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Development of Nutri-bar Using Quinoa

Nisha M Wagh[1], Prof. Hanmant Bodhankar[2], Prof. Todkar Ashish[3]
Department of Food Technology[1,2,3]
Parul Institute of Applied Science, Parul University, Waghodia, Gujarat, India
nishuwagh1@gmail.com

Abstract: *The study of Nutri-bar development was carried out at the Parul Institute of Applied Sciences, Parul University, Vadodara. The main objective of study was to develop a Nutri-bar which will provide enough energy and protein to the body and can be consume by celiac disease patients as well. Quinoa Nutri-bars was developed using quinoa and whey protein concentrate, oats, date paste, honey, nuts, psyllium husk. Dry heat treatments were given to quinoa and oat prior to use in preparation of Nutri-bar. Significant variations were found after heat treatment of quinoa and oats among all the physico-chemical parameters of grain, but ash content showed a non-significant variation. Four different formulations were developed with different concentration of date paste (40%, 60%, 80%, 100%) and whey protein (0%, 5%, 7%, 10%). Nutri-bar with F4 formulation with 100% date paste and 10% of whey protein was found to be the best on the basis of sensory evaluation like taste, texture, color, mouth feel, and overall acceptability. Selected Nutri-bar was assessed for physico-chemical parameters, microbiological and sensory characteristic. The selected Nutri-bar had 7.525% moisture content, 2.35% ash content, 16.63% protein content, 14.63% fat content, 277.16% carbohydrate content and provided 475.35Kcal. It can be concluded from the results that Nutri-bars are good source protein and energy and can be consumed when a meal has been missed as well as it can be consumed by malnourished and school children.*

Keywords: Quinoa, Nutri-Bar, Psyllium husk, Whey Protein Concentrate

I. INTRODUCTION

Food bars/Nutri-bars or cereal bars are snacks of good sensory and nutritional characteristics due to their high carbohydrates, protein, fats and mineral contents. Increasing demand from consumers for nutritious snacks, has provoked the food manufacturers to develop food bars that provide nutrition and convenience (Shrimathi Dhammika Dharmarathne 2012). Cereal bar is chosen as an alternative source of snacks being high in protein, bioactive compounds and is a major supplier of energy to every day (Dutcosky et.al., 2006). They contain a wide range of vital nutrients and vitamins, as well as sufficient protein and carbohydrates to keep the body functioning. Quinoa is a marvelous food due to its multi-functional characteristics and nutritional profile. Quinoa is ample in mineral and vitamins as a good source of calcium, iron, magnesium, potassium, phosphorus, copper, zinc and B vitamins. It is also pre-eminent for people with lactose intolerance and coeliac disease (Vetha Varshini et.al., 2013).

Quinoa (Chenopodium quinoa Willd.) is a dicotyledonous indigenous plant in Andean region and it is considered as an excellent pseudo-cereal for its nutritional characteristics. It is widely cultivated in Peru, Bolivia, Ecuador, Chile and Argentina (Bhargava et.al., 2006). Though quinoa is a dicot crop, it is often mistaken for a cereal grain like rice, corn and wheat and has therefore acquired the term “pseudo-cereal”. This plant has been investigated extensively because of its high protein content, 12-23% and in particular its amino acid composition, which is close to the ideal protein balance recommended by FAO. Due to is great food potential, Quinoa is being introduced in many other countries and it is considered as a potential crop for National Academy of Science (NASA 1975). Because of its high protein content (Koziol, 1992), it can be used as an alternative protein resources for the development of blends for end products. Its protein fractionation shows the presence of albumin as well as a globulin called chenopodin (Brinegar & Goundan, 1993; Brinegar et.al., 1996; Abugoch et.al., 2008).

According to the National academy of Science of the United States, quinoa is considered among “golden grain” and because of its high nutritional value, NASA integrated it in the diet of astronauts. Taking in to account potentially significant contribution of quinoa to fight against hunger and malnutrition, the thirty-seventh session of the General Conference of FAO declared year of 2013 as the International Year of Quinoa (United Nations, 2011).

