INTERNSHIP REPORT

THE DEVELOPMENT OF PROTEIN BAR AS THE ALTERNATIVE PROTEIN SOURCES FOR ATHLETE AND SPORTS PERSON

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STATEMENT OF ORIGINALITY

ABSTRACT

PT Nutrisi Harapan Bangsa is a company engaged in the sport nutrition industry which provides products that design specifically for athletes and sports persons, as distinctive nutrition is required for them. PT Nutrisi Harapan Bangsa sold the products under the name of Strive. The creation of this company was driven by the desire to have nutrition dense, delicious and affordable sports foods in order to fulfill nutritional needs during exercising. Strive already has 3 variants of product: energy bar, energy gel and strive mee. To expand the variety of products, Strive intended to develop new products such as protein bars and new variants of energy bars. Moreover, Strive also collaborates with other companies to produce several sports products. These reports aim to depict the scope of works and activity as well as presenting information gained from the internship period, including the Protein Bar Development, BPOM License Application, Energy Bar New Variant Development and Assistant Project Manager. The protein bar was successfully developed to have 24.9g of protein per 60g serving size. For the new variant development, there are 2 new variants developed and the further process will be conducted based on the company regulation. Moreover, the registration process of BPOM obtains the license. For the task of Assistant Project Manager, the results obtained were the progress of the ongoing project and will be continued by the Strive team to further ensure the progress of the projects.

Keywords : Sport Nutrition, Protein Bar, BPOM regulation, Energy Bar, Protein Analysis,

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2022 is tough. The first encounter with *real-life work* is arduous. The journey of knowing yourself is laborious and the future is terrifying. I will not be here if I take my step alone. This gratefulness I convey to:

1. Lord. Thankyou for not giving up on this broken human.
2. Mr. Teguh, Mrs. Lina and Jason. Thankyou for listening to my endless crying and stories. For supporting me through my choices and steps.
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8. Corinthia Angie. *Ku masih ingin melihatmu esok hari (Hindia, 2019)*

Sekiranya pula, maaf aku lantunkan di hadapanmu untuk semua perilaku dan tuturku yang belum tepat. Terakhir;

Segala doa yang baik adanya (Hindia, 2019)

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LIST OF ABBREVIATIONS

BCAA	Branched Chain Amino Acid
BPOM	Badan Pengawasan Obat dan Makanan
AS	Sampel brand Strive
AL	Sample brand L-Men
AE	Sample brand Evolene
AR	Sample brand RX-bar
AQ	Sample brand Quest
AF	Sample brand Fitbar
AS	Sample brand Soyjoy
NIE	Nomor Izin Edar

I. INTRODUCTION

1.1. PT Nutrisi Harapan Bangsa History

PT Nutrisi Harapan Bangsa is a company engaged in the sport nutrition industry which provides products that design specifically for athletes and sports persons, as distinctive nutrition is required for them. The company was founded in 2017 by a group of passionate recreational cyclists, where they sold the product under the name of Strive. Currently, it is managed under the supervision of two of the founders, Mr. Eduardus Aditya Bawono and Mrs. Ariane Eileen Suhardjo. The factory was located in Bantar Gebang, Bekasi.

The creation of this company was driven by the desire to have nutrition dense, delicious and affordable sports foods in order to fulfill nutritional needs during exercising. Therefore, the first product that was launched was an energy bar and became the first brand in Indonesia to provide a sports bar that is suitable for long and high intensity exercise due to its texture and nutrition content. These products served by Strive are a breakthrough, as previously amateur and athletes fulfill their nutritional needs during exercise by using imported products, which have doubled price.

By now, Strive has been developed into a foremost sport nutrition company in Indonesia. The product development is continuing to produce a different type of product that is aimed to support the sport industry in Indonesia. Strive has participated in a lot of big and prestigious sports events in Indonesia, such as Jakarta Marathon, Borobudur Marathon and Tour de Bintan. This action is in line with their mission to support and contribute to the development of world class athletes from Indonesia, as well as young athletes as the future of Indonesian sports. Strive already has three different types of products that are already sold in the market which are energy bar, energy gel and healthy noodle with various flavors. Strive products could be found in retail markets such as Food Hall, Kemchick Market, Gelael Supermarket as well as in sports shops such as Rodalink and Decathlon. The company is evolving its product variety to serve the markets' demand and needs, by also collaborating with a lot of companies to create an advanced product that is designed specifically to serve markets' needs and demand.

1.2. Main Activity

Even though Strive has 3 kinds of products, the factory only produces the energy bars, whereas the other products are outsourced or produced by other companies. To comply with the high demand of the energy bar, PT Nutrisi Harapan Bangsa (Strive) operates and produces the energy bar from Monday to Friday, starting from 8 am to 5 pm. Each day the factory will produce a different flavor of energy bar depending on the remaining stock.

Strive factory has 4 divided rooms, where each of the rooms are designed specifically for different purposes. Room 1 is the storage room, where the raw materials are stored. Before the production starts, the staff will take out each material depending on the needs and deliver it to the Room 2, where the processing takes place. In room 2, the weighing and roasting process will be done then followed to room 3 where the material will be mixed using a commercial mixer. In the same room, the finished dough will be moved to the bar automatic line, where it will be molded automatically to a bar shape with specific size. The finished product will be moved to Room 4, where the packaging process occurs, as well as the storage place of the finished product.

As PT Nutrisi Harapan Bangsa focused on sport nutrition, their products vary on to sports specific nutrition and/or healthy food. Below are the several types of product produced and distributed by PT Nutrisi Harapan Bangsa (**Figure 1, 2, 3, 4, 5 6)**

Figure 1. Strive Energy Bar Variant

Figure 2. Strive Energy Bar New Flavor

Strive started the business by releasing a 40 gram (fullbar) energy bar with 5 varieties of flavor: choco, peanut butter and coffee, coco pandan, salted caramel and nasi uduk. The energy bar is made from organic and natural ingredients, which contain no preservatives. It has a soft-delicate texture and high moisture content to comply with the needs of athletes and sportspersons having an easy to swallow food during exercising. Thereafter, Strive started to produce a smaller size bar which weighs 20 grams (bite size), with the intention of facilitating the demands of having more efficient energy bars. Strive expand the product variety by developing 4 new flavors (**Figure 2**.), green tea, pineapple, ginger and turmeric, in two different sizes, 40 gram and 20 gram. The energy bar is sold for Rp. 20.000 for the 40g size and Rp. 10.000 for the 20g size.

Figure 3. Strive Energy Gel Mango and Passionfruit

Figure 4. Strive Energy Gel Pineapple

Subsequently, the product development continues by collaborating with other companies to develop an energy gel, with the first flavor produced is pineapple. The energy gel was aimed as an energy booster during exercising, hence the product contains caffeine, BCAA, maltodextrin, electrolyte, date extract, guarana extract and ginger extract. The development continues as more flavor is developed such as mango and passion fruit. Strive energy gel is sold per box, consisting of 5 energy gel with price Rp. 75.000. Moreover, Strive also collaborated to develop a healthy noodle with the trade name Strive Mee, to serve healthy choices of nutrition after exercising. For Strive Mee, it is sold for Rp. 15.000 per pack.

