners, energy bars, flaxseed, omega-3 fatty acid, free fatty acid, sensory evaluation, nutrition, food composition

1. Introduction
Energy bars are an excellent option for breakfast or sports workouts. The variety of dry fruits, seeds, and soluble and insoluble dietary fiber in the bar, composition allows for their easy adoption into a diet as a source of slowly digestive carbohydrates, micro, and micronutrients. The inclusion of natural sweeteners such as dates powder and jaggery powder, dried fruits, dry mango, kiwi fruit, and cranberry, increased the energy value of bars.

Energy bars provide the majority of their food energy in carbohydrates. Energy in food comes from all three main sources – fat, protein & carbohydrates but mostly from carbohydrates. To provide energy quickly, most of the carbohydrates are various types of jaggery powder and dry dates powder like fructose, glucose, dextrose, and others in various ratios. Energy bars are supplemental bars containing dry fruits and other high-energy foods targeted at people that require quick energy but do not have time for a meal. *The first energy bar* in the *American* marketplace was space food sticks which *Pillsbury* company created in late 1960 for the space program. The energy bar is mixed with jaggery and other ingredients such as dry fruits and dry dates powder to produce several locally marketed and consumed delicacies by its color. A healthy diet is required for the well-functioning of the body of an individual but due to certain circumstances often people niggled consuming essential nutrients and rather than healthy eating they to eating junk food or packaged chips etc. It is also because the options available in the market to buy healthy bars and food are very limited and more often most of the conveniently available food products and the healthiest food is too expensive, and not easily accessible. This issue observed we have developed an energy bar which a healthy all the junk foods and to satisfy that is not only healthy and nutritious but also delicious. The product is carefully made by using all-natural ingredients. Dates have endless benefits and contain a substantial amount of CHO, protein, vitamins, high fiber, and antioxidants. Jaggery is a great source of vitamins and minerals, energy making it comparatively heal they're than white sugar. It is a type of sugar. Other dried fruits used are muskmelon seeds, pumpkin seeds, flake seeds, almonds, cashew, walnut, oats, sesame, chironji, peanuts, dates, and jaggery powder, kiwi fruits, cranberry, mango, etc. Which are everyday dried fruits one should never skip.

These nuts are known to be the powerhouse of goodness and are also considered brain fruits. These nuts help in maintaining healthy cholesterol levels and also maintain normal blood pressure. Seeds like flaxseed, sesame seed, pumpkin seeds, muskmelon seed, and oats which are present in the energy bar add to the overall nutritional profile. Seeds are a great source of vegetarian protein and energy, healthy fats, fiber, and antioxidants.

Energy bars are healthy, convenient, and proportioned snacks, providing nutrients in adequate amounts (Ho *et al*., 2016). Also known as snack bars, they are usually marketed as 'ready-to-eat' formulations that are based on whole cereal grains (Svisco *et al*., 2019) [49]. Energy bars are dense and portable foods were fat, protein and carbohydrates are the primary sources of calories. Thus, they boost energy levels on consumption and can often replace a meal (Tiwari *et al*., 2016) [50]. Reported that an energy bar (45-80g) supplies about 200-300 kcal (840-1,300kj), 3-9g fat, 7-15g protein, and 20-40g carbohydrates. Approximately ninety percent of Australians regularly consume confections such as energy bars (Williams, 2006) [52]. Mainly consumers such as athletes and sportspeople, who do not have adequate time for a full meal, require energy bars as a quick source of energy. However, people on a diet and individuals with nutritional problems or irregular meals can also utilize energy bars for nourishment. Snack bars are highly versatile foods and confer nutritional benefits (high-quality proteins, polyunsaturated fatty acids, minerals, vitamins, and fiber) apart from necessary energy. They are convenient and are available in easy-to-store and carry packages.