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The main carbohydrate component of quinoa is starch and it constitutes 52%-69% of it. Its total diet fiber is close to that in grain products 7%-9.7% while its soluble fiber content is known to be in the 1.3%-6.1% band. Quinoa contains sugar by about 3%. It mostly contains maltose, Dgalactose, and D-ribose in addition to low level of fructose and glucose (Abugoch James, 2009). Quinoa is accepted as an alternative oily seed. It has an oil rate of 2.0%-9.5%, and is rich in terms of essential fatty acids such as linoleic and alpha-linolenic acid. It contains antioxidants like alpha and gama-tocopherol in high concentration. Its oil content (7%) is higher than that of corn (4.7%) and other grains, and lower than that of soy beans (19.0%) (Maradini Filho et.al., 2015; Abugoch James, 2009).

Quinoa is also rich in micronutrients, such as vitamins and minerals (USDA, 2015). It contains pyridoxin (B6) and folic acid in high concentration. Pyridoxin and folic acid levels in 100g of quinoa are reported to meet adult's daily needs (Abugoch James, 2009). Quinoa's ash content (3.4%) is higher than that of rice (0.5%), wheat (1.8%), and most other grains. Because of this, quinoa seeds contain large amount of minerals (Vega-Galvez et.al., 2010).

II. Review of Literature

Many components of the human diet previously overlooked are now becoming part of human diet. Today the most important nutraceutical formulations contain vitamins, minerals, protein, carbohydrates, fats, antioxidant properties and others. Many under-exploited raw materials such as quinoa, flaxseeds, amaranth, psyllium, peanut, whey protein concentrate, soy protein isolate, etc., have been proved to be a rich source of protein, mineral, fat, fiber and vitamins. In the present research plan, efforts are made to utilize the underutilized grains and husk by incorporating them in the snack bar. The literature about different aspects of the present study has been reviewed under following captions:

1. Snack Bars
2. Functional Properties of Snack Bars
3. Nutritional value and Physio-chemical characteristics of Quinoa
4. Coeliac disease and gluten-free diet

2.1 Snack Bars

Snack bars are popular snack which is high in sugar, fat and energy. Snack bar looks out to meet the satisfying and health and wellness. The consumption of nutritional snack bar is influenced by age, gender and the nutritional understanding of the buyer. The utilization of the snack bar is also decided by the following aspects: fulfilling the needs of sweet, time saving, utilizing of energy source, for weight loss purpose, or for using for its nutritional components (Rush et.al., 2016). There can be different kinds of snack bars often made with fruits and nuts to provide healthy nutrients, bioactive compounds and dietary fibers to consumers.

2.2 Functional Properties of Snack Bars

Constantin et.al. (2018) concluded from the findings that compounds present in the snack bar have different actions that are essential to life. Proteins are needed to support the growth, repair tissue and protection, generally, the protein influenced by the gender, age, activity level, body health, or physiological state, bioactive factor is the importance of dietary fiber. The traditional sources of protein are plant protein, meat, fish, soy, milk, etc.

Agbaje et.al. (2014) explored the acceptability of cereal bars by the consumers. Cereal bars were prepared by using glutinous rice which were converted to flake and agglutination syrup (glucose syrup and honey). The dried fruits were mixed with dry ingredients and binding agents at different percentage. In the sensory evaluation, it was found that the sample CB-C (honey19.73%, glucose syrup-13.18% and 9.50% fruits) had the greatest acceptability. The consumer acceptability of the cereal bars was carried out using a 9-hedonic scale. All the qualities evaluated did not significantly ($p \leq 0.05$) affect the acceptability and preference of the samples, except texture which shows a significant difference ($p \leq 0.05$) among the samples. Hence it was concluded that incorporation of halal/sunnah fruits into the production of cereal bars will still make it to retain much of the nutritional and sensory properties.

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2.3 Nutritional Value and Physio-Chemical Characteristics of Quinoa

Quinoa is annual dicotyledonous herbaceous plant usually about 1-2 m high (Franc and Martina, 2006). Quinoa differs from cereals in that the storage reserves for the developing embryo are found in the perisperm rather than in the endosperm, hence called as a pseudo-cereal (Varriano-Marston & DeFrancisco, 1984; Becker & Hanners, 1990).