Figure 5. Strive Mee Goreng

Figure 6. Strive Mee Ayam Bawang

1.3. Vision and mission

- Vision
  - To contribute in building Indonesia to be the powerhouse nation in sport and supporting the nascence of world class athletes and young athletes.
- Mission
  - Contributes as the sports nutrition provider in sports event
  - Support athletes with strive products to fulfill their nutritional needs during training

1.4 Organizational Structure

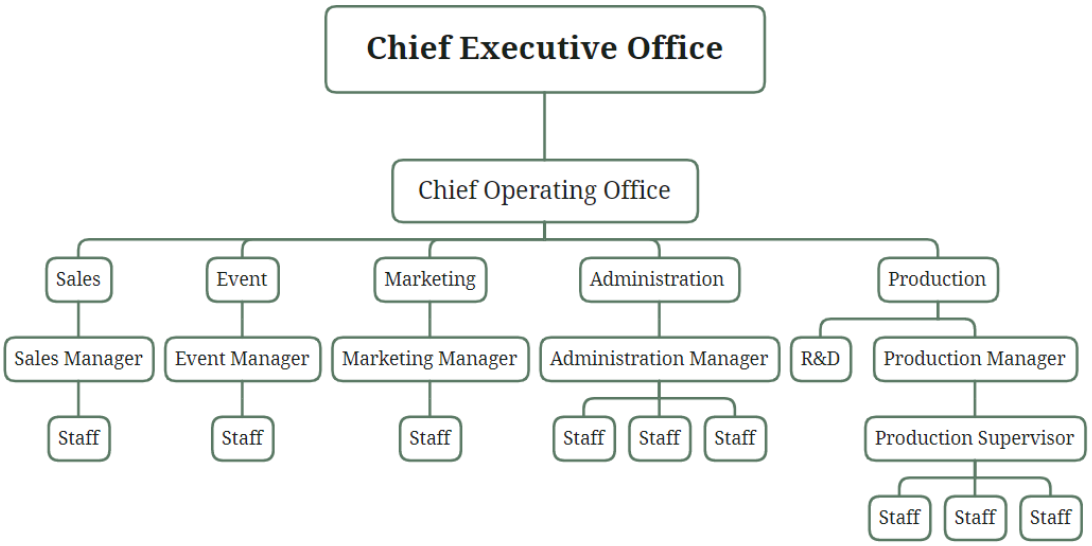

Figure 7. Organizational Structure

Strive organization is led by a Chief Executive Officer (CEO). Under CEO, Chief Operating Officer works to supervise 4 divisions consisting of Sales, Event, Marketing, Administration and Production. All the information from each division will be delivered to the CEO and COO, as well as crucial and important decisions will be made by them.

1.5 Internship Department

The company does not have a specific department to regulate and manage interns, thus there is no specific job description and work load. During the author internship period, there was no other intern work in the company. Mostly, the author is assigned to many work loads that are not only specific to the product research and development, but also to the product regulation and project manager work related as the author is responsible as assistant project manager.

II. INTERNSHIP ACTIVITIES

The internship in PT Nutrisi Harapan Bangsa was conducted from July 14th to 14th November 2022, in Bantargebang, Bekasi. The tasks were usually delivered via Whatsapp chat, voice call or weekly meetings. Usually, after the task is delivered, the results will be asked for the next 2-3 days. Whereas, even though there was no regular working schedule and minimal working duration, the author will come everyday from 9 AM-5PM to the factory and complete all the tasks there.

2.1 Internship Task

2.1.1 Protein Bar Development

There is a significant growth in the demand for ready-to-eat meals due to the convenience factor and generally appealing for the majority (Samuel & Peerkhan, 2020). Nutritional bars meet this demand and expectation as it is nutrient dense. It is typically made from cereal grains, dried fruit and nuts which add sweetness and flavor, and hence induce the palatability. Nevertheless, the industry continues the development by creating high protein bars, intended as the alternative sources of protein for athletes and anyone looking to gain muscle growth (Jovanov *et al.* 2021)

The author is assigned to develop a protein bar that contains 20g of protein per 60g of protein bar with the source of protein is soy protein isolate crisp. The development includes BPOM registration, production trial and material outsourcing. The protein bars are intended to have a unique selling point from the crispy texture to make a differentiation with other brands. The company intends to launch a protein bar in 2023 with one and half year preparation.

2.1.2 Protein Bar Production Trial and Material Outsourcing

Production trial is the process to assess the process flow and line layout, to be proven as the most effective way to be implemented. There will be much profitable information gained from this action. The production trials will give the information needed to create a clear work guideline and standard operating procedure, as well as training the staff member. Information about health and safety during the production will also be revealed and prevention action could be designed. Furthermore, this will also create a checklist on quality assurance of the product and identify potential hazards and allergens that may be present during production. The total production per batch of product will be straightly revealed and a rational production target will be achieved.

The protein bar manufacturing trial was conducted to gather knowledge and comprehend the production process, including production flow and identify any shortcomings. Additionally,

material outsourcing is being tested to determine the most suitable material to be used as packaging. Moreover, the manufacturing trial was done 4 times from August to November.

2.1.3 BPOM Registration

Badan Pengawasan Obat dan Makanan (BPOM) is the Indonesian government institution that focuses on formulating and establishing norms, standard and procedure to supervise the pre-market and post market process of food and medicine. In terms of food, every food in Indonesia's industry is required to have a license to prove that the food produced is safe for the consumer and also serves accurate product information. The food regulation of Indonesia is governed by Law No.18/2012 of food. In the regulation, food includes anything processed or unprocessed, that comes from a biological source of agricultural product, forestry, plantation, fisheries, farms, marine. Moreover, the food quality is governed by Government Regulation No. 28/2004 on Food Safety, Quality and Nutrition (GR 28). It regulates several things such as sanitation of food, additional ingredients, food packaging, laboratory analysis, contaminated food, etc.

BPOM regulates the information present in the food label to ensure the accuracy and relevancy. To be mentioned, the label has to contain details such as name of the product, list of ingredients, name of manufacturing and importer and date of expiration. Moreover, the label requires information on nutritional content which contains information of total macronutrients and if applicable, micronutrients of the food product. Another requirement needed to be included are the mandatory warnings and advisory statements such as irradiated food, genetically engineered food and specific design food such as infants food or those who suffer specific disease.

The protein bar is designed to obtain a BPOM license in order to guarantee customer safety and product trust. The author's scope of works include providing information needed by the BPOM regulator such as labeling requirements revision and additional data to complete the BPOM demands. The estimated time to gain BPOM licenses is 4-8 months depending on the completeness of the data and BPOM officers responses.