Studies report that energy bars can act as good carriers of healthy nutrients, bioactive compounds (such as phytochemicals and essential fatty acids), and dietary fiber. Thus, it is an edible food commodity potentially able to be classified under the category of functional foods, such foods are known to private additional health benefits apart from original nutrients, such foods can be developed by fortification and enrichment with other bioactive components. Therefore, modifications in product formulations and the adoption of new technologies in processing have allowed a significant improvement in the nutritional quality of bars and have allowed meeting consumer requirements as well. Many firms in the processed-food industry manufacture ultrprocesseded foods including cereal bars, snack bars, and candy bars which are prevalent among adolescents, because of enhanced desirability characteristics (flavor, color, and texture), convenience (portability, shelf life, and preparation time) and efficiency, the use of energy bars in the United States has rapidly increased owing to these important food environment characteristics. However, ultra-processes foods can potentially be largely composed of additives including synthetic colors, flavors, sweeteners, emulsifiers, and preservatives which can compromise food safety. Therefore, several attempts have been made to develop natural, nutritious, and cost-effective bars to ensure food quality as well (Ho *et al*., 2018, Mridula *et al*. 2011) [30]. Frying, molding, and hydrogenation are some techniques that are commonly involved in the processing of such food products (Svisco *et al*., 2019) [49]. Moreover, fortification of food with micronutrients is widely done and is important for meeting the RDA specifications set by the National Institute of Nutrition. The paper presents the study done to determine the availability, compositional differences, and economic value of the energy bars marketed by companies in India and the United States.

2. Ingredients & Nutritional Value

- **Pumpkin Seeds:** Pumpkin (Cucurbita) belongs to the family Cucurbitaceae generally grown in the regions of the globe as vegetables. These are grown up in cucumbers and squash. Worldwide there are three types of pumpkins present names "Cucurbita pepo" "Cucurbita maxima" and "Cucurbita moschata" (Wyrick, Jason *et al*., 2016) [53]. For the purpose vegetables and medicinal pumpkins are grown throughout the world. On many counts, ries the pumpkin has been conventionally used as a remedy in China, Pakistan, India, Yugoslavia, Argentina, Mexican regions, America and Brazil (Zhang, H *et al*., December 2019) [56]. The physical proportion was determined by an investigator and his colleagues who found that pumpkin seeds contained 41.59% oil, 25.4% protein, 5.2% moisture, 25.19% carbohydrates, 5.34% fiber, and 2.49% total ash. Total phenolic compounds, total sterols, waxes, and total tocopherols were 66.25% (mg gallic acid per kg oil), 1.86%, 1.56%, and 882.65(mg tocopherol per kg oil) respectively Ardabil (Stevenson, *et al*., 2007) [46].
- **Flaxseeds:** Flaxseed is one of the oldest crops, having been cultivated since the beginning of civilization. We, in India, have an amazing capacity to ignore our plant kingdom riches and consign them to the archives, till someone from the developed countries publishes exciting news about the medical and other uses of such things (D H Morris *et al*., 2007) [17]. There was so much one read about flax seeds, all the time. How useful they were, how best to take them, how Not to take them, the quantities, the various recipes, and so on. The Latin name of the fake seed is Linum usitatissimun, which means "very useful". Flake was first introduced in the United States by colonists, primarily to produce fibre for clothing (P Ganorkar *et al*., 2013). The protein content in flaxseed has been reported to be between 10.5% and 31%. Chatelain cultivars grown in India had a protein content of 21.9%. Differences in protein can be attributed to both genetics and the environment (M Rubilar *et al*., 2010) [32]. The proximate protein content of dehulled and defatted flaxseed varied considerably depending upon cultivar growth location content. The major protein in flax is albumin and albumin constitutes about 26.6% of total protein (Vaisey-Genser *et al*., 2003) [33]. Flake seed proteins are relatively high in arginine, aspartic acid, and glutamic acid, while lysine is limiting. High cysteine and methionine contents improve the antioxidant levels, thus helping in reducing the risk of cancer.
- **Almonds:** Almonds (Prunus Amygdalus) are one of the important stone fruit grown in Pakistan. It is also included in nuts according to its usage. Almond is a high-value crop and one of the most non-perishable nut fruit (Ahrens S *et al*., 2005) [2]. Almonds are 4% water, 22% carbohydrates, 21% protein, and 50% fat. In a 100-gram reference amount, almonds supply 2,420 kilojoules (579 kilocalories) of food energy (Muhammad S *et al*., 2015) [35]. The almond is a nutritionally dense food, providing a rich source (20% or more of the daily value) of the B vitamins riboflavin and niacin, vitamin E, and the essential minerals calcium, copper, iron, magnesium,

manganese, phosphorus, and zinc. Almonds are a moderate source (10-19% DV) of the B vitamins thiamine, vitamin B6, folate, choline, and the essential mineral potassium (Barreira J.C.M 2010) [10]. They also contain substantial dietary fibre, monounsaturated fat, oleic acid, and seeds, almonds are a source of phytosterols such as beta-sitosterol, stigmasterol, campest Erol, sitosterol, and campstool. It is also included in nuts according to its usage. It is very delicious with high nutritional value because of its oil contents (Balta F., *et al*., 2009) [15].