Proximate composition	Villa et.al. (2014)	Schoenlechner et.al., (2008)	Ramos Diaz Martin (2011) (g/100gm)	Repo -Carrasco-valencia (2011) (g/100gm)
Protein (%)	11.7	13.8	16.4	3.04-5.46
Carbohydrate	55.3	69	63	68.84-75.82
Fat (%)	12.4	5.04	6.3	4.69-6.85
Crude fiber (%)	2.2	12.88	11.5	1.92-3.38
Ash (%)	3	3.33	3.2	13.96-15.47
Moisture (%)	14.7	-	11.6	10.78-12.62

Table 1: Proximate composition of quinoa seed

2.4 Coeliac Disease and Gluten Free Diet

People suffering from coeliac disease react with inflammation of small intestine, leading to the malabsorption of several important nutrients including iron, foliate, calcium and fat- soluble vitamins (Feighery, 1999 and Murray, 1999). Coeliac disease is cause by a reaction to gliadin, a prolamin found in wheat. Upon exposure to gliadin, and specifically to peptides found in prolamin, the enzyme tissue transglutaminase modifies the protein, and the immune system cross-reacts with the small bowel tissue, causing an inflammatory reaction (Moore er.al., 2006). That leads to villous atrophy, which interferes with the absorption of nutrients namely vitamin and minerals (Pite, 2008).

Study of recent advances in the formulation of gluten free cereal based products was carried out by (Gallagher, et.al., 2004). The replacement of the gluten was a great challenge because it was an essential structure-building protein, which was essential for developing hight quality cereal products. Due to increase in celiac disease or intolerance to gluten there was increasing demands for gluten free products (Ramandeep Kaur, 2016).

Coeliac disease is a genetically linked autoimmune disorder that's triggered by consuming protein gluten, which is present in several cereals like wheat, rye, barley. When people with coeliac disease eat foods containing gluten, their immune system responds by damaging the finger-like villi of the small intestine, resulting in malabsorption of nutrients due to an immunological reaction to gluten. Gluten-free diet is only lifelong treatment for coeliac patients. So, quinoa, amaranth, arrowroot, millet and rice are the best option to develop gluten-free diet (Green et.al., 2005).

III. Materials and Methods

The present study entitled "Development of Cereal Bar utilizing Quinoa" was carried out in the Department of Food Technology, Parul Institute of Applied Sciences, Parul University, Vadodara. This section enlists the material used and elaborates the processing techniques, organoleptic evaluation and analytical procedure following during the research.

3.1 Materials

A. Raw Materials Used in Studies

The ingredients used in preparation of cereal bar were quinoa, oats, flaxseeds, almonds, cashew, pistachio, dates, black raisins, butter, honey, vanilla essence, psyllium husk procured from local market of Vadodara.

B. Chemicals and Glassware's

Sufficient glassware and chemicals for analytical grade are available in the department of Food Analysis and Food Processing lab, Department of Food Technology, Parul Institute of Applied Sciences, Parul University, Vadodara,

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C. Processing Equipment

Equipment required for the preparation of cereal bar are: Weighing balance, heating medium, grinder, molds, and other utensils were obtained from Food Processing Lab, Department of Food Technology, Parul Institute of Applied Sciences, Parul University, Vadodara.

3.2 Methods

A. Physio-chemical Analysis

Quinoa, oats, psyllium husk, dates, dried fruits (Almonds, cashews, pistachio, black raisins), flaxseeds were used and prepared cereal bars were analyzed for proximate composition including moisture, ash, protein, fat, carbohydrate, and calories content as per the standard procedure given by (AOAC 2005).

1. Moisture content

Moisture content was estimated by drying the empty dish and 5g of sample was weighed and grounded in the dish. The dish was then subjected to oven for drying at 105^0C for 4hrs. It was again weighed after cooling in desiccator until constant weight. The resultant loss in weight was calculated as moisture content.