2.1.4 Energy Bar New Variant Development

It cannot be ignored that nutrition plays an important role in athletic performance. It is crucial for preparation, during performance and recovery of athletes. In response, the food industry has led the development for various sport nutrition products, intended to support the nutritional demands. One of the products are food bars that were designed to contain a perfect nutritional characteristic due to the high carbohydrate, protein, and lipids content (Bhavani *et al.* 2018). It is highly suitable for the gain of quick energy before and during races or exercise. Moreover, it is also

suitable to feed people ‘on-the-go’, as the bars are nutrition dense and convenient. Energy bars mostly serve 200-300 calories per serving, which mostly consist of cereals and sugar sources such as fructose, glucose and maltodextrin (da Silva *et al.* 2014).

Energy bar has been the initial product of Strive. As mentioned before, there are 9 variants of flavors of Strive energy bars. Strive aiming to expand the flavor variants to offer a new experience to the consumer. There have been 2 flavor variants developed, with the task included determining the proportional recipes for the new variants as well as discovering the supplier for ingredients needed with expected time of 1 month.

2.1.5 Assistant Project Manager

Strive also collaborates with other companies to produce several sports products. For the new projects, the author was assigned as an assistant project manager which tasks include to support the data and information needed for the product development, packaging development and BPOM. The author also participated in external meetings that were usually held to discuss the big plan of the project and for further plan of the execution. The author was also assigned to do negotiation and production details from the collaborating company. Moreover, monitoring project progress was also included in the task, as the author is required to do a weekly update into the spreadsheet as the project tracker and present it to the management once every two weeks. The task's anticipated results include keeping management informed of all project developments, ensuring the smooth operation of collaborative projects, and gathering all necessary data.

2.2 Problem Encountered During Internship Period

During the internship period, there were several problems encountered in the product and development process as well as related to the assistant project manager jobs. Problems related to the research and development process mostly related to the improvement of the new product developed, are solved through discussion with staff and literature review. Whereas problems arise related to the assistant project manager jobs are mostly caused by miscommunication that lead to misinterpretation. Problem resolved through further discussion and communication.

2.3 Application of Theories

During the studies, the author was provided with a lot of theories and information important to support the performance in the work field. The most related courses with the internship task is Sports and Exercise Nutrition. The theories from the courses provide the author with the basics of thinking and knowledge for the sports related product, as during the course, the author learned

about the unique nutritional requirements for athletes. These theories help to design the specific nutrient composition in the product to help fulfill the needs. Moreover, Human Nutrition courses also help the author to understand the way to calculate the exact amount of nutrients in foods. However, during the execution of the task, there are a lot of things related to the product design that are not consistent with the theories, therefore a lot of adjustments need to be made.

III. PROJECT DESCRIPTION

3.1. Project Introduction

3.1.1 Sport Nutrition

Sport nutrition is defined as a broad interdisciplinary science that focuses on the relationship between nutrition strategies and athletic performance (Jeukendrup & Gleeson, 2018). Nutrition is stated as the important component in sports, as nutrition strategies can manipulate fatigue, performance and recovery. Fundamentally, nutrition strategies should be implemented from the training season in order to achieve long-time goals, such as meet the requirements of energy and fuel during training programs and competition, achieve and maintain the ideal physique to support their goals, and to maximize recovery to avoid physical, mental and metabolic injuries (Daries, 2012).

Principally, nutrition itself is a crucial component that is needed by humans in order to function and develop. Nutrition is defined as the ingestion, digestion, absorption, and metabolism of food by human bodies, followed by the assimilation of the nutrient to human tissue (Jeukendrup & Gleeson, 2018). Whereas nutrient is a substance present in food that has a specific function and effect on the body, such as growth and development promoters, provision of energy, and regulation of metabolism. Nutritional recommendations of athletes and physically active people may deviate from the general nutritional recommendation due to different treatment done to their body. For example, athletes will be recommended to consume more high fiber foods in order to minimize the probability of cardiovascular disease and cancer due to high ROS. However, dietary fiber fueling should be done during training days rather than competition days, as it could induce gastrointestinal problems. Another mentioned example is athletes and physically active people are required to consume more sodium than general people, as it is necessary to expedite the restoration of body fluid losses during exercising.

Nutrients are composed of macronutrients and micronutrients. Macronutrient is defined as the nutrient that consumes more than a few grams each day, whereas micronutrient is only required in small amounts. Macronutrients are composed of carbohydrates, fat and proteins. Furthermore, micronutrients are composed of minerals and vitamins.

Carbohydrate

Carbohydrate plays an important role as the energy provision for the contracting muscle, where it is stored in the muscle and liver as glycogen also in glucose form in blood (Daries, 2012). Although fat is also driven to be the source of energy for adenosine triphosphate (ATP) production

during exercising, carbohydrate is the preferred source of energy due to its rapid conversion from the carbohydrate form to energy. Moreover, carbohydrates become more important sources of energy as they serve the rapid fuel with or without oxygen presence.

During a high intensity and prolonged exercise such as road cycling, marathon and cross country ski, the depletion of glycogen is expedited and the energy requirements exceed the capacity to store glycogen by more than 100% (Podlogar & Wallis, 2022). Thus, nutritional strategies are often implemented to resolve this problem, by carbohydrate loading and carbohydrate feeding during exercise to increase the exogenous carbohydrate availability. However, this action is only useful and highly recommended for events longer than 90 minutes, but adequate carbohydrate availability is still important to be assessed. Moreover, combining the type of carbohydrate will be beneficial for the glycogen synthesis where the depletion could be induced. During exercising or competition, it is recommended to ingest carbohydrates up to 60 $g.h^{-1}$ - 90 $g.h^{-1}$, of a rapid ingest carbohydrate such as glucose, glucose polymers and glucose-fructose. Furthermore, the consumption of carbohydrate post exercising also needs to be taken into account, in order to replenish the liver and muscle glycogen. To expedite the full repletion of glycogen, it is advised to consume a high glycemic index food as soon as possible at the rate of 1.0 - 1.2 $g.kg^{-1}$ $BM.h^{-1}$.

Protein

Protein is crucial for athletes as it works to synthesize new muscle or repair muscle damage, due to high intensity of usage of the muscle (Philip & Van Loon, 2011). Thus, the protein requirement for resistance-trained and endurance-trained athletes can be as high as twice RDA/RDI, due to the upregulation of protein utilization than the untrained people. However, to define the optimal level of protein for athlete are a difficult task do be done, as optimal level should refer to where the protein is adequate for repair and replace damage protein due to mechanical dan oxidative stress, maintain optimal function in which amino acid act as participatory intermediate, accommodate the increment of lean mass, as well as optimal rate of production of all plasma protein required for optimal physiological function (Philip, 2012). Moreover, the optimal requirements should not promote an excessive production of urea as nitrogen has a tendency to be toxic for mammals. To gain maximum effects, protein ingestion time in athletes should be considered as the recommendation time lays on 2 hours after exercising. Athletes could gain their protein sources from dairy and/or protein supplements with protein content 20g-25g.

Fat

Fundamentally, fat is an essential component of the cell membranes, as it plays roles in nerve function, providing the insulation and vital organ protection as well as signaling and transporting.

