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New Hard Boiled Candy Development by Incorporation of D. kaki Leave Extract to Reduce Migraine Headache

Ruqayya Rubab*, Maryam Mujahid, Midhat Rehmani and Shanzay Khan
Department of Food Science & Technology, Jinnah University for Women, Karachi, Pakistan

Abstract

Product development is the life-blood of companies and societies. In the present study a new migraine headache reducing candy was produced by incorporating of a fruit plant persimmon i.e. D. kaki. Among the various combinations, the D. kaki mixed candy containing 80mg/5g was found better than other combinations in respect to organoleptic properties and nutritional quality. The addition of 80mg/5gm of D. kaki to produce candy imparts migraine reducing impact. The pH, energy contents, moisture, ash, total soluble solids, titrable acidity, protein, fiber, and carbohydrate of newly developed anti-aging toffee were found to be 6.7±0.01, 47.14±1.9 kcal/5g, 7.9±0.05%, 2.82±0.02%, 62.7± 1.2%, 0.17± 0.02%, 1.95 ± 0.03%, 0.75 ± 0.01% and 54.5 ± 0.94% respectively. The standard plate counts were found to be less than the detection limit. On the sensory and microbiological point of view, the presently developed candy was found highly acceptable. The total aerobic plate count and mold count were found to be the acceptable according to food standards. The newly established candy imparts anti-migraine impact due to medicinal importance of the ingredients. There is several confectionery products sold in the market and are happily consumed by the consumers and few of them have medicinal properties, but no hard boiled candy with migraine headache reducing properties have been reported in the literature earlier. Therefore, the introduction of this first ever candy as remedy of migraine headache in the market will improve the health of consumers as well as the product cycle of the industry. It also has the market competent price therefore the product is likely to gain the attraction of consumer and improves the market trends.

Keywords: New food product development, hard boiled candy, persimmon, migraine headache

Introduction

Migraine is believed to be a neurological disorder that is started with headaches; producing transient motor and excessive plethora of somatosensory disturbances (Charles 2018). Migraine is a complex and multidimensional disorder (Buse, Greisman et al. 2019). Environmental and genetic factors influence this disorder (Burstein, Noseda et al. 2015, Nyholt, Borsook et al. 2017). The efficient treatment and preventive measures have been attempted and reported in the literature, however remain only cure humans to a limited extent making its control a challenge (Puledda and Goadsby 2017, Vikelis, Spingos et al. 2018, Bertels and Pradhan 2019). Attempts have been made by researchers to develop modification in the lifestyle to treat headaches (Robblee and Starling 2019). In this line, the role of dietary triggers has been recognized (Zaeem, Zhou et al. 2016), leading to strategies for diet therapy for headaches, including migraine (Orr 2016, Razeghi Jahromi, Ghorbani et al. 2019).

Scientific research-based evidence on the influence of food on human wellbeing has contributed to significant observations of agricultural processes and product developments. A modern type of foods, currently known as purposeful foods, has been illustrated by the role of food for wellbeing by reducing the

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possibility of health issues. A unit of calculation of purposeful foods and medicinal agents derived either directly or indirectly from entirely separate natural sources (Yaqub, Farooq et al. 2016). Persimmon (Diospyros kaki) can also be a trendy and common fruit among the vegetables, and its leaves have many bioactive compounds such as flavonoids, polyphenols, carotenoids, terpenoids, hormones, dietary flavonoids, and minerals these compounds have a valuable impact on human health because of their ability to prevent or control various diseases. Persimmon leaves also have four flavonols (Lordan, Ross et al. 2011). The leaves of persimmon contain the subsequent compounds: tatarinec, 40-dihydroxy-atruxillic acid, myricetin, trifolin, annulatin, astragalin, hyperin, isoquercetin, rutin, quercetin, kampferol, kakis pyrone, kakiglycoside, proanthocyanin. During the period of growth, most persimmon fruits accumulate a significant quantity of proanthocyanidins in their flesh, creating the sensation of astringency thanks to oral protein coagulation. Therefore, if these fruits are not artificially processed to remove astringency, these PA are fundamentally different from persimmon leaves in terms of pharmacological impact, persimmon pas have been documented to induce hypercholesterolemia as well as antioxidant and free radical scavenging effects (Karaman, Toker et al. 2014). For many years, Persimmon fruits, its seed extracts and leaves have been used in Japanese medicines to treat a number of illnesses. Persimmon leaves contain vitamin C and flavonoids. Due to their antioxidant properties, they have been used for the treatment of stroke and CVA syndrome. They are filled with inhibitors, vitamins a, c, elements, iodine, manganese, and other components. Proanthocyanidins, which chemically belongs to oligomeric flavonoids. It is the active ingredient in the prevention and treatment of headaches and migraines. The total proanthocyanidins amount is 540.2 ce/100g. They are renowned for having anti-oxidant, free-radical scavenging, anti-cancer, and anti-inflammatory, antiviral and tissue-protecting properties. The proanthocyaniidins have ability to change the structure and control it. It is possible that proanthocyanidins is effective in treating and preventing the headaches and migraines, by direct molecular scavenging as well as by modulation of different downstream signal pathways which are associated with stress responses. Proanthocyanidins can effectively avoid aerobic stress-induced injury and increase cellular inhibitor potential which ultimately minimize the headache (Kim, Lee et al. 2017).