- **Cashew Nuts:** Cashew nut is made up of a fruit in which the Kernel is embedded. The real fruit of the cashew is commonly a nut. Cashew also contains vitamin C and B. According to the US Department of Agriculture (USDA) National Nutrient Database, 1 ounce of raw cashews (28.35g) contains 157 calories, 8.56g of carbohydrates, 1.68g of sugar, 0.9g of fiber. 5.17g of protein, 12.43g of total fat, 10 mg of calcium, 1.89 mg of iron, 83 mg of magnesium, 168 mg of phosphorous, 187 mg of potassium, 168 mg of phosphorous, 187 mg of potassium, 3 mg of sodium, 1.64 mg of zinc, 0.1 mg of ascorbic acid, 0.120 mg of thiamine, 0.016 mg of riboflavin, and 0.301 mg of niacin (Gupta Shakti *et al*., 1996) [24]. The nut is composed of kernel and pericarp or shell. The kernel is slightly curved back on itself and forms two cotyledons, representing about 20-25% of the nuts weight. It is a kidney- or heart-shaped achene, in any normal variety. Its color varies from bottle green to greyish brown (dried fruit) (Nadkarni *et al*., 1914) [41]. It is attached to the end of a fleshy footstalk or peduncle, which is the receptacle of the flower, that is, broadened and swollen, and forms the false fruit. The annual production of cashew nuts is the highest of all tree nuts, with a value of more than 3.5 million tons. Cashew nuts contain 50% fats (Manchester *et al*., 2007) [34]. It is a good source of vitamin E and minerals, especially magnesium and zinc. It is wrapped in a thin, difficult-to-remove peel (tests), reddish-brown membrane, which in turn approximates 5% of the whole nut. Cashew is of considerable have numerous use (Singh AK *et al*., 2016).
- **Walnuts:** While walnuts are known for their healthy fat content, they are a good source of protein and other nutrients as well. Along with 654 calories per 100g, the USDA list walnuts as containing protein of 15.23g, and fat of 65.21g. Walnut trees are native to eastern North America but are now commonly grown in China, Iran, and within the United States in California and Arizona (Mayhew AJ. *et al*., 2016) [36]. Beneath the husk of the walnut fruit is a wrinkly, globe-shaped nut. Walnuts is the common name for any of the large, deciduous trees comprising the genus Juglans of the flowering plant family Juglandaceae, which is known as the walnut family (Aune D *et al*., 2016) [3]. Walnut is also the name for the nuts or edible, the ridged seed of these trees, or for their hardwood. This article provides a nutritional breakdown of walnuts, a look at its possible health benefits, how to incorporate more walnuts into the diet, and any potential health risks of consuming walnuts. The walnut is split into two flat segments to be sold commercially (Guasch-Ferré M *et al*, 2017) [21]. Walnuts are available both raw or roasted and salted or unsalted.
- **Oats:** Oats have played a significant role in farming systems from domestication to the present due to the versatile uses of the grain and plant. They are most commonly rolled or crushed and can be consumed as oatmeal or used in baked goods, bread, muesli, and granola. Whole grain oats are called oat groats (Joyce, *et al*., 2019) [27]. They are most commonly rolled or crushed into flat flakes and lightly toasted to produce oatmeal. World oat production was similar to millet and exceeded rye and triticale. Oats (*Avena sativa*) is a whole-grain cereal mainly grown in North America and Europe (Whitehead A *et al*.; 2014) [54]. They are a very good source of fiber, especially beta-glucan, and are high in vitamins, minerals, and antioxidants. The nutrition facts for 3.5 ounces of raw oats are calories 389, water 8%, protein 16.9gm, carbs 66.3 gm, sugar 0 gm, fiber 10.6 gm, fat 6.9 gm. Oats are high in many vitamins and minerals, including Manganese, Phosphorus, Copper, vitamins, Iron, Selenium, Magnesium, Zinc, etc. Oats currently rank sixth in the world production of cereals after maize, rice, wheat, barley, and sorghum (Gauldie *et al*., 1981) [20]. Whole oats are the only food source of avenanthramides, a unique group of antioxidants believed to protect against heart disease. Due to their many benefits, such as lowering blood sugar and cholesterol levels, oats have gained considerable attention as a health food.
- **Sesame Seeds:** Sesame seeds are a good source of healthy fats, protein, B Vitamins, minerals, fiber, antioxidants, and other beneficial plant compounds. Sesame (*Sesamum indicum* L.) is the oldest indigenous oilseed crop, with the longest history of cultivation in India (Hirakawa Y *et al*., 2010) [26]. Sesame or gingerly is commonly known as til (Hindi, Punjabi, Assamese, Bengali, Marathi), tal (Gujarati), Tuvalu, manchi (Telugu), ellu (Tamil, Malayalam, Kannada), tila/pitratarpana (Sanskrit) and rasi (Odia) in different parts of India. India ranks first in the world with 19.47 Lakh ha area and 8.66 Lakh tonnes of production (Chakraborthy G. S *et al*., 2008) [16]. The average yield of sesame (413 kg/ha) in India is low as compared with other countries in the world (535kg/ha). The main reasons for the low productivity of sesame are its rainfed cultivation in marginal and input starved conditions. However, improved varieties and agro production technologies capable of increasing the productivity levels of sesame are now developed for different agro-ecological situations in the Country (Dogan T *et al*., 2005) [18]. A well-managed crop of sesame can yield 1200-1500 kg/ha under irrigated and 800-1000 kg/ha under rainfed conditions. The crop is grown in almost all parts of the country. More than 85% production of sesame comes from West Bengal, Madhya Pradesh, Rajasthan, Uttar Pradesh, Gujarat, Andhra Pradesh, and Telangana. The oil content of sesame is among the greatest of any seed. It is a common component in cuisines across the world because of its rich, nutty flavor. Sesame oil is most widely utilized in bakeries. Protein, vitamins, dietary fiber, phosphorus, iron, magnesium, calcium, manganese, copper, and zinc are all abundant in sesame seeds. Regularly eating substantial portions of these seeds – not just an occasional sprinkling on a burger bun- may aid blood sugar control, combat arthritis pain, and lower cholesterol (Martin J. H*et al*., 2005).