However, proper fat intake is less considered than carbohydrate and protein as it does not offer a significant effect on athletic performance. However, the consumption of fat should be higher than 20% of total energy to avoid the low intake of fat soluble vitamins and carotenoids. It should be taken into account that fat consumption higher than 40% of total energy does not offer any advantages for athletic performance (Philip, 2012).

3.1.2. Sports Nutrition Industry

In the past few years, there is a significant growth in the nutrition trends and consumer concern (Arenas-Jal *et al.* 2020). They started to take proactive steps to achieve a higher health status and evade chronic disease. Furthermore, consumers start to be more aware about healthy living wherein it impacts not only the food industry, but also increases the traction of active lifestyle and exercising. This in fact also affects the growth of sports nutrition industries as consumer awareness of a high quality diet for good training increases, causing the sports nutrition product to be mainstream among the market (Almada, 2015). These consumers are not just focusing on performance and muscle growth, but also health and well being focused.

Sport nutrition products are the product that serve the consumer needs to improve nutritional needs to support performance, muscle growth and recovery. Moreover, it also provides the alternative and additional nutrients when it is not feasible to be fulfilled. The example of food from sports nutrition categories are whey protein, energy bar, energy gel and electrolytes. These products were initially designed to meet the athlete's unique nutritional requirements. However, sport nutrition products are becoming more appealing to a recreational active population, dominated by young people who invest in sports and fitness. They carry a greater focus on increasing performance and fitness level.

Figure 8. RX- Energy Bar

Figure 9. Clif Energy Bar

Regardless of different types of consumer, they seek for product transparency, with an open and clean label information (Kang and Hustvedt 2014), as seen in **Figure 7,8 and 9.** This led to the reduction of artificial and unnecessary ingredients, and only focusing on several ingredients with maximum benefits. Furthermore, the development of sport nutrition products are heading toward

products that serve needs outside the exercise, such as ready to eat meals, healthy snacks and cereal. These products will fulfill the demands of nutrition concern outside exercising as the consumer raises cognition of a healthy lifestyle, as also broadening the industry.

Figure 10. Strive Energy Bar

3.1.3. Protein Bar

High protein products have recently become popular as protein grown to be a staple food for bodybuilders and athletes. Moreover, this phenomenon has also grown in the sports enthusiasts and general consumer as they raise interest to incorporate more protein into their diets. Following that, the market of high protein products has expanded. In fact, there are several types of commercial protein products, such as ready-to-mix (RTM) powders, ready-to-drink (RTD) beverages and protein bars that have been on the market. These products offer a variety of flavor, health claims and protein content.

The protein sources are mainly gained from dairy sources, which are whey protein hydrolyzate (WPH) and whey protein isolate (WPI), where it contains abundant alpha-lactalbumin and beta-lactoglobulin (Imtiaz *et al.* 2012). Moreover, proteins of this type are widely used due to its high nutritional value, desirable sensory and functional properties (Malecki *et al.* 2020). However, there has been increased concern of dairy protein sources usage due to low availability and high cost. This led to the sharp increase of interest in plant protein sources as an alternative. One of the widely used plant protein sources is soy protein isolate. It promotes a high nutritional value with low price, as well as high availability. Moreover, soy contains abundant antioxidants such as isoflavones, saponins and copper (Brown *et al.* 2004). This antioxidant may help to fight against oxidant stress and free radicals that produce due to high intensity exercise, that may delay muscle recovery and lead to the development of disease.

Due to the mentioned quality, Strive aimed to make a high protein bar with soy protein isolate as the source of protein, which contains a minimum 20 grams of protein per bar and low in fat. The form of soy protein isolate chosen by Strive was crispy-like-cereal. This decision was made after several research of protein bars that were already marketed locally or internationally. The research aimed to compare the taste between products and find the best sources of protein to be

incorporated into the Strive protein bar. The conclusion is that the soy protein crispy is the best source to be used, where it also offers the unique selling point for Strive protein bar.

Furthermore, the soy protein isolate crispy was preferred than WPI or WPH due to the absence of bitter and tangy aftertaste. Beside soy protein isolate, dates are the second dominant ingredients incorporated in the protein bar as the source of sweet and emulgent. Naturally two-thirds of date flesh consists of sucrose, fructose and glucose, whereas one-fifth of the flesh consist of water and dietary fiber. This in fact is a good source of fast energy during exercising (Ahmed *et al.* 2013). Dates also prove to be rich in phytochemicals such as tannins, carotenoid, phenolic acid, isoflavones, lignans, flavonoids and sterols (Ayad *et al.* 2020). This phytochemical composition initiates varying degrees of antioxidant, anti-inflammatory and antimutagenic activity. Furthermore, dates have a high water holding capacity and oil holding capacity that are suitable to be used in the food industry. Moreover, palm sugar is also incorporated in the protein bar. Palm sugar is a natural sweetener that is made from nectar that started to be used widely in South Asia as the substitute for sugar cane. It promoted a high phenolic compound and exhibited a free radical scavenging activity that helped reduce the development of oxidative stress-related disease (Victor & Orsat, 2018). Another health benefit possessed by palm sugar is the low glycemic index due to minimally processed.

3.1.4. Protein Content Analysis

Proteins are engaged in an important role in the food and biological system. It is a highly complex system with a diversity of function arising from different chemical make-up (Damordan, 2017). It is mainly composed of hydrogen, carbon, nitrogen, oxygen and sulfur. Denaturants like heat, acid, alkali, 8M urea, 6M guanidine-HCL, organic solvents, and detergents can change the distinctive conformations of proteins, where the characteristics and solubility of protein may also be affected by it. In the food system, the function of protein is related to the structural, physicochemical and sensory characteristics (Nielsen, 2010). It helps to create a desirable taste and texture, as well as comply with the daily protein requirements in humans.

Protein analysis is complicated due to the same possession of physicochemical properties from food components. Nitrogen from non protein sources could be obtained from amino acids, small peptides, nucleic acids, phospholipids, amino sugar. Depending on methodology, the analysis of food proteins may be physically hampered by other important food components like lipids and carbs. Several protein analysis methods have been developed where the basic measurement is focusing on nitrogen, peptide bond, aromatic amino acids, dye-binding capacity, ultraviolet absorptivity of protein and light scattering properties. Different types of methods will emerge with different

sensitivity, accuracy, precision, speed and cost of analysis where this becomes the consideration factor to determine the best methods for particular application. Protein analysis is done to meet several importance such as nutritional labeling, pricing, functional property investigation, and biological activity determination.

Commonly used protein analysis methods in laboratories are Kjeldahl methods, Nitrogen Combustion, Infrared Spectroscopy, Lowry Methods, Dye Binding Methods, Bicinchoninic Acid Methods, and Ultraviolet 280 nm Absorption Methods. In this project, Kjeldahl methods are used to analyze the protein due to simplicity in sample preparation, lower initial cost, ability to cope with widely varying samples and high level of automation. Furthermore, Kjeldahl methods are widely used in the industry as the protein determination methods for food, animal feed, agricultural materials, environmental samples, biological tissue and pharmaceutical analysis (Saez-Plaza *et al.* 2013). Kjeldahl methods work by direct nitrogen measurement, where all the nitrogen in the sample is transformed into ammonium sulfate by the digestion of sulfuric acid. The ammonium sulfate will be released by pH raised resulting in ammonia that will be calculated via distillation to a measured volume of standard acid. Lastly, the excess will be determined by titration.