Moisture % = Initial weight (W1)-final weight(W2) / Initial weight (W1) × 100

2. Ash content

Ash content was determined using (AOAC 2005) procedure. 5g of sample was weighed into pre-weighed crucible and it was heated at low flame till all the material was completely charred (smokeless) and cooled. The sample was then kept in the muffle furnace for about 4hrs, at 550^0C. It was again cooled in desiccator and weighed. The procedure was repeated until two consecutive weights were constant. The percent ash was calculated by knowing the difference between the initial and final weight.

Ash %=Weight before heating – Weight after heating/ weight of sample × 100

3. Determination of Protein content: Protein content was determined by Micro-Kjeldhal method.

- **Digestion:** 200mg of defatted ground sample was accurately weighed and a pinch of catalyst mixture K_2So_4:C_uSo_4:H_gO red (91:8.2:0.8g) was added and then it was transferred to the digestion flask, digestion was carried out with 5ml of concentrated H_2So_4 for 2-3hrs at 45^0C till the content becomes colorless.
- **Neutralization and Distillation**: Digested sample was diluted to the 50ml in volumetric flask and made final volume to 50ml with distilled water. Then the 5ml of aliquot was neutralized with 30% HCL and 40% of NaOH containing 5g of sodium thiosulphate. Distillation was carried and liberated ammonia was absorbed in 2% boric acid solution containing methyl red as indicator.
- **Titration:** The collected ammonia was titrated against 0.01N H_2SO_4. Titer reading was noted, Nitrogen was calculated by using following formula and % protein was calculated by multiplying 6.25. Simultaneously a blank sample was also run.

  Crude Protein % = (Sample titre – Blank titre) × 0.0014 × 6.25 / Sample weight × 100
- **Crude Fat:** The fat analysis of cereal bar was done using Soxhlet. 5g of sample was weighed and took in thimble. The extraction cups were dried in oven at 130^0C for 15 min and took the weight of empty cups. The extraction cups were cooled and 70ml of petroleum ether was added. The instrument was pre-heated and when the temperature was attained, the extraction cups were attached to the instrument and left for boiling for 30min, followed by rising for 20min and last of all recovery of solvent was done for 10 min. The recovered ether was collected and fat contained in extraction cups were estimated.

  Fat = (W2 – W1) / W × 100
- **Determination of Carbohydrates:** The carbohydrate content was calculated by deducting the sum of the value of moisture, fat, protein, total ash, and crude fiber. The NFE was calculated by the following formula

  NFE % = 100 – (CP% + CF% + CF% + TOTAL ASH%)

  CP = crude protein, CF= crude fat, CF= crude fiber.

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3.3 Microbial Parameter

In food products quality analysis, microbial examination is the perfect quality assessment protocol performed. The microbial quality of prepared cereal bar was determined. In the present study different microbial parameters such as Total Plate Count, Yeast and Mould were examined also the samples were examined during the storage at ambient temperature. Microbial examinations were carried out as per the methods given by APHA, (1992).

A. Determination of total plate count

- Preparation of nutrient agar medium: 28g of nutrient agar was added in 1000ml of distilled water and it was heated till it dissolved properly. Its mouth was plugged with cotton and it was sterilized in an autoclave for 20min at 120^0C and 15lbs pressure.
- Preparation of sample solution (serial dilution): Nine sterilized test tubes were taken and numbered. In each tube 9ml of distilled water was poured. The test tubes were plugged with cotton plugs and were sterilized in an autoclave at 121^0C for 15min with 15lbs pressure. 1ml of sample was added inn 9ml distilled water of sterile test tube serially.
- Preparation of plates: Petri plates and pipettes were sterilized by hot air oven (dry heat treatment) or by autoclave (moist heat treatment). Sterilized petri dishes were taken to the laminar airflow cabinet and ultraviolet light was switched on for 30min. After 30min UV light was switched off and then blower was switched on, and the working surface was cleaned by 70% alcohol. Plates were properly marked then 1ml of samples were poured into the plates. 15-20ml of molten media was poured into each plate. This was done near a flame to prevent contamination of the plate by microbes. The plates were firmly swirled and kept for solidification. The plates were then placed into the incubator for 48hrs at 37^0C and then observed for the colonies on the plates.

