Standardization and Value Addition for Development of Frozen *Kebab* using Germinated Brown Rice, Fenugreek Microgreens and Mustard Microgreens.

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ABSTRACT

The ingredients incorporated in frozen *kebab* is loaded with various nutritional properties. microgreens is 40% more nutritious than mature greens. The microgreens incorporated in frozen *kebab* prevents various health conditions.The addition of germinated brown rice, fenugreek microgreens and mustard microgreens was aimed for improving nutritional properties and to develop a convenience food product. The formulation of developed frozen *kebab* is standardized using germinated brown rice and two different types of microgreens (fenugreek microgreens, mustard microgreens), formulated with 20% GBR, 10% FM, and 10% MM was selected based on sensory characteristics. The selected product S3 has highest sensory score among all samples color (7.9), appearance (8.2), texture (8.3), flavor (7.8), taste (7.9), overall acceptability
(8.02). The proximate analysis of S3 shows protein (12.66%), carbohydrates (26.64%), crude fiber (7.41%), dietary fiber (2.79%), ash (2.2%).

Keywords: *Germinated brown rice, fenugreek microgreens, mustard microgreens, kebab.*

1. INTRODUCTION

In response to changing lifestyles, there is an increase in demand for ready to fry convenient food items. A variety of frozen food products are continuously being launched to the market in order to meet the demand. The main drivers of increased use and variety of frozen meals are growing consumer preference for time saving convenience in food preparation and consumer openness to trying new food products (Torres and Canet, 2001).

Microgreens are young vegetable greens that have been collected after cotyledon leaves have formed and having intense aroma. Microgreens are excellent source of potent nutrients and can be used in various products to add a value to that product (Yanqi Zhang *et al*., 2021). Microgreens are having larger concentrations of phenolics, antioxidants, minerals, and vitamins than developed greens or seeds. These ae well recognize as good carrier of biologically active components (Mir *et al*., 2017). Microgreens are gaining increasing interest as a potential functional foods, due to their relevant contents of micronutrients and bioactive compounds (Sun j. *et al*., 2013). They are gaining popularity due to their attractive colors, textures, and flavors. (Renna *et al*., 2017).

In addition to being used as garnish, microgreens are increasingly being used as fundamental ingredients in the creation of new product with distinctive flavors (Renna *et al*., 2017).

Microgreens are loaded with nutrients despite the fact that their concentration may vary slightly, many varieties are rich in K, Fe, Zn, Mg, and Cu (Xiao *et al*., 2012). studies have shown that the percentage of nutrients in microgreens are up to nine times greater than the mature greens (Pinto *et al.*, 2015). Presence of antioxidants can facilitate to lower risk of type 2 diabetes. In laboratory experiments, it is shown that fenugreek microgreens increases cellular sugar uptake by 25-44% (M.H., 1996; Wadhawan *et al*., 2018). Mustard (*Brassica juncea L.*) greens includes a variety of phytochemicals that are known to promote health, including carotenoids and phenolic compounds. These chemicals are frequently linked to their capacity to act as detoxifiers against oxidative stress. Mustard greens include a number of antioxidants such as phenolic compounds that may have health advantage against the onset of chronic diseases (Marissa D. Frazie *et al*., 2017).

The antioxidant activity of fenugreek microgreens is higher than fenugreek mature leaves, research clearly reveals that the antioxidant activity of fenugreek microgreens is 35% and fenugreek mature leaves is at 19.3% (M. D. Ghoora and N. Srividya, 2017).

Germinated brown rice having higher GABA content aids in the prevention of Alzheimer's disease. GBR dramatically enhanced spatial learning. Germinated brown rice have a powerful inhibitor of the protylendopetidase enzyme, which has been linked to Alzheimer disease (Kayahara and Tsukahara, 2000).

Germinated brown rice (GBR) was created to enhance the taste and flavor of brown rice. germination process produces beneficial bioactive compounds. Brown rice that has been germinated is also referred as sprouted brown rice, The germination process increses the bioavailability of nutrients (Swati B. Patil *et al*.,2011). It has been discovered that the germination of brown rice grains boosted the amount of numerous nutrients including total protein, vitamin B, reducing sugar (Trachoo *et al*.,2006).

The wholesomeness of germinated brown rice have drawn the attention of a growing number of researchers, and some of them have discovered a link between a diet high in germinated brown rice can treat the specific disease. germinated brown rice can be viewed as a functional food because it has been shown to have a variety of physiological effects such as antihyperlipidemia and antihypertension as well as it may decreased risk of cancer, diabetes, cardiovascular disease and alzheimers disease. functional foods have received special attention because they play a significant part in illness prevention or slowing the progression of chronic diseases by providing the critical nutrients through consistent ingestion at effective amounts as a part of a diet (Hasler, 2002) and (Viuda Martos *et al*., 2010).