3.1.5. Nutritional Fact Analysis

Nutrition label contained nutritional information of the product. In the food packaging, the nutritional labels are present in the front-of- package nutrition label and Nutrition Fact Labels, and required to be attached in every food product label (Christoph *et al.* 2018). Nutrition labels are made to encourage healthy purchasing and eating habits by presenting information for the customer's consideration of their food choices. Special consideration may appear in people with obesity and diabetic. The nutrition fact usage has been associated with lower fat and sugar intake, higher vitamin C, fiber and iron consumption. The nutritional label needs to have good label comprehension correlated with high literacy and numeracy, to facilitate the consumer understanding. Moreover, to simplify the information, the front-of-package nutrition labels mostly are made less complex and implement colors and symbols to convey nutrition information (Graham *et al.* 2015).

In Indonesia, BPOM has regulated the components of nutrition needed to be attached in the nutritional label such as total energy, total fat, saturated fat, protein, total carbohydrate, sugar, natrium, trans fat, cholesterol, and dietary fiber. This information needs to be present in order to get BPOM approval.

3.1.6. Objective

The project aims to:

- To develop protein bar with minimum of 20g protein content per servings
- To conduct production trial in order to understand the production flow and encounter drawbacks arises
- To obtained BPOM license for Strive protein bar
- To develop new variant of Strive energy bar
- To ensure the flow of the collaborated projects based on the timeline approved

3.2. Material and Methods

3.2.1. Protein Bar Manufacturing Material

During the project, ingredients used are provided by the company such as soy protein isolate, dates, palm sugar, oat, peanut butter and almond. The materials used such as commercial food mixer, mold and label were also provided by the company.

3.2.2. Other Projects Material

Material used to conduct BPOM registration and assistant project manager was laptop.

3.2.3. Protein Bar Manufacturing Methods

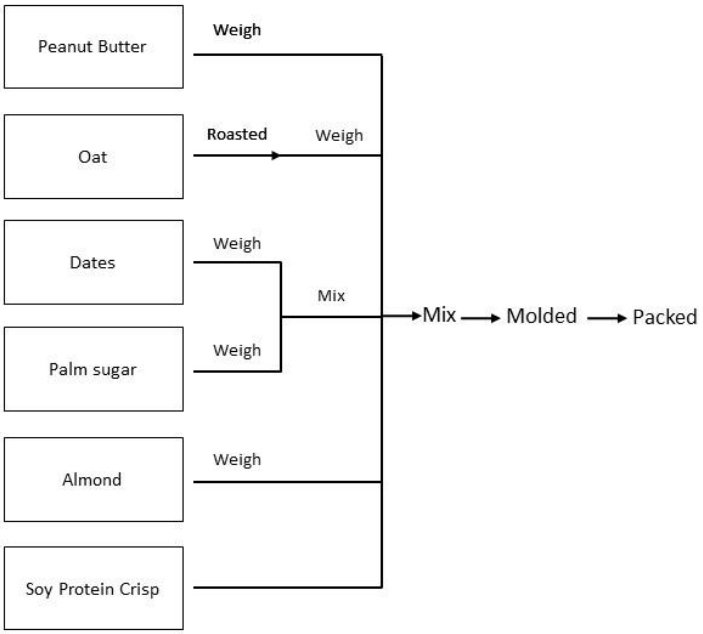

Figure 10. Protein Bar Manufacturing Process

To begin, soy protein crisp, oat, dates, peanut butter, palm sugar and almond are weighed based on the ratio developed (**Figure 12).** Half of the soy protein crisp mashed to create a powder-like texture, in order to decrease volume and ease the incorporation of ingredients. Whereas oats needed to be roasted first to eliminate the earthy flavor, then mashed to create an oat flour. Before the addition of dry ingredients, palm sugar and dates were blended to create a paste-like texture (**Figure 11)**. Afterwards, all the ingredients are incorporated into the commercial food mixer to combine the wet and dry ingredients for around 10 minutes (**Figure 13)**. The dough generated is molded manually using a specific mold (**Figure 14)** and finished goods were moved to the packaging room to be packed.

Figure 12. Wet Ingredients Consist of Dates and Palm Sugar

Figure 13. Soy Protein Isolate, Oat Peanut Butter and Almond

Figure 14. Mixing Wet and Dry Ingredients

Figure 15. Dough is Molded

3.2.4 Collaborative Product Development Methods

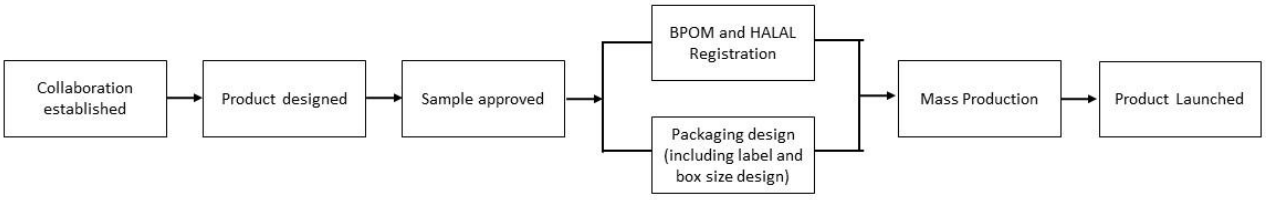

Figure 16. The Flow of Collaborative Product Development

Strive also collaborates with other companies to produce a wide variety of sports related products. The project is initiated by kick-off meetings, to brainstorm the big plans and ideas. It is continued by the product design and development of samples, until the product fits with the design's characteristics. The process will continue to the BPOM and HALAL registration. In this process, there is a lot of data and information needed to be gained and given to the BPOM and HALAL to comply with their standard. There were a lot of revision and additional requirements data. This process could take 4-8 months depending on the comprehensiveness of data and the regulator valuation. Along with the regulation process, the packaging design was also established. At the same time when the license is obtained, the mass production will be started and products are ready to be launched.

3.2.5 Sample Analysis

The samples were sent to Saraswanti Indo Genetech for nutritional analysis and protein analysis. Fat analysis was done using weibull methods, sugar analysis by Luff-Schoorl analysis, protein content analysis done by Kjeldahl methods, whereas energy and carbohydrate content analysis done by calculation.

3.3. Results

3.3.1 Nutritional Content Analysis

Table 1. Nutritional Analysis Results

Parameter	Results (100g)
Protein (g)	41.57
Total Fat (g)	1.64
Energy (kcal)	346
Carbohydrate (g)	41.33
Energy from fat (kcal)	14.6
Sugar (g)	27.7

The protein bar that was designed as mentioned in Section 3.2.2. was prescribed to achieve certain results. Shown in **Table 1**., the nutritional content of Strive protein bar based on laboratory analysis. The parameters present include the content of protein, energy, total fat, carbohydrate, energy from fat, sugar and saturated fat. All the data is based on measurement of a 100g sample.