- **Chironji:** Most people know this name as an ingredient used for dressing the various sweet dishes cooked in their kitchen on special occasions (Sushma N *et al*., 2013) [47]. It is a wild plant growing in the forests of North, Central, and Western India, mainly in the states of Rajasthan, Gujarat, Madhya Pradesh, Bihar, Orissa, and Jharkhand, Chhattisgarh, A Andhra Pradesh, and Maharashtra. As it replaces the almonds, it is also called 'Cuddapah almond' (Prasad, *et al*., 2020) [42]. It is also known as chironji tree, almondette, calumppong nut, cheronjee, or Hamilton mombin. The tree has leathery leaves with a blunt tip and rounded base, often identified by its crocodile bark with a red blaze. When it comes to the nutritional profile of chironji, just like their nut family, they are rich in essential nutrients like protein, fiber, carbohydrates, and essential oils like omega-3 fatty acids along with omega-6. Chironji is also rich in important vitamins like Vitamins A, IU, C, D, E, and K. Covering essential minerals like calcium, iron, magnesium, potassium, sodium, zinc, copper, and manganese, chironji boasts a nutrients profile that provides your body with all the essential nutrients that it needs every day to stay healthy and build a strong immunity system (Neeraj, Bisht V *et al*., 2020) [40]. The fruit of the chironji tree bears a single edible seed, which is known as chironji. The health benefits of chironji go without saying that it has labeled itself as one of the best dry fruits that everyone should add to their diet to treat various ailments and keep their body strong and strong and healthy. Chironji has a special place etched in Indian history in the form of Ayurvedic books where it is written about being used as a vital ingredient to make medicines to treat various diseases like cough, fever, jaundice, breathing difficulties, heart problems, etc. (Malik, SK *et al*., 2012) [31].
- **Muskmelon seeds:** Muskmelon provides almost all the fat and water-soluble vitamins except vitamin D and E. A small quantity of vitamin E is also present in muskmelon flesh and a higher content of tocopherol is found in seeds (Akasaka-Kennedy, *et al*., 2015) [8]. Muskmelon also contains vitamin K, which plays a vital role in blood clotting and this makes the fruit very useful in the prevention of cardiovascular diseases. Although Muskmelon does not contain vitamin A as such, the content of pro-vitamin A, carotenoid, is high in most of the yellow and orange-fleshed fruits (Alvarez, J.M. *et al*., 2000). In addition to α and ß carotene, melon fruits are also good sources of cryptoxanthin, lutein, and zeaxanthin. Muskmelon provides most of the essential amino acids required for normal functioning, which include glutamic acid, alanine, and aspartic acid in major concentrations, and arginine, glycine, lysine, and proline in lower concentrations (Bachlava, E *et al*., 2014) [14]. Cysteine and tryptophan were not detected in the muskmelon. It is very important that is essential for maintaining good health and a higher supplement is essential during pregnancy and for the prevention of macular degeneration. The content of ascorbic acid is more than 40 mg/100g of fresh weight. Additionally, muskmelon also contains vitamins B1, B3, and B6, which makes it a special fruit compared to others. Muskmelon and other melon fruits are also rich in folate which is also known as vitamin B9 (Bachlava, E *et al*., 2014) [14].