During the analysis it is observed that acylated steryl glucoside (ASG) is major growth factor in brown rice after germination of brown rice the level of good enzymes are increased which is beneficial for preventing diabetes and helps to control the blood sugar level and reduces the risk of type 2 diabetes (Rasolt, 2008).

Germinated brown rice requires less cooking time and due to water absorption by kernels during germination resulted in size expansion of brown rice and has better sensory properties (Jiamyangyuen and Ooraikul, 2008).

Starch is main component found in rice grains, in endosperm polysaccharide is stored and hydrolyzed during the germination to produce soluble sugars. it is identified that during the germination the reducing sugar content of brown rice increases as germination process is initiated (Ayernor and ocloo, 2007).

The albumin and gluten protein contents of brown rice are increased during germination, while the globulin and gliadin concentrations are decreased. hence the bioavailability of the protein available in brown rice is improved much better (Zheng *et al*., 2007).

It is reported that during the germination process the level of protein is significantly increases time of the germination (Chen *et al*., 2003).

Initially the free amino acid content of brown rice is 1.96 mg/g but as germination process starts the free amino acid content is also increases to 3.69 mg/g (Veluppillai *et al*., 2009).

It has been reported that the germination of grains increases the antioxidant activity and also having a higher total phenolic acid contents (Xu *et al*., 2009).

2. MATERIALS AND METHODS

2.1 Materials

2.1.1 Raw Materials

Raw materials such as fenugreek microgreens, mustard microgreens are grown in laboratory on Grow mat, germinated brown rice were purchased from e-commerce website and soya chunks and other minor ingredients were purchased from the local market Loni kalbhor, Pune.

2.1.2 Chemicals

Chemicals of analytical grade were made available in the laboratories of MIT School of Food Technology.

2.1.3 Processing Equipments

The analytical equipment's like microwave oven for moisture content, kejaldhal for protein estimation, soxlet for fat estimation, fibrotron for total fiber estimation, muffle furnace for estimation of ash content were made available in the laboratories of MIT School of Food Technology.

2.2 Methods

2.2.1 Preparation of germinated brown rice and microgreens frozen *kebab*

The preparation starts with the production of microgreens, in product two varieties are used i.e. fenugreek microgreens and mustard microgreens were grown on grow mat for 6-7 days and then procured for product preparation. then soya kheema is prepared from boiled soya chunks (80℃-4min) grind the boiled soya chunks and add ingredients required to make a soya kheema i.e. gram flour, corn flour, boiled potato, use this soya kheema mixture for further preparation of the product. the preparation of the frozen kebab starts with the blanching of microgreens at (60℃-3min) in next step germinated brown rice is coarsely ground and cooking is done at (70℃-6min) then add other minor ingredients (soya kheema, black pepper, chili powder, asafoetida, cumin seeds, black salt) mixing is carried out, after mixing of all ingredients shaping is done into a round shape(each kebab is weighed contains 25 gm of mixture) the prepared kebab is packed in metallized polyester and LDPE (low density polyethylene) and allowed to stored at (-18℃). The similar process was followed by (Maity T. *et al.,* 2012).

2.2.2 Formulation of brown rice and microgreens frozen *kebab*

Table 1 : Formulation of frozen *kebab*

Sample	Soya kheema	GBR	FM	MM
Control	100	0	0	0
S1	40	40	10	10
S2	40	30	20	10
S3	60	20	10	10
S4	60	10	10	20

GBR- germinated brown rice
FM- fenugreek microgreens
MM- mustard microgreens
for preparation of 40% soya kheema contains 24g boiled soya chunks, 4g bengal gram flour, 4g corn flour, 8g boiled potato. and 60% soya kheema contains 36g boiled soya chunks, 6g bengal gram flour, 6g corn flour, 12g boiled potato.

2.3 Sensory analysis

The sensory evaluation of frozen kebab sample was evaluated using a 9 point hedonic rating test (1-Extremely dislike to 9-Extremely like). The scorecard suggested by Ranganna,(1986) was used for judging the product frozen kebab during this study. A sensory judging panel was constituted with panelists among the faculty members of the MIT School of Food Technology. The experimental samples were served to the judges under ambient conditions. The panelists were instructed to rate each sample on 9 points hedonic scale which included a score for color appearance, taste, flavor, texture, mouthfeel, and overall acceptability of developed product. Also, judges were asked to comment on the characteristics of the samples. The final score for each attribute was obtained by averaging the score of all the panelists.

2.4 Proximate composition of frozen *kebab*

The developed product were analysed for moisture, fat, protein by AOAC, (2005), ash Ranganna, (1986), crude fiber AOAC, (2005), dietary fiber AOAC, (985.29), and carbohydrate content was calculated by difference method.