3.3.2. Protein Content Evaluation

Figure 17. showed the protein content analysis between Strive protein bars with other protein bars from local and international products. The protein bar that is produced and distributed locally is L-men (AL) and Evolene (AN) protein bar. Whereas other competitors from outside Indonesia are RX-bar (AR) and Quest (AQ) protein bars. In **Table 1**., protein bars were also compared with local energy bars that do not focus on the protein content, which are Fitbar (AF) and Soyjoy (AS). Overall comparison showed that AE, AL, AN, AR and AQ does have a higher protein bar than AF and AS, fulfilling the brands aim and claim. AE protein bar was shown to have the highest protein content than other protein bars. Whereas the second highest protein content was AQ, followed by AL, AN and lastly AR.

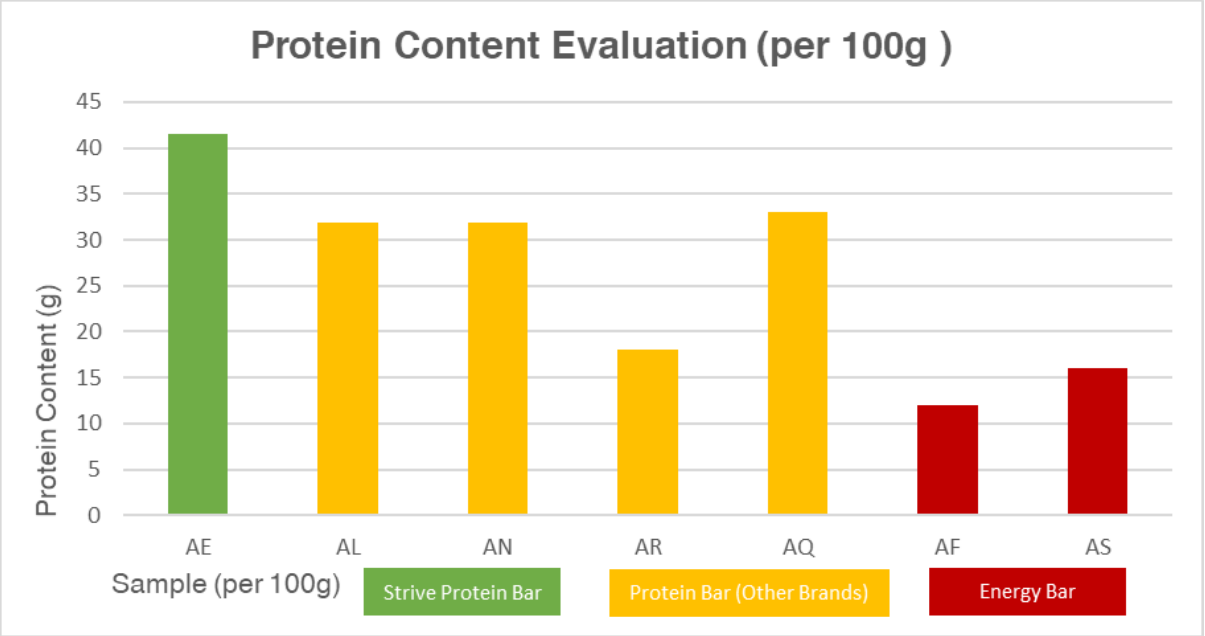

Figure 17. Protein Content Evaluation Results

3.4. Discussion

3.4.1 Protein Bar Development

3.4.1.1 Nutritional Content Analysis

Data in **Table 1.** summarizes the nutritional content of Strive proteins bar per 100g sample. It is shown that 100g of Strive protein bars have 41.57g of protein. The protein bar is designed to have 60 grams per servings, with that the protein content is 24.9g. The result is corresponding to the initial aim of the protein bar development as the desired minimum of protein content per 60g of protein bar is 20g. The bar is initially designed as a snack bar that is high in protein. According to BPOM No.1 tahun 2018, food that will be classified as a high protein food product is when the 31%-70% energy sources are from protein. With the total energy of 346 calories, 52.6% of the energy sources are from protein (see **Appendix 1.)** The protein sources of Strive protein bars are from soy protein isolate, which originally contain 90% of protein per 100g. This will be further discussed in the next section.

Fat content in a 100g Strive protein bar is 1.64g. This can be classified as low fat food, as based on BPOM, the requirement of low fat food is containing 3g or less fat per 100g sample (). The low fat content in the protein bar is caused due to low fat sources used, with possibility from peanut butter and almond. However, peanut butter is considered low fat, as it is widely applied as butter and margarine substitute in the low calorie improved food product (Sadaf *et al.* 2013). Peanut butter is considered healthier as it is dominated by plant based unsaturated fat and negligible amount of trans-fat (Shibli *et al.* 2019). Peanut butter is originally a dispersion of roasted peanuts in the peanut

oil, and a good source of protein, fiber, bioactive compounds and healthy fat. Besides its wide usage as a fat replacer, it has a high acceptability and likeness. Almonds also contribute as a fat source with 49.34g/100 g. Fat utilized by almonds is an unsaturated fat, where it is considered as a healthy fat because it promotes many health benefits such as reducing cardiovascular disease and decreasing cholesterol (Li *et al*. 2015).

The total energy of a Strive protein bar is gained from all the ingredients incorporated. The protein bar is made to have a high energy content because it is also aimed to be a meal replacement, while contributing to fulfilling the daily targeted protein. Meal replacement has gained more attention due to changes in trends and lifestyle. The longer working hours and busier lifestyle has led to changes in eating habits, where the traditional meal times and number of meals per day are no longer applicable. Instead, there is an increased demand for nutritional dense meal replacement to fulfill their needs, in the form of food and beverage. Moreover, meal replacement started to be widely used in the weight loss program to reduce the caloric intake (Astbury *et al*. 2019).

The carbohydrates in the protein bar are gained from the usage of dates and palm sugar. Dates and palm sugar used in protein bars are quite a lot, as it is necessary to bind the dry ingredients. However, dates and palm sugar are considered as healthy sources of sugar. Dates originally stated as highly nutritious and healthy fruits. It is also a very high energy food as 65%-75% of the fruit weight is glucose, fructose and sucrose (Vayalil, 2012). Regardless of the high sugar content, dates are low glycemic index (GI) fruits with a range number of 31-50. Sugar in dates does not require enzymatic mechanisms to be digested, but can be readily absorbed to the blood circulation. This in fact promotes dates as the sources of rapid energy during exercise and recovery. Moreover, dates are also perceived as the sources of vitamins, minerals and antioxidants. Palm sugar as another source of carbohydrate in Strive protein bars is also found to have a lower GI than sugarcane, even though the major components are similar which are sucrose (Srikaeo, 2015). Likewise with lower digestion rate of palm sugar, it is suspected due to minimal processes and the significant amount of inulin as dietary fiber.