B. Determination of Yeast and Mould count

- Preparation of potato dextrose agar medium: 39g of Potato dextrose agar medium was added in 1000ml of distilled water and it was heated to dissolve properly. Using cotton plug the mouth was plugged and it was sterilized in an autoclave at 121^{0-}C for 15min with 15lbs pressure.
- Preparation of sample solution (serial dilution): 9 sterilized test tube were taken and numbered accordingly. 9ml distilled water was poured in each tube. The test tubes were closed with cotton plugs and were sterilized inn an autoclave at 121^{0-}C for 15min with 15lbs pressure. 1ml of sample was added in 9ml distilled water of sterile test tube serially.
- Preparation of plates: Petri plates and pipettes were sterilized in hot air oven (dry heat treatment) or by autoclave (moist heat treatment). Sterilized petri dishes were taken to laminar air flow cabinet and ultraviolet light was switched on for 30min. After 30min UV light was switched off and then blower was switched on, and the working surface was cleaned by 70% alcohol. Plates were properly marked and then 1ml of samples were poured into the plates. 15-20ml of molten media was poured into each plate. This was done near a flame to prevent the contamination of the plate by microbes. The plates were firmly swirled and kept for solidification. Then the plates were kept into the incubator for 48hrs at 37^0C and the colonies were observed on the plates. The former colonies were counted on the plate.

3.4 Preparation of Nutri-Bar

Table: Formulation of Quinoa bar

Constituents	F1	F2	F3	F4
Quinoa (g)	75	75	75	75
Oats(g)	25	25	25	25
Dates(g)	40	60	80	100
Whey protein concentrate(g)	_	5	7	10
Flaxseeds(g)	20	20	20	20
Almonds(g)	10	10	10	10

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Pistachio(g)	10	10	10	10
Cashew(g)	10	10	10	10
Black Raisins(g)	10	10	10	10
Honey(g)	60	60	60	60
Psyllium husk(g)	0.5	0.5	0.5	0.5
Butter(g)	10	10	10	10

The various ingredients used for the standardization of recipe for the preparation of quinoa Nutri-Bar consist of 75g of Quinoa, 25g of oats, 20g of flaxseeds, 100g of seedless dates, 10g of almonds, 10g of pistachio, 10g of black raisins, and 10g of cashew, 0.5g of psyllium husk, 10-15g of butter, and 60g of honey, 1tsp vanilla extract. Each of the above ingredient required for making 7-8 bars was weighed consisting of 250g of the mixed material in total. Honey was used as a binding agent in bar preparation. The dry ingredients were added to the binder syrup and mixed well. After mixing the ingredients thoroughly with the binding syrup, the contents were transferred to the molds and compressed by applying pressure, cooled and packed in Polyp-ropylene (PP) pouches. The bars were stored at ambient and 37^0C temperature conditions for shelf-life evaluation.

IV. Result and Discussion

The result obtained during investigation "Development of Nutri-bar utilizing quinoa" is discussed here. Honey and date paste were used as a binding agent in all the selected formulations. The final product was analysed for physico-chemical analysis, microbial analysis, sensory evaluation and stored at room temperature. Research experiments undertaken to standardized the method for manufacturing of Nutri-bar have been discussed under heading follows:

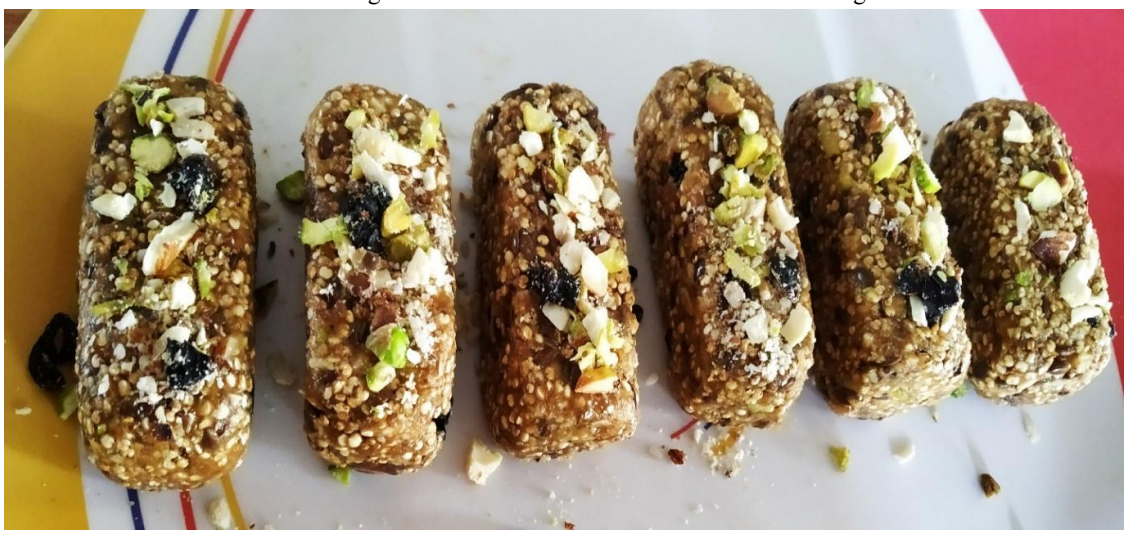

Figure 1: Nutri-bar prepared from selected formulation

4.1 Proximate composition of Nutri-bar

The mean values for the moisture contents of Nutri-bars ranged from 6.92±0.23 (F1) to 7.52±0.10 (F4). The minimum moisture content (6.92±0.23), ash content (1.87±0.01), protein content (7.37±0.06), fat content (13.656±0.2), carbohydrate content (94.032±0.18) and calories were found in F1. The maximum moisture content (7.52±0.10), ash content (2.35±0.05), protein content (16.63±0.02), carbohydrate content (277.16±0.13) were found in F4.

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Table: Mean value ± SD for proximate composition of Nutri-bar

Formulations	Moisture (%)	Ash (%)	Protein (%)	Fat (%)	Carbohydrate (%)	Calories (Kcal)
F1	6.92±0.23	1.87±0.01	7.37±0.06	13.656±0.2	94.032±0.18	246.416
F2	7.19±0.18	1.93±0.01	11.75±0.04	14.104±0.15	155.572±0.15	329.528
F3	7.31±0.13	2.27±0.02	13.80±0.04	14.33±0.01	216.212±0.20	400.394
F4	7.52±0.10	2.35±0.05	16.63±0.02	14.63±0.05	277.16±0.13	475.35

4.2.Microbial analysis of Nutri-bar

- **Total plate count (TPC) of Nutri-bars:** The mean values for TPC of Nutri-bar samples vary from 3.26 to 2.72 Log_{10} cfu/g. The maximum value was observed in F4 (3.26 Log_{10} cfu/g). With different treatment there is a significant difference in TPC. Al-Hooti et.al. observed that TPC significantly varied from 1.00 to 2.18 Log_{10} cfu/g in date bar samples.
- **Total mold count of Nutri-bar:** The mean values for mould count of Nutri-bar sample ranged from 2.65 to 3.01 Log_{10} cfu/g. The maximum count was found in F4 (3.01 Log_{10} cfu/g) and minimum count in F1 (2.65 Log_{10} cfu/g). With different treatments there is a significant difference in mold counts. Al-Hooti et.al. observed that mold varied significantly in date bars from 2.6 to 3.00 Log_{10} cfu/g.

4.3 Sensory evaluation of Nutri-bar

Table: Sensory evaluation of produced Nutri-bar

Sr. No.	Sample code	Color	Aroma	Taste	Flavour	Appearance	Overall Acceptability
1	F1	4.625	4.5	4.75	4.75	4.18	4.561
2	F2	4.87	4.87	5.43	5.75	5.75	5.334
3	F3	7.125	7.31	7.43	7.56	7.56	7.41
4	F4	8.75	8.8	9	9	9	8.87