- **Peanuts:** Peanuts are similar in taste and nutritional profile to trees such as walnuts and almonds, and as a culinary nut, are often served in similar ways in Westen cuisines. Calories of the 161 calories in peanuts, 78% of them come from fat, 18% come from protein, and the rest come from carbs (Kochert, Gary *et al*., 1996) [29]. Peanuts provide healthy mono and polyunsaturated fat, fiber, and protein. They also provide important nutrients including niacin, vitamin E, manganese, folate, and thiamine (Kochert, Gary *et al*., 1996) [29]. The capacity to fix nitrogen means and improve soil fertility, making them valuable in crop rotations. The botanical definition of a nut is "a fruit whose ovary wall becomes hard at maturity". Using this criterion, the peanut is not a nut. However, peanuts are usually categorized as nuts for culinary purposes and in common English more generally. The peanut belongs to the botanical family Fabaceae, commonly known as the legume, bean, or pea family. Like most other legumes, peanuts harbor symbiotic nitrogen-fixing bacteria in root nodules (Krapovickas *et al*., 2016) [28].
- **Jaggery Powder:** Jaggery Powder is fae than sugar, as it is made up of longer chains of sucrose. Jaggery contains more nutrients than refined sugar because of its molasses content (Manay SN *et al*., 2001) [38]. Molasses is a nutritious by-product of sugar making process, which is usually removed when making refined sugar. Including the molasses adds a small number of micronutrients to the final product (Nath A *et al*., 2004) [39]. The exact nutrition profile of this sweetener can vary, depending on the type of plant used to make it. The jaggery contains 60-85% sucrose, 5-15% glucose, and fructose along with 0.4% of protein 0.1% of fat, and 0.6 to 1.0% of minerals (8 mg of phosphorous, 11.4 mg of iron per 100 gm of jaggery) (Nath A *et al*., 2004) [39]. Jaggery has got better nutritional properties compared to sugar hence jaggery is more valued for its nutritional and medicinal value. Jaggery is a traditional non-centrifugal cane sugar consumed in South Asia and some other countries in Asia and the Americas. According to one source, 100 gm of jaggery may contain calories 383, sucrose 65-85gm, fructose and glucose 10- 15gm, protein 0.4gm, fat 0.1 gm, iron 11mg, or 30% of the RDI, manganese 0.2-0.5mg, or 10-20% of the RDI. However, keep in mind that this is a 100-gm serving, which is much higher than you would generally eat at once. It is also found to contain traces of vitamins, amino acids, and antioxidants (Uppal SK *et al*., 1999) [51].
- **Dates powder:** The dried version of dates is an excellent source of protein, fiber, and a powerhouse of calcium and vitamin C. Sukhee khajoor or dry dates are mentioned extensively in Ayurvedic scriptures like Bhojana for combating issues related to data and pitta doshas (Ahmad, J. *et al*., 2005) [4]. It describes kharijoor as a fruit that has Madhura Rasa (sweet to taste), Guru (heavy for digestion), and Snigdha Guna (slimy to touch), with a Shita Virya (cold potency). Dates exude a natural cooling effect and pacify the body besides boosting immunity. Researchers believe that the sugars in this fruit are complex carbohydrates, heavy o digest, and aid in the slow release of energy into the bloodstream by keeping you satiated for a long time, and that's why Ayurveda strongly recommends eating soaked dry dates before lunch or dinner to feel food and cut down on food