Table 2. Show the ingredients incorporated in different protein bars. All the samples shown to have different carbohydrate, protein, fat and vitamins sources. The different ingredients incorporated will generate different nutritional content and benefits, where it is also affected by the amount of incorporation. Different ingredients incorporation will also differently affect the body's response to the ingestion and metabolism of the food's components. Due to this reason, the nutritional status of each brand will differentiate from each other depending on the product design and initial brand purpose.

Table 2. Ingredients Incorporate in different Protein Bar brands

AE	AN	AL	AR	AQ
Soy protein Isolate	Dark chocolate compound	Rice Crisp	Dates	Protein blend (milk protein isolate, whey protein isolate)
Date	Soy protein puff	Glucose Syrup	Peanuts	Peanuts
Oat	Tocoferol	Chocolate compound	Egg Whites	Waters
Palm Sugar	Oat	Corn Chips	Chocolate	Erythritol
Peanut Butter	Whey Protein Concentrate	Soy Protein	Natural Flavors	Cocoa Butter
Almond	Rice Crispy	Margarine	Sea Salts	Glycerin
	Pistachio Nuts	Isolate Whey Protein	Cocoa	Unsweetened Chocolate
	Steviol Glycoside	Inulin Fiber		Sodium Caseinate
	Tocoferol	Margarine		Natural Flavors
	Ascorbyl Palmitate	Humectan		Sea Salts
	Synthetic Chocolate Flavor	L-carnitine natural identical flavor		Stevia
	Cacao Extract	Vegetable Emulsifier		Lecithin
	L-carnitine	Potassium Sorbate		

3.4.1.2. Protein Content Evaluation

Figure 17. Show the protein content between protein bars from different brands. It is shown that strive protein bars have the highest protein content, 41.57g per 100g. The protein source of Strive protein bar is soy protein isolate, where the protein content is claimed to contain 90% of protein per 100g. It is supported by Koshy *et al.* (2015), that soy protein isolate contains ≥ 90% protein on a moisture free basis. The ratio of ingredients developed incorporates the soy protein isolate in half of the bars, which became the reason for high protein content. Furthermore, the higher protein content is also affected by the minimum ingredients incorporated, mentioned to be only 6 ingredients where this will let the bigger ratio of soy protein isolate. Whereas as mentioned in **Table 2.** other brands such as Evolene, L-Men and Quest bar contain 12 to 13 ingredients in one bar. It also can be seen in the composition of Evolene and L-Men bars that they incorportae rice crisp and/or corn chips to be mixed with soy protein crisp and increase the volume of the bar, while there are no other significant additional ingredients in the Strive protein bar. The addition of other fillers will result in the decrease of protein content of the bar. Moreover, there is the addition of whey protein isolate (WPI) in the L-Men protein bar. According to the literature, whey protein isolate contains 90% or more protein (Lowery *et al.*, 2012), where theoretically it could contribute to a significant increase of protein content in L-men protein bars as the protein content is approximately

similar to soy protein isolate used in Strive protein bars (≥ 90%). However, as mentioned in **Figure 17.**, the protein content is only 31.8g and serves 7g protein per servings, where it may be caused due to low incorporation of WPI in the protein bars. Reciprocaly with WPC incorporation in the Evolene protein bar, where based on literature WPC contains 34%-80% of protein per 100g. However, it depends on the type of WPC used by the brand to achieve certain protein content.

Soy protein isolate is incorporated into AE as the main source of protein due to beneficial effects of it. To some extent, soy protein isolates a high effectiveness to decrease muscle damage, inflammation and oxidative stress that is caused by high physical activity (Shenoy, 2016). This action of protein isolate is supported by the antioxidant content such as isoflavones. Isoflavones act as antioxidant and anti-inflammatory by down regulating the cytokine-induced signal transduction in the cell of the immune system (Yu *et al.* 2016). Moreover, it ameliorates fatigue and muscle damage due to high free radicals. Soy protein isolate is also rich in BCAA (leucine, isoleucine, and valine) which contribute in muscle growth and recovery promoters, as well as for the activation of mTOR to stimulate muscle synthesis.

In **Figure 17.**, AR is shown to have the lowest protein content because it only depends on egg whites as the sources of protein. Even though egg whites are a good source of protein, there is only 11g of protein per 100g (Abeyrathne, 2013) and the product does not include any protein sources that can contribute significantly. Additionally, AE are proven as high protein bars as can be compared from **Figure 17.,** where AE has a significantly higher protein content than AF and AS. AF and AS is a snack bar that is produced and distributed in Indonesia,where it is stated as a cereal bar that aims for meal replacements and quick sources of energy (Aleksejeva, 2017). It is a bar-shaped food product made from cereal and incorporated with dried fruits and nuts, pressed and aggregated by a glucose syrup. Due to its aim, the cereal bars are dominantly carbohydrate with a range of 53g/100g to 71g/100g carbohydrate content. Whereas the protein content is in the range of 6g/100g to 10g/100g only. Moreover, cereal bars also contribute to the compliance of daily needs of dietary fiber, with the main source from oats, wheat and bran.

3.4.1.3. Problem During Protein Bar Development

Several problems arose during the product development, where the product cannot bind well due to the large volume caused by the soy protein crisp. On the other hand, the wet ingredients which contain dates and palm sugar cannot be increased due to the calorie factor. Maltodextrin was initially used to thicken the wet materials and make binding easier. The maltodextrin, however, made the soy protein crisp soggy and unappealing. The second step was to reduce the volume by crushing half of the soy protein crisp into the flour-like texture, which helped the bar come together smoothly.

3.4.2. Protein Bar Production Trial and Material Outsourcing

Production trials for Strive protein bars were done several times. The goal of the first attempt, which was aided by a mechanic, was to examine the packaging machine and the proper label size. After the manufacturing trial, there are a few label size revisions until the size is eventually decided. A packaging trial was conducted afterward with the goal of determining the best packaging type for the protein bar because the soy protein's crunch must be preserved. The product was packed in two different types of packaging, oriented polypropylene (OPP) doff combined with Vacuum-Metalized Cast Polypropylene Film (VMCPP) and Polyethylene Terephthalate (PET) combine with Aluminium (ALU) and Cast Unoriented Polypropylene (CPP). After the allotted period, the protein bar's crispness and flavor were evaluated every week for eight weeks and conclude that OPP doff + VMCPP is the best choice from price and quality perspective. This trial unintentionally also reveals the reaction of flavoring to the protein bar, which creates a bitter taste. Due to that, another option can be considered to improve the product.

