The Pharma Innovation Journal 2023; 12(4): 2090-2095

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2023; 12(4): 2090-2095

www.thepharmajournal.com
Received: 21-02-2023
Accepted: 24-03-2023

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Development of nutritious honey coated khatta mitha fruits and vegetables bites

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Abstract
The study was carried out to increase the intake of fruits and vegetables and to decrease the intake the sugar which leads to non-communicative diseases and obesity. The aim of the study was to investigate physical, chemical, and sensory parameters of honey coated khatta mitha fruits (Pineapple, Banana, Amla) and vegetables (carrot, Beetroot) bites. The samples were procured from local market, primary processing and pre-treatment like blanching was done. The product was dehydrated using 2 variations (tray drier and hot air oven). The dehydrated samples were subjected to sensory analysis. Based on the sensory analysis, honey coated khatta mitha bites in tray drier treatment was more accepted. Based on the overall acceptability of the samples, tray dried honey coated khatta mitha bites were further analysed for physio-functional, nutritional, phytochemical and consumer acceptability. The nutritional parameters of mixed honey coated khatta mitha bites were analysed, which content 18.83 g of protein, 3.1 g of crude fibre, 193.06 mg/100 g of total sugars and 50.30 mg/100 g reducing sugars. Consumer acceptance for carried out for the best accepted product, which shows 90% of consumers liked the product. The work concluded that natural, healthy, and dehydrated bites were invented to promote health and nutritional status of the population.

Keywords: Fruits and vegetables, honey, bites, sensory and nutritional analysis

Introduction
Fruits and vegetables are highly recommended for their health-promoting factors which are rich in vitamin C and A, minerals, and antioxidants. These concentrations help to manage micro-nutritent malnutrition. Moreover, fruits and vegetables have historically been useful in dietary advice (Marlett JA, *et al*.., 1997) [5]. Chronic conditions like obesity, diabetes, cancer, and heart disease which are the main causes of death worldwide. Also, there is an evolutionary disconnect between current diets, which are high in calories from fats and grains but low in fruits and vegetables (Martin *et al.,* 2013) [3]. So, increasing the amount of fruits and vegetables may be beneficial for health in place of some added sugars and saturated fat. According to the research, eating more fruits and vegetables lowers the chance of developing serious illnesses and postpones the development of age-related ailments. Traditional Mediterranean eating habits are linked to a decreased risk of cardiovascular disease (USDA, 2010) [4]. Consuming fruits and vegetables, which are perishable products and a significant source of vitamins and minerals for the human diet, is especially vital in countries like India where micronutrient shortages are a common problem (Meenakshi, 2016) [22]. They are believed to contribute 91% of vitamin C, 48% of vitamin A, 27% of vitamin B6, 17% of thiamine, and 15% of vitamin B6 together. (Quebedeaux and Bliss, 1988; Wargovich, 2000) [6, 8]. In addition, to having distinct and enticing flavours, colours, and textures, fruits and vegetables are also free of cholesterol and generally low in calories. Certain horticultural crops having nutraceuticals such as fibre, phytosterols, carotenoids like lycopene, ascorbic acid, tocopherols, glycosylates, and thiosulfates, as well as phenolic compounds like flavonoids, hydroxycinnamic acid-derivatives, stilbenes, and catechins, aid to prevent diseases (Voutilainen *et al.,* 2006) [7]. Fruit phytochemicals and dietary components may potentially have adverse, supplementary, or cooperative effects (Heinonen *et al.,* 1998) [9].
Honey is a natural food that appeals to people of all ages and sexes and is seen as part of a balanced diet. Honey is a naturally occurring sweet, viscous substance that honeybees make from the nectar of flowering plants or the excretions of insects that feed on living plant parts. Honeybees collect these substances, transform them into other substances, mix them with other substances, then store them in honeycombs where they ripen and mature.