(Bhaduri, S. *et al*., 2013) [13]. Dry dates are as nutritious as ripe ones and these fruits do not contain moisture, look hard, and are shriveled to the touch (H. J. and C. Y. Lee *et al*., 2005) [25]. Constipation is caused due to lack of fiber in the food, dehydration, or can be an indication of some underlying condition. Dry dates are loaded with huge amounts of dietary fiber and serve as a natural laxative and regulate bowel movements. The cooling effect of these fruits brings down acidity and soothes the tummy. Digestive issues like acidity and constipation can be dealt with effectively by including dry dates in the daily diet (Jagirdar, S.A. *et al*., 1998). Dry dates contain cholesterol in very negligible amounts and can regulate the amount of low-density lipoprotein (LDL or bad cholesterol in the bloodstream. Blood pressure patients should make it a habit to consume at least three dry dates daily as it is high in potassium, but low on sodium making it an ideal diet for regulating blood pressure (Zahra, S. *et al*., 2014) [57]. Traditional medical practitioners recommend soaking 4 to 6 dry dates overnight and consuming them daily in the morning, along with water for boosting immunity (Yaseen, T., *et al*., 2012) [55].

- **Mint Powder:** Mint is known for its refreshing aroma and cool feel. Mint leaves are a great source of vitamin C, A, and E as well as beta carotene (Boure, M.C. *et al*., 1978) [12]. Mentha is a member of the tribe Mentha in the subfamily Nepetoideae. The tribe contains about 65 genera, and relationships within it remain obscure (Boure, M.C. *et al*., 1991). Authors have disagreed on the circumscription of Mentha. For example, M.cervina has been placed in Pulegium and Preslia, and M.cunninghamii has been placed in Micromeria. In 2004, a molecular phylogenetic study indicated that both M. cervine and Cunninghame should be included in Mentha. Mints are aromatic, almost exclusively perennial herbs. They have wide-spreading underground and overground stolons and erect, square, branched stems (Sharp, T. *et al*., 2000) [45]. The leaves are arranged in opposite pairs, from oblong to lanceolate, often downy, and with a serrated margin. Leaf colors range from dark green and grey-green to purple, blue, and sometimes pale yellow, the flowers are white to purple and are produced in false whorls called verticillate (Dillard, C.J. *et al*., 2000). The corolla is two-lipped with four subequal lobes, the upper lobe usually the largest. The fruit is a nutlet, containing one to four seeds. Chewing leaves of mint freshens breath and offers micronutrients such as calcium, potassium magnesium, iron, dietary fiber, and manganese. Essential oils are loaded with antioxidants which help to promote the immune system in the body (Pokorny, J *et al*., 1991) [43]. It is free of cholesterol. Menthol or Mint oil which is extracted from the herbs is used as a flavoring agent in mouthwashes, toothpaste, mouth fresheners, and chewing gums (Pokorny, J *et al*., 1991) [43]. It is used in oral care products and also used in shampoos, soap,s, and oils for massage or aromatherapy. Mint extracts are used to provide relief from stomach upsets, nasal congestion, headache, col, I,c, and gingivitis (Brennan, C.S *et al*., 2004) [11].

Table 1: Ingredients & Nutritional Value

Ingredients	Order	Family	Genus	Species	Kingdom
2014	Cucurbitales	Cucurbitaceae	Cucumis	C. Mela	Plantae
2014	Cucurbitales	Cucurbitaceae-gourds	Vuvurbita L. gourd	Cucurbita Maxima	Plantae
2014	Malapighiales	Lilaceae	Lilum	Lilum Usitatissimum	Plantae
2014	Rosales	Rosaceae	Prunus	P. Amygdule	Plantae
2014	Sapindales	Anacardiaceae	Anacardium	A. Accidental	Plantae
2014	Fagales	Juglandceae	Juglans	-	Plantae
2014	Poales	Poaceae	Avena	A. Sativa	Plantae
2014	Lamiales	Pedaliaceae	Sesamum	S. indicum	Plantae
2014	Sapindales	Anacardiaceae	Buchanania	B. cochinchinensis	Plantae
2014	Fabales	Fabaceae	Arachis	A. hypogaea	Plantae
2014	Arecales	Arecaceae	Phoenix	P. dactylifera	Plantae
2014	Poeles	Poaceae	Saccharum	S. officinarum	Plantae
2014	Ericales	Actinidiaceae	Actindia	A. deliciosa	Plantae
2014	Ericales	Ericaceae	Vaccinium	Vaccinium erythrocarpum	Plantae

3. Materials and Methods

Muskmelon seeds, pumpkin seeds, flax seeds, almonds, cashew, walnut, oats, sesame, chironji, peanuts, dates powder, jaggery powder, kiwi fruit, cranberry, mango were procured from a supermarket of Bareilly. This chapter delineates information pertaining to the research design and methodological steps used for investigation. The research procedure has been distinctly described as under in the following heads:

- Procurement of material
- Processing of raw material
- Development of energy bar
- Sensory evaluation
- Statistical analysis

1. **Procurement of material:** For the present investigation material i.e. Muskmelon seeds, pumpkin seeds, flax seeds, almonds, cashew, walnut,oats, sesame, chironji, peanuts, dates powder, jaggery powder, kiwi fruit, cranberry, mango were procured from the local market of Bareilly U.P. The procuring was done in singal a lot to avoid variation compositional differences so that the quality differences should be rules out.
2. **Processing of raw material:** The materials were subjected to cleaning, washing, and drying in the following manner.