During another production trial, it was revealed that the bar automatic line specification that was aimed to be used is not suitable. The machine is initially designed to mold energy bars. However, due to the different texture and moisture content between the protein bars and energy bars, it failed to be used. Therefore, the protein bars are molded manually. Afterwards, another production trial is conducted to determine the protein bar's total manufacturing time and to create a precise production guideline. Additionally , there were size changes in the product size in order to provide a more ergonomic and convenient design. Due to that, the packaging design needed to be modified and go through several changes to finally meet the appropriate size. ‘

The concatenation of the production trial was really useful to gain full understanding of the product as well as the production flow. It provides much information that is crucial for enhancing the production process and end product. Additionally, a distinct production flow was established, and this flow became the production guidelines.

3.4.3. BPOM Registration

Strive intended to gain BPOM license application to gain consumer trust that the product is safe and reliable. During the author internship period, the Strive protein bar BPOM license application is processed. The company received a lot of feedback from the BPOM regarding ingredients technical data and certificate of analysis, halal certificate verification, and obligatory information in the label. The author was assigned as the liaison between the design team and the BPOM regulator to deliver the revision and feedback needed to be done, in order to comply with the

BPOM standar. The BPOM process could take 5-8 months before the certificate, Nomor Izin Edar (NIE), packaging approval and barcode is gained. The problem encountered during the process was mainly due to the miscommunication between the authors and the regulator and straightly solved by further discussion.

Fortunately, the BPOM license of the protein bar was published in December. There are four data sent by the BPOM, which are the final label and carton design, barcode and certificate of food distribution permit which are attached to the Nomor Izin Edar (NIE). The final label and carton design was sent with a sign of approval from BPOM. Whereas the barcode and NIE gain will be attached to the final design of Strive protein bar.

3.4.4. New Variant Development

Strive already has 9 flavors of energy bar; choco, salted caramel, coco pandan, green tea, pineapple, ginger, turmeric, nasi uduk and peanut butter coffee. However, to expand the experience and flavor option, Strive intended to create a more unique flavor. The author is assigned to develop 2 new flavors with an expected time of 1 month. To achieve new flavors, the addition of powder flavoring was intended. The powder flavoring is chosen because it provides a high mouthfeel and aroma also more stable towards evaporation and oxidation (Taylor & Linforth, 2002). The powder flavor was obtained from one of the food flavoring and colorant distributors in Indonesia after several prospecting. Furthermore, the ingredients incorporated are similar with the previous variant, including oat, dates, palm sugar, almond, peanut butter, sunflower seeds and pumpkin seeds. After the development process was done, the sample was brought to the management for feedback and scoring. There were two revisions done for both samples due to imprecise flavor development. Furthermore, the new variants were accepted by the management and further process will be conducted according to the company regulation.

3.4.5 Assistant Project Manager

Beside producing its own product, Strive also collaborated with other companies to develop a variety of sports related products. The projects outsourced are with different companies. To initiate the collaboration, there will be kick-off meetings conducted to introduce each company and understand each field of focus. Following by the delivering of purpose and scope of product in order to design the desired product. The samples according to the product design will be made and delivered to Strive to be reviewed. Moreover, important information such as minimum quantity (MOQ), cost of goods (COGS), and production timeline will be obtained and discussed. Different collaborators will have different requirements of the MOQ and COGS. Mostly, COGS will include filling

and packaging cost as well as delivering cost. Moreover, during the product development, the author is assigned to contribute to the product characteristic design.

To ensure the flow of the projects, the author was assigned as the assistant project manager to keep track of project progress to adhere to the project timeline. The authors were also assigned to become the representative of the company to communicate with collaborators regarding further development processes, including BPOM and HALAL license application. Good communication skills are required in this task, due to their expected communication with collaborators for various purposes including revision and problems encountered during the process. All that information will be brought to the management to provide the latest update and information to also be used as consideration in decision making.

3.5. Conclusion and recommendations

People with high protein demands, including athletes and sports persons, increase the demand of high protein products, including protein bars. The development of protein bars utilized different types of protein sources such as from dairy or non-dairy sources. The utilization of soy isolate protein crisp from non-dairy sources may support the protein content of the protein bars with an intended amount of 20g protein per servings. Due to a certain ratio of protein, the protein in AE is significantly higher than other protein bar samples. Moreover, production trials were effectively conducted during development to identify potential drawbacks in the product, so that decision and solution could be made to prevent it from occurring in the future. Additionally, the BPOM license was able to be acquired in a timely manner, preventing a delay from the initial timeline. The new variant developments obtained two new variants that have been approved by the management. This led to further work including BPOM regulation, HALAL certification, packaging design and production trials before the product was ready to be launched. Moreover, projects that have been assigned to be supervised by the author have shown several improvements in the progress. However, further supervision is needed to ensure the flow of the project adheres to the initial timeline.

For the protein bar development, it is recommended to conduct another production trial before the launch date to ensure the relevance and accuracy of the guideline. It is also recommended to distribute samples to the potential customers to gain feedback. In regards to outsourced projects, it is recommended to frequently communicate the progress and the further steps of the project to keep both teams on the same work pace.

IV. SELF REFLECTION

The internship period lasted for 4 months, from 14 July to 14 November 2022. I can confidently say that I successfully completed all the tasks given by the company such as product development and as assistant project manager, and with that gained skills to solve problems, fastly adapt with new environment and workload, to make precise and fast decisions, to communicate with people effectively and accurately, to manage stress and expectation and to keeping integrity of my words and actions. I believe this will be largely useful in the future career as manners will also determine how the company sees our capability as employees.

I got an honor to learn a lot about the sports industry and handle such big things as an intern, that I do not expect to be faced during the first day of my internship. The first day was really hard and I needed to fastly adapt to the new environment and new workload. I need to handle things that I am not familiar with and have never been teached in the classes. Fortunately, all the staff members and the CEO are very helpful and kindly explaining and answering my question. The knowledge gained from the classes in I3L contributed significantly, as it is related to the workload assigned. The most relevant courses are Sport and Exercise Nutrition, Quality Management and Assurance and Food Analysis. The courses provide me with knowledge to finish the workload efficiently and accurately. Moreover, those experiences given contributed to the CV writing which is the main consideration of the company to hire me as an intern. i3L also taught me integrity and to be responsible with everything I did, which contributed a lot to my work performance.

I am grateful for the opportunity and trust given by PT Nutrisi Harapan Bangsa to help me learn and develop as a student and human. Also for I3L for the endless guidance and support for me to grow.

V. CONCLUSION & RECOMMENDATION

The internship goal was to give hands-on experience in the industry for the student. The author was grateful for the opportunity given by Strive and I3L to develop and grow as a student and human. In a way, the authors surely have learned a lot about real-work life which prepares the author for her real encounter with the real world. Through this experience, the author had a chance to sharpen the ability to communicate, responsibility, integrity and persistence. The authors recommend nothing because the internship period and guidance given by I3L is impeccable for the growth of the students.

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APPENDICES

Appendix 1. Technical data of soy protein isolate crisp

PGP INTERNATIONAL
An ABF Ingredients Company

Calculated Nutritional Information per 100 gram

BASIC COMPONENTS

Calories	364
Protein	81.09 g
Carbohydrate	10.28 g
Fat	0.79 g
Moisture	3.00 g
Ash	5.05 g

Appendix 2. Similarity Assessment