A complex mixture of carbohydrates, water, a few proteins, vitamins, minerals, and phenolic chemicals make up honey (Alvarez-Suarez, Arawwawala *et al.*, 2017) [11]. The average amount of water in honey is 17.1%, along with 82.4% of total carbohydrates, 0.5% of proteins, amino acids, vitamins, and minerals. Fructose (38.5%) and glucose (31% of the average carbohydrate content) make up the majority. Maltose, sucrose, and other sugars make up the remaining 12.9% of the carbohydrates, 85 to 95% of the sugars and 95 to 99% of the dry matter in honey are made up of sugar (Krell R 1996) [12]. These simple sugars are responsible for honey's sweetness, hygroscopic qualities, energy content, and other physical characteristics (White JW 1979) [13]. Enhancement of fruit and vegetable-based products with protein will be one of the best method to mitigate protein as well as micronutrient nutrition. Soya protein is one of the best plant-protein equal nutrient to animal protein, needs to be incorporated in daily diet.it can be used in variety of forms, including flours, protein isolates and concentrates and textured fibres (Liu *et al.*, 2000) [23].

Food drying is a most important process for preserving food products since it has a great effect on the quality of the dried products. Drying prevents occurrence of undesirable changes due to microbial activity. It also lowers the product mass and volume, which improves the efficiency of packaging, storing and transportation. Osmatic dehydration is a water removal technique, which is applied to horticultural products such as fruits and vegetables to reduce the water content while increasing soluble solid content (Kaymak-Ertekin *et al*., 2000) [14].

Keeping the above facts in background, present study was done on value addition of fruits and vegetables was done by developing a honey coated khatta mitha fruit and vegetable bites.by using fruits and vegetables as main ingredient and honey is used as a natural sweetener keeping in mind to decrease the intake of sugars and enhances the intake of fruits and vegetables.

Materials and Methods

Procurement of the samples

A fresh fruits and vegetables were used for the study were procured from the local market, Bengaluru. The fruits and vegetables were manually separated and washed in tap water to remove the extraneous matter. Peeling was done by removing a very thin outer layer with a peeler, followed by a washing with drinking water. Slicing was done with the help of slicing machine.

Steam blanching of the primary processed samples

Fruits and vegetables were blanched before being frozen, canned, or dried in order to deactivate enzymes and alter texture, retaining nutritional value, colour, and flavour while releasing trapped air (Lee, F.A.*et al*.., 1958) [1]. Fruits (amla) and vegetables (carrot and beetroot) were subjected to steam blanching (95±3 °C) for 3 min (Barrett *et al*.., 1995) [2].

Honey coating and osmosis

Plate 1 to 5 depicts the samples prepared for honey coated khatta mitha bites**.** Fruits and vegetables were soaked in 30% of honey for 10 hours. When the samples were dipped in a hypertonic solution, the cells in the first layer of the material contact the solution and start to loose water due to concentration of gradient between the hypertonic solution and the cells, which led to the shrinkage of the material (Lewicki *et al.* 2020) [15]. The osmatic mass transfer rate was also affected by the size and shape of the produce due to variation in surface area to thickness ratio (Tortoe, 2010) [24].

Dehydration process

Processed fruits (Amla, Banana, pineapple) and vegetables (Carrot and beetroot were subjected for in tray drier for 15 hours at 55 °C and hot air oven at 80 °C for 6 hours.

Sensory analysis

Honey coated khatta mitha fruits and vegetables bites were analysed for sensory characteristics by a panel of 21 semi-trained members using a 9-point hedonic scale. The products were evaluated for their appearance, colour, consistency, aroma, flavour, taste, and overall acceptability.

Proximate analysis

The analysis of honey coated bites for its quality attributes has been conducted in laboratory using standard methods. Moisture, ash, protein, fat, crude fibre, carbohydrates was done by AOAC, 2005 [10] method. Total sugars were determined through anthrone method (Manickam, 2007) [25] Reducing sugars were determined through DNS method

Consumer acceptability

Developed bites was subjected to consumer acceptability by using FACT scale (Deepa, 2015) [26]. Fifty consumers were participated in consumer acceptability study and evaluated the product (Fig 1).