3.1 Cleaning: The materials was cleaned and then rinsed remove dirt, dust, and other adhering impurity.

3.2 Roasting: Roasted muskmelon seeds, pumpkin seeds, flax seeds, almonds, cashew, walnut, oats, sesame, peanuts.

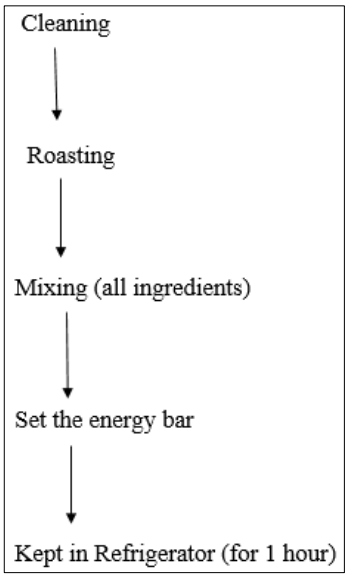
Table 2: Development of energy bar

Ingredients	Amount
Pumpkin seeds	20gm
Flake seeds	20gm
Almonds	20gm
Cashew	20gm
Walnuts	20gm
Oats	15gm
Sesame seeds	15gm
Chironji	15gm
Muskmelon seeds	15gm
Peanuts	20gm
Jaggery powder	280gm
Date powder	50gm
Mint Powder	1gm

- Mixed all ingredients in a bowl.
- Jaggery powder, date powder and mint powder will be mixed in all the ingredients.
- Set the energy bar.
- Kept in refrigerator for an hour.

Table 3: Nutritional composition of ingredients used in energy bar

Ingredients	Amount	Energy	CHO	Protein	Fat	Sodium	Calcium	Potassium	Iron
Pumpkin seeds	20gm	91.2gm	10.46gm	3.8gm	3.8gm	7.52mg	11mg	183mg	0.66mg
Flake seeds	20gm	113.2gm	5.8gm	8.8gm	8.4gm	5.6mg	51mg	162mg	11.4mg
Almonds	20gm	115.6gm	3.94gm	4.2gm	10.1gm	0.02mg	4.2mg	116mg	4.2mg
Cashew	20gm	110.6gm	6gm	2.6gm	8.8gm	-	7.4mg	132mg	1.34mg
Walnuts	20gm	130.8gm	2.8gm	3gm	1.3gm	0.2gm	19.6mg	80.2mg	0.58mg
Oats	15gm	56.85gm	7.65gm	1.9gm	0.9gm	-	81mg	64.3mg	0.70mg
Sesame seeds	15gm	85.8gm	4.5gm	2.7gm	7.5gm	1.6mg	19.5mg	93.6mgm	2.92mg
Chironji	15gm	98.4gm	1.8gm	3.24gm	8.8gm	-	41.8mg	-	1.27mg
Muskmelon seeds	15gm	5.1gm	1.2gm	0.12gm	0.02gm	_	1.6mg	46.3mg	0.03mg
Peanuts	20gm	113.4gm	3.2gm	5.2gm	*9.8gm*	3.6mg	18.4mg	141mg	0.92mg
Jaggery Powder	280gm	1072gm	277.0gm	0.25gm	_	8.4gm	244mg	_	3.78mg
Date Powder	50gm	141gm	0.14gm	0.03gm	0.009gm	_	1.5mg	328mg	2.85mg
Mint	1gm	0.7gm	37.5gm	1.25gm	0.2gm	_	2.4mg	5.6mg	0.05mg



Flow diagram

4. Result and Discussion

The data were collected aspects per plan were tabulated and analyzed statistically. Energy bar are emerging cereal, seeds and dried fruits based foods in the market. Both Indian and international players have already forayed into the domestic energy bar market.