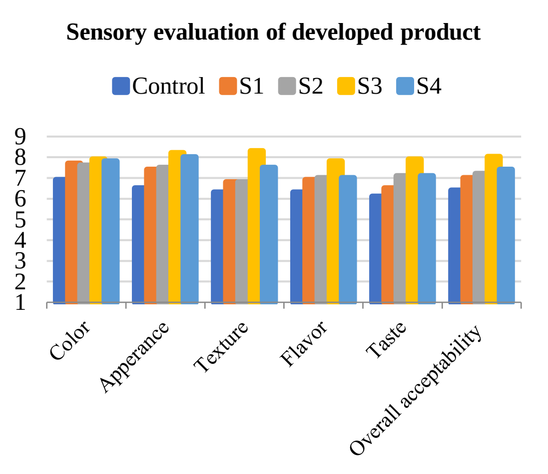
2. 5 Statistical analysis

The statistical analysis was performed by applying a one-way analysis of variance. The mean was calculated from triplicate readings. The level of significance was calculated CD (critical difference at 5%). The statistical design for analysis for analysis of data was used completely randomized design (CRD) as given by Panse and Shukhatme, (1967).

3. RESULT AND DISCUSSION

3.1 Sensory evaluation of frozen *kebab*

Kebab prepared with different formulations of Germinated brown rice, fenugreek microgreens and mustard microgreens were subjected for sensory evaluation to evaluate maximum acceptability of the product. The obtained results are presented in graph 1.



Graph 1: Sensory evaluation of developed product

The S3 incorporated with 20% germinated brown rice, 10% fenugreek microgreens, 10% mustard microgreens scored highest to sensory parameters color (7.9), appearance (8.2), texture (8.3), flavour (7.8), taste (7.9), overall acceptability (8.02) as compared to other samples.

3.2 Proximate composition of instant frozen *kebab* fortified with GBR, FM and MM

The prepared *kebab* were further analysed for proximate composition and obtained results are indices in Table 2.

Table 2: Proximate composition

Samples	Moisture (%)	Protein (%)	Fat (%)	Carbohydrates (%)	Crude Fiber (%)	Dietary Fiber (%)	Ash (%)
Control	39	19.9	10	15.7	4.2	9	2.2
S1	38.7	8.1	9.8	33.3	6.4	1.7	2.2
S2	38.8	9.8	9.8	34	6.2	1.5	2.3
S3	38.45	12.66	10.24	26.64	7.41	2.79	2.2
S4	38.6	12.4	10.2	27	7.3	2.6	2.1
SE±	0.0522	0.0384	0.0180	0.0165	0.0285	0.0160	0.0253
CD@5%	0.1647	0.1210	0.0567	0.0522	0.0899	0.0506	0.0800

(The values were mean ± standard deviation of three independent readings)

The moisture content of formulated frozen kebab was found constant in all samples S1 to S4 (38.7%-38.6%) and slightly increased in control (39%). protein has immense importance as body building component. data from table 6 indicated the rise in protein S3 (12.66%). The control has highest protein because it contains 100% soya kheema so results are obvious regarding the protein content of control. The fat content was found slight difference (10%) for control, (9.8%) for S1 and S2, S3 has (10.24%) and S4 (10.2%). Fiber is made up of indigestive plant components or substances that pass through our stomach and intestines relatively undamaged, the primary function of fiber is to keep the digestive system healthy. due to inclusion of soya kheema and germinated brown rice the crude fiber content is increased from control (4.2%) to S3 (7.41%). The finished product has contain (7.41%) crude fiber highest among all the samples. The sensorially accepted frozen kebab incorporated with germinated brown rice, fenugreek microgreens and mustard microgreens (S3) contains (2.79%) dietary fiber. The ash content of food product is simply the result of organic content being burned away, leaving inorganic minerals. In frozen kebab ash content was found from control (2.2%) to S4 (2.1%). carbohydrates provide energy to perform daily tasks. carbohydrates was observed for finished product is (26.64%) for S3.

4. CONCLUSION

It can be concluded that new product is developed successfully by incorporating 60% soya kheema, 20% germinated brown rice, 10% fenugreek microgreens and 10% mustard microgreens. This could be improved the nutritional status of population. The developed product contains sufficient amount of nutrients such as protein (12.66%), carbohydrates (26.64%), crude fiber (7.41%), dietary fiber (2.79%). The product was gone through 12-semi trained panel members and it indicates that product was sensorially well accepted. The standardized product sensory score were found highest among all the samples color (7.9), appearance (8.2), texture (8.3), flavor (7.8), taste (7.9), overall acceptability (8.02).

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