Keeping in view the medicinal, especially migraine headache reducing effects of persimmon leaves, in the current study, a new hard boiled candy product was formulated aiming to contain appropriate amount of persimmon leaves for the treatment of migraine headache. Newly established candy is not only capable of fighting with various diseases such as cardiovascular disorders and diabetes mellitus, but it also ready to compete in market due to its cheap cost. Establishment and marketing of such candy can be an attractive way to treat such common diseases such as and to reduce migraine headache. The neuro-pharmacological screening and market research may further be carried out expending the area of study.

Methodology

Chemicals and Glassware

Analytical grade chemicals were used for analysis. All glassware was pre-rinsed with 10% HCl followed by de-ionized water. The ingredients of D. kaki candy including cane sugar (local), corn syrup (local), citric acid (commercial), and salt (National Foods) were purchased from super market.

Collection of D. kaki Leaves

Fresh leaves of D. kaki were collected directly from local fresh fruit and vegetable market, Karachi. Identification of the D. kaki leaves was confirmed by the Botany Department of the University.

Preparation extracts

The dirt and other possible impurities were removed by washing the sample with distilled de-ionized water. Drying of D. kaki leaves was carried out at room temperature for fifteen days. The dried plant was grinded into powder and was kept in sterile plastic bags before taken for further processing. 10gm of dried grinded powder of D. kaki leaves were extracted using water:ethanol (50:50 v/v) as a solvent by soxhlet extraction method (De Castro and Priego-Capote 2010).

Packaging materials

Metallic coated Polyethylene and butter paper were used to wrap the toffees and 50-micron Polyethylene bags were purchased from market.

Preparation of Candy

Mixture of sugar, corn syrup and water was added in the cooking pan in a ratio 48% weight percent sucrose, 32% weight percent glucose syrup, and 20% weiht water (Shukla, Bhise et al. 2018). Three types of candies were prepared using 80, 120 and 160mg/mL of D. kaki leaves extract. The extract was mixed with other ingredients into stainless steel container. The mixture was then heated to 110°C with constant stirring and without stirring to 130°C. The mixture was then finally cooked to 150°C and the end point was checked by cold water test. The cooked mix was then poured into mold (smeared with fat). The heated mass was cooled to solidify.

Organoleptic Evaluation

Standard 9-point hedonic scale procedure was used to carry out the sensory (organoleptic) evaluation of the finally produced toffees (Amerine, Pangborn et al. 2013). The mean score of each quality parameter such as overall acceptability, colour, texture, flavor and taste was recorded which was analyzed by 20 trained/and semi trained panelist.

Physical and Chemical Analysis

Physical and chemical tests of the final product such as moisture, pH, ash, colour carbohydrate and titrable acidity were carried out according to the standard methods of AOAC (Helrich 1990). The texture was analyzed by texture analyzer, and the calorific value was estimated by Bomb Calorimeter.

Microbial Analysis

Standard Plate Count (SPC) method was used to record microbial counts. Petri dishes with Potato Dextrose Agar (PDA) as the cultivation medium were kept for incubation at $37 \pm 5^{\circ}$ C for 2 days. The colonies were counted by colony counter.

Result and Discussion

Table 1: Standardization of Candy Recipe

Parameters	Control	Sample1	Sample2	Sample3
***D. kaki* extract (mg/5g) candy**	**0**	**80**	**120**	**160**
Organoleptic acceptability score*	8.50	8.60	8.25	8.10
Remarks	Control	**Selected**	Not Selected	Not Selected

*Nine point hedonic scale:

Keeping other ingredients constant 80, 120, and 160mg *D. kaki* were incorporated in 5g of migraine headache reducing candy to establish three different compositions. The sensory analysts recommended the sample with 80mg/mL *D. kaki.* As compare to the control sample, both had almost the same taste, texture and mouth feel but were differ in colour, the sample with *D. kaki* was darker in appearance. It can be revealed from the sensory results that the acceptability of candy containing *D. kaki* was found to be above average.

Table 2: Sensory score of fresh candy

Parameters	Control	Sample
Colour	8.5±0.02	8.7±0.03
Texture	8.3±0.04	8.5±0.05
Flavour	8.5±0.01	8.6±0.02
Taste	8.7±0.03	8.7±0.04
Organoleptic acceptability score*	8.50±0.03	8.6±0.03

*Nine point hedonic scale:

The sensory score of fresh candy has been summarized in Table 2. The colour of final product was observed to be 8.5 and 8.6 for control and sample prepared with mixing *D. kaki*. This might be due to reddish golden colour formation by *D. kaki*. The score for texture for control and the final product was found to be 8.3 to 8.5. The texture of candy is happened to be affected by the additional moisture content. Flavour score for control and final product sample was found to be 8.5 and 8.6. The taste scores for both control and sample was observed as 8.7. Both of the products control and final product were found to be highly acceptable. The composition and better sensoryscores of both of the products might have made both of the products acceptable.

The physical, chemical and microbial analysis of fresh controlled and final product the sample containing *D. kaki* has been recorded in Table 3. The results of pH analysis have provided an evident result that since the pH is neutral; it is suitable according to the product. The colour of controlled candy was light brown, the addition of aqueous extract of *D. kaki* to the candy cause the colour to one tone darker. Colour is one of the important qualities that attract consumers visually. The colour of candy is also influenced by the thermal process and flavonoid content of *D. kaki*. It has been reported in literature that solution containing flavonoid will appear darker i.e. red, orange or yellow when thermally processed. The food product containing sugar appears to be darker when getting caramelized (Priecina and Karlina 2013).

Table 3: Physical, Chemical and Microbial Analysis of the