The quality of Nutri-bars was greatly influenced by their flavour, texture and taste. There were significant changes in texture and taste of Nutri-bar due to different concentration of date paste. The Nutri-bar with F1 formulation got 4.625 hedonic score on color, 4.5 hedonic score on aroma, 4.75 hedonic score on flavour, 4.18 hedonic score on appearance and its overall acceptability was 4.561. The bar with F1 formulation got 4.56 for overall acceptability which indicates that the bar neither liked nor disliked according to 9-point hedonic scale. It can be because of dull taste, poor texture and appearance, dull aroma and flavour. The bar with F2 formulation got 4.87 hedonic score on color, 4.87 hedonic score on aroma, 5.43 hedonic score on taste, 5.75 hedonic score on flavour, 5.75 hedonic score on appearance and its overall acceptability was 5.33. The Nutri-bar with F2 formulation got 5.33 for overall acceptability which indicates that the bar ranged between neither liked nor disliked and slightly liked according to 9-point hedonic scale. It can be because of uneven texture and dull taste of Nutri-bar. The Nutri-bar with F3 formulation got 7.12 hedonic score on color, 7.31 hedonic score on aroma, 7.43 hedonic score on taste, 7.56 hedonic score on flavour, 7.56 hedonic score on appearance and its overall acceptability was 7.41. The Nutri-bar with F3 formulation got 7.41 hedonic score for overall acceptability which indicates that the bar ranged between like moderately and like very much. It can be because of brittle texture of Nutri-bar and taste was moderately liked as compared to previous formulations. The Nutri-bar with F4 formulation got 8.75 hedonic score for color, 8.8 hedonic score on aroma, 9 hedonic score on taste, 9 hedonic score on flavour, 9 hedonic score on appearance, and 8.87 hedonic score for overall acceptability. The Nutri-bar with F4 formulation got 8.87 hedonic score which indicates the bar ranged between like very much and like extremely according to hedonic scale. It can be because the bar contains acceptable stable taste, texture, aroma, flavour, appearance and overall acceptability. Therefore, Nutri-bar with F4 formulation was selected as the best Nutri-bars.

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V. CONCLUSION

It can be concluded from above results that from all the formulations containing different concentrations of dates, whey protein, roasted quinoa, flaxseeds, roasted oats, nuts, honey, psyllium husk, F4 was found to be the best among all the different treatments. Nutri-bar with F4 formulation contain 7.52% moisture, 2.35% ash, 16.63% protein, 14.63% fats, 277.16% carbohydrates and 475.35 Kcal of energy. The prepared Nutri-bar can provide sufficient amount of energy and protein to the body. Nuts provide extra nutritional value to the Nutri-bar. People suffering from celiac disease and diabetes can consume this Nutri-bar. It can be healthy food option to replace unhealthy foods. The prepared Nutri-bar can also be a best option for those who are unable to take their meal on time which will provide sufficient amount of energy and protein. The ingredients for Nutri-bar preparation were chosen wisely with an intention to provide enough energy and protein which can be helpful to the diabetic and celiac disease patients. These Nutri-bar will prove healthy food product in terms of protein, energy and other nutrients for humans. It can also be called as Meal-replacement bar as it provides enough energy and nutrients to the body.

REFERENCES

[1]. Abugoch L, Romero N, Tapia C, Silva J and Rivera M (2008) Study of some physicochemical and functional properties of quinoa (*Chenopodium quinoa W)* protein isolates. *J Agri Food Chem* 56:4745-750

[2]. Adetunde O T, Oluseyi T O, Oyeyiola A O, Silva B O, Olayinka K O and Alo B I (2012) Effects of roasting on the proximate composition and levels of polycyclic aromatic hydrocarbons in some roasted Nigerian delicacies. *JETEAS* 3:857-62.

[3]. Agbaje R, Hassan C Z, Afirin N & Rahman A (2014) Sensory preference and mineral contents of cereal bars made from glutinous rice flakes and sunnah foods. *J Environ Sci Toxicol Foods Technol* 8: 26-31.

[4]. Agbaje R, Hassan C Z, Norlelawati A, Abdul Rahman A and Huda-Faujan N (2016) Development of Physico-chemical analysis of granola formulated with puffed glutinous rice and selected dried sunnah foods. *J Intl Foods Res* 23: 498-506.

[5]. Aigster A, Duncan S E, Conforti F D & Barbeau W E (2011) Physico-chemical properties and sensory attributes of resistant starch-supplemented granola bars and cereals. *LWT Food Sci Technol* 44: 2159-65.