Table 1: Consumer acceptability scale

Sl. No	Opinion	✓
1	I would eat every opportunity that I had	
2	I would eat this very often	
3	I would frequently eat this	
4	I like this and would eat it now and then	
5	I would eat if available but would not go out of my way	
6	I don't like this but would eat this on an occasion	
7	I would hardly ever eat this	
8	I would eat this if there were no other food choices	
9	I would eat this only if forced	

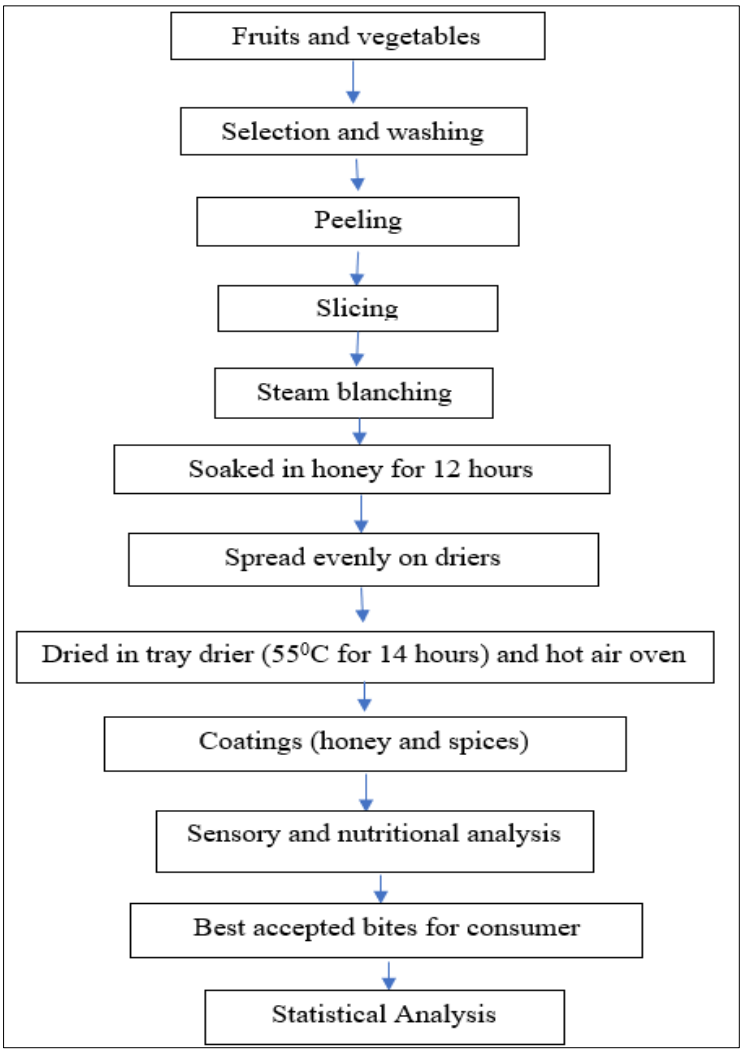


Fig 1: Flowchart for development of honey coated khatta mitha bites

Results and Discussion

Honey coated khatta mitha fruits and vegetables were prepared using fruits such as banana, pineapple, amla and vegetables such as carrot and beetroot and honey as main ingredient for coating. For coatings, spices used were white pepper powder, dry mango powder, dry mint powder, cumin powder and black salt. For toppings soy protein was added.55 percent of fruits and vegetables, 30% of honey, 10% of spices and 5% of soy protein powder was incorporated for formulation (Table 2) of khatta mitha bites.