Energy bars are meant to aide you with your nutrition- but they are not meant as a replacement for a healthy diet. Your body needs fruits, veggies, whole grains, healthy fats and lean protein in their most natural forms. If you are looking for a product to help you fill the nutritional gap, bars can meet that need. They are often fortified with vitamins and minerals, which can help fill nutritional gaps. But, like many foods in a specific category, not all energy bars are created equal. Those that are low in saturated fat and sugars, with a decent amount of protein and fiber, can provide a nutritious, satisfying pick-me-up. Energy bars are used in a variety of contexts. Energy bars may be used as an energy source during athletic events such as marathons, triathlons and other activities which require a high energy expenditure for long periods of time. They are also commonly used as meal replacements in weight-loss programs. Carbohydrate was the most variable component followed by the Indian energy bar market is growing rapidly.

Protein energy bar was the most variable component followed by protein, fat, and fiber. The serving size range from 30 to 40g, costing between 0.013 to 0.058 USD per g to consumers. With over 40 alternatives available, carbohydrates, protein, fat, and fiber. There is a rapid growth of the energy bar market in the US. PEB (Bionutritional Research) was found to have the highest calorie content (525 kcal) was of Bumble Bar Inc. OEB which also appeared to have the highest fat content (37.5%) “Energy bars quick, healthy and wholesome snack for adolescents “.

Six protein energy-bars (B1-B6) were prepared for Pakistani-

athletes using dates, dried appricots, Cheddar-cheese and whey-protein isolate. Bars B1-B3 contained 5 g Cheddar-cheese and 13 g whey- protein isolate while quantity of dates were 74, 68 and 65 g and apricots 8,14 and 17 g respectively. All bars have good sensory attributes expects B6 that showed lower acceptability. The ph, water highest firmness was recorded in B_2 and lowest B_6. The increase of total phenolic content was noticed in B_6 and the highest increase of total flavonoid content was estimated in B_2 at day 45, while B5 showed the highest antioxidant- activity on the 30th day afterwards a decline was observed in all the bars. "Formulation and characterization of protein- energy bars prepared by using dates, apricots, cheese and whey protein isolate."

In my study, Energy bars are an excellent option for breakfast or sports workouts. The variety of dry fruits, seeds, and soluble and insoluble dietary fiber in the bar, composition allows for their easy adoption into a diet as a source of slowly digestive carbohydrates, micro, and micronutrients. The inclusion of natural sweeteners such as dates powder and jaggery powder, dried fruits, dry mango, kiwi fruit, and cranberry, increased the energy value of bars. The total calories obtained from the energy bar showed a significant increase with the increasing levels of flaxseed, the maximum (397.95 kcal) being for bars with 20% flaxseed and 45% sweeteners. This energy bar sample also showed the maximum protein (12.41%), crude fat (11.86%), ash (1.65%), iron (3.77 mg/100 g), crude fiber (2.18%) and omega-3 as alpha-linolenic acid (22.50%, fatty acid basis) content.

Table 4: Nutritional composition of energy bar

Sample Name (Energy bar)	Nutritional level
Moisture	7.28%
Fat	13.47%
Protein	5.03%
Ash	1.63%
Crude fiber	15.16%
Energy	431.71kcal/100gm

5. Summary and Conclusion

Energy bar are supplemental bars cereals and other high energy foods targeted at people who require quick energy but do not have time for a meal. They are different from energy drinks, which contain caffeine whereas bars provide food energy.

Energy bar is a breakfast cereal made from dried fruits, seeds, oats, Jeggery powder and dates powder. Protein bars are targeted to people who primarily want a source of protein that does not need preparation (unless homemade). There are different kinds of food bars to fill different purposes. Energy bar provide the majority of their food energy in carbohydrate form.

Nutritional quality particularly protein, fat, crude fiber, moisture, and energy content increased with increasing flaxseed (5-20%) in energy bar. Energy bar are supplemental cereal-based foods that are formulated to target consumers requiring immediate energy and need replacing full meals. Nutrient bars, particularly protein bars, contain protein and carbohydrates in significant amounts, which can contribute to bioactive compounds apart from meeting basic nutritional requirements. Therefore, researchers attempt to develop high calorie energy bar from diverse protein-rich ingredients to maximize the range of phytochemicals. This can increase their availability as well among adolescents. However, in developing countries meeting needs lower income can be achieved by formulating economical products. Further research is necessary to find the potential of plant by-products in bars to minimize resource wastage and maintain the economy as well. Moreover, it is also promising for improving nutritional availability to school-going and gym-going adolescents to meet RDA requirements specified by the National Institute of Nutrition.

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