[6]. Alvarez-Jubete, L.; Arendt, E. K. and Gallagher, E. (2009a). Nutritive value and chemical composition pseudocereals as gluten-free ingredients. *Int. J. Food. Sci. Nutr.,* 60(suppl 4):240-257.

[7]. Alvarez-Jubete, L.; Holse, M.; Hansen, A.; Arendt, E. K. and Gallagher, E. (2009b). Impact of baking on the vitamine E content of the pseudocereals amaranth, quinoa and buckwheat. Cereal Chem., 86(5):511-515.

[8]. Alvarez-Jubete, L.; Wijngaard, H. H.; Arendt, E. K. and Gallagher, E. (2010). Polyphenol composition and in vitro antioxidant activity of amaranth and buckwheat as affected by sprouting and bread baking. *Food Chem.,* 119:770-778.

[9]. Anonymous (2013) Flax nutrition, Flax Council of Canada. www.flaxcouncil.com

[10]. Aslanta R, Guleryuz M and Turan M (2001) Some chemical contents of selected almond *(Prunus amygdalus* Batsch) types. *CIHEAM* 4: 347-50.

[11]. Barbera G, Marco L D and Schirra M (1994) Effects of rootstock on productive and qualitative response of two almond varieties. *Acta Hortic* 373*:*129-34.

[12]. Coskuner Y and Karababa E (2007) Some physical properties of flaxseeds (*Linum usitatissimum)*. *J Foods Engg* 78: 1067-73.

[13]. Escobar B, Estevez A M and Vasquez M (1995) Cereals and nut bars, nutritional quality and storage stability. *J Plant Food Hum-Nutr* 47:309-17.

[14]. Faber M A and Yuyama L K O (2015) Functional Dietary Cereal Bar based on Amazon Fruits. *J Nutr Food Sci* 5:2-10.

[15]. Farinazzi-Machado F M V, Barbalho S M, Oshiiwa M, Goulart R and Junior O P (2012) USW of cereal bars with quinoa (*Chenopodium quinoa W)* to reduce risk factors related to cardiovascular diseases. *J Sci Technol* 32:239-44.

[16]. Feighery, C. (1999). Fortnightly review- Coeliac disease. *British Medical Journal,* 319:236-239.

[17]. Gallagher, E. (2009). Gluten-free food science and technology. *London, UK: John Wiley & Sons.*

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[18]. Garcez-de-Carvalho M, Correia-da-Costa J M, Passos – Rodrigues M C, Machado – de- Sousa P H and Clemente E (2011) Formulation and sensory acceptance of cereal bars made with almonds and chicha, sapucaya and gurgueia Nuts. *J Foods Sci* 5:26-30.

[19]. Garcia M C, Lobato L P, Benassi M T and Junior M S (2012) Application of roasted rice bran in cereal-bars. *Clin Technol Aliment Campinas* 32:718-24.

[20]. Ghrairia T F, Lahouarb L, Arem-Amira E L, Brahmi F, Ali Ferchichi A, Achour L and Saida S (2013) Physicochemical composition of different varieties of raisins *(Vitis vinifera L.) Indian Crops Prod* 43:73-77.

[21]. Hettiarachchy N S, Hareland G A, Ostenson A and Bladner S G (1990) Chemical composition of 11 flaxseed varieties grown in North Dakota, Proceedings of Flax Institute Pp:1-25.

[22]. Hidalgo M J, Villafare R N, Sgroppo S C, Marchevsky E J and Pellerano R G (2015) Toxic Trace Element Contents in Gluten-free Cereal-bars Marketed in Argentina. *Intl J Celiac Disease* 3:12-16.

[23]. Kavitha S and Parimalavalli R (2014) Effect of Processing Methods on Proximate Composition of Cereal and Legume flours. *J Hum Nutr Food Sci* 2:1051-75.

[24]. Khan A and Saini C S (2016) Effect of roasting on physicochemical and functional properties of flaxseed flour. *Cogent Engg* 3:1-14.

[25]. Khan H N, Farooqi H, Ali S and Khan J S (2010) Serum lipids profile and retinol in rats fed micronutrient rich edible vegetable oil. *J Biosci* 2:109-15.