Table 2: Formulation of ingredients for honey coated khatta mitha bites

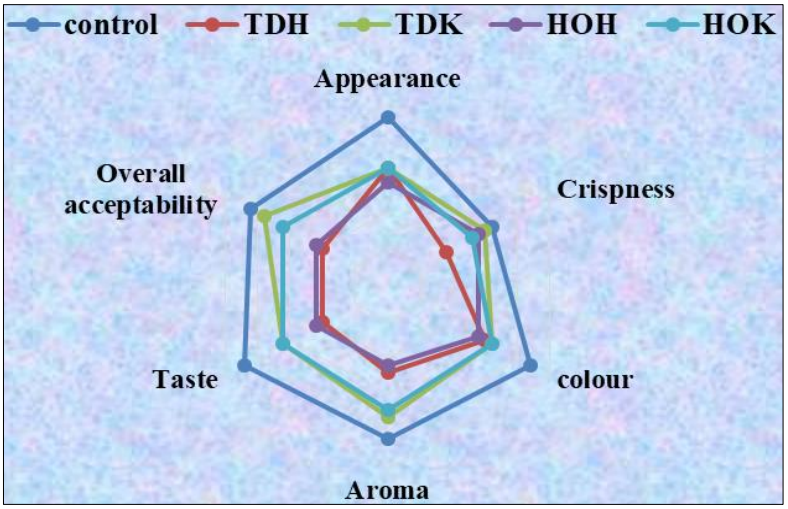
Ingredients	Percent (%)				
	Carrot	Beetroot	Amla	Pineapple	Banana
Sample	55	55	55	55	55
Honey	30	30	30	30	30
White pepper	2	2	2	2	2
Black salt	1	1	1	1	1
White salt	1	1	1	1	1
Dry mango powder	2	2	2	2	2
Cumin powder	2	2	2	2	2
Mint powder	2	1	1	1	1
Soy protein isolate	5	5	5	5	5

The sensory attributes of the developed khatta mitta fruits and vegetables bites in terms of appearance, flavour, aroma, consistency, taste, and overall acceptability was conducted, the results revealed significant differences. Mean scores of the sensory analysis of the samples are depicted in the table 3. Scores for honey coated khatta mitha bites in tray drier revealed appearance is 8.1±0.5, colour is 8.0±0.8, aroma is 8.3±0.4, taste is 8.1±0.5, overall acceptability is 8.3±0.7. Whereas honey coated khatta mitha bites in hot air oven showed appearance is 8.1±0.7, colour is 8.1±0.7, aroma is 8.2±0.7, taste is 8.1±0.7, overall acceptability is 8.1±0.7 respectively. Among the different variations, overall acceptability score was found high for honey coated khatta mitha bites which were dehydrated in tray drierthan hot air oven treated. The graph on mean sensory analysis scores of honey coated khatta mitta is also depicted in Fig. 2.

Table 3: Sensory analysis of honey coated bites by different variations

Samples	Appearance	Crispiness	Colour	Aroma	Taste	Overall acceptability
Control	8.8±0.3	7.8±1.0	8.6±0.7	8.6±0.7	8.7±0.7	8.6±0.6
HOK	8.1±0.7	7.9±0.8	8.1±0.7	8.2±0.7	8.1±0.7	8.1±0.7
HOH	7.8±0.5	7.8±0.7	7.8±0.7	7.6±0.7	7.6±0.5	7.6±0.7
TDH	8.1±0.3	7.4±0.9	8.0±0.4	7.7±0.6	7.5±0.8	7.5±0.7
TDK	8.1±0.5	8.0±0.8	8.1±0.7	8.3±0.4	8.1±0.5	8.3±0.7

TDH: Honey coated bites in tray drier, TDK: honey coated khatta mitha bites in tray drier, HOH: honey coated bites in hot air oven, HOK: honey coated khatta mitha bites in hot air oven



TDH: Honey coated bites in tray drier, TDK: honey coated khatta mitha bites in tray drier, HOH: honey coated bites in hot air oven, HOK: honey coated khatta mitha bites in hot air oven

Fig 2: Mean sensory analysis scores of honey coated bites

The proximate composition of mixed honey coated khatta mitha bites were analysed using AOAC (2005) [10] method. Moisture content is inversely proportional to the quantity of dry matter. Lower moisture content helps to preserve and store foods for longer time. Higher moisture content contributes to an increase in the microbial growth and causes damage to the product. Moreover, moisture also plays an important role in determining the food product (Tamrin *et al..*, 2017) [16]. Moisture content of tray dried honey coated khatta mitha fruit and vegetable bites is 11.4±0.6 where 89 percent of moisture was lost. Ash content reflects the mineral elements (Mbatchou *et al..*, 2013) [17]. Ash content of honey coated khatta mitha fruit and vegetable bites is 4.295±0.2. fat contents represent the lipid profile of the product as fruits and vegetables are low in fat, fat content is 1.2±0.2. Crude fibre content is 3.1±0.1. Carbohydrate content is 64.27±0.2. Protein content shows 18.83±0.4, due to the application of soy protein powder to the product. Whereas hot air oven dried honey coated khatta mitha bites reported moisture 9.45±0.5, carbohydrates 63.56±0.06, protein 10.2±0.3, fat 1.2±0.1, crude fibre 2.7±0.2, as 3.475±0.1. Among these two methods, tray drying proved better than hot air oven.

Table 4: Proximate parameters of mixed honey coated khatta mitha bites

Parameters	Tray drier	Hot air oven
Moisture (%)	11.4±0.6	9.45±0.5
Carbohydrates (g)	64.27±0.2	63.56±0.06
Protein (g)	18.83±0.4	10.2±0.3
Fat (g)	1.2±0.2	1.2±0.1
Crude fibre (g)	3.1±0.1	2.7±0.2
Ash (g)	4.295±0.2	3.475±0.1

Pectin is a common, heterogeneous, and structurally complex polysaccharide present in plant cell walls that is naturally present in staple foods and commonly used in the food and biomedical industry which helps to reduce blood cholesterol levels and gastrointestinal disorders. (Augusto, P. E. D 2014). Pectin content of the best accepted honey coated khatta mitha bites is 12.52%. Total sugars content is 193.06 mg/100 g and reducing sugar content is 50.30 mg/100 g. (Table 5)

Table 5: Chemical composition of honey coated khatta mitha bites

Parameters	Quantity
Total sugars(mg/100 g)	193.06
Reducing sugars(mg/100 g)	50.30
Pectin (%)	12.52

Consumer acceptability of a new product is an important factor to be considered for exploring the market potential of the product. Consumer response studies plays a key role in launching a newly developed product in the market and the consumer opinion is vital in determining actual acceptability of the product. The best accepted honey coated khatta mitha fruit and vegetable bites was subjected to consumer acceptance (n=50) to know the extent of likability and dislikability. Table represent the consumer acceptability of the honey coated khatta mitha fruit and vegetable bites using FACT scale. Among the different statements, it was noticed that 26% of the consumer opted “I would eat every opportunity that I has”.24% of the consumer reported that “I would eat this very often”. 18% reported that “I would frequently eat this”.24% reported that “I like this and would eat it now and then”. This study showed that developed fruit

and vegetable bites is having very good market potential as majority of the respondents showed their special interest to have honey coated khatta mitha bites as it has good nutritional benefits.

Table 6: Consumer acceptability of honey coated khatta mitha bites

SI. No	Opinion	Number of respondents	Percentage of total
1.	I would eat every opportunity that I had	13	26
2.	I would eat this very often	12	24
3.	I would frequently eat this	9	18
4.	I like this and would eat it now and then	12	24
5.	I would eat if available but would not go out of my way	2	4
6.	I do not like this but would eat this on an occasion	1	2
7.	I would hardly ever eat this	1	2
8.	I would eat this if there were no other food choices	0	0
9.	I would eat this only if forced	0	0
	Total	50	100

Plate 1: Osmosis of fruits and vegetables

Plate 2: Honey coated bites in tray drier

Plate 4: Honey coated bites in hot air oven

Plate 3: Honey coated khatta mitha bites in tray drier

Plate 5: Honey coated khatta mitha bites in hot air ove

Conclusion

Among the 2 drying methods applied, honey coated khatta mitha fruit and vegetable bites in tray drier were more accepted compared to hot air oven. Nowadays, consumers prefer healthier foods which increases the healthy nutrition. This study showed that a healthier snack developed from fruits and vegetables and uses honey as sweetener could be an alternative product with bioactive compounds and nutrient composition. These bites can be a healthier snack in the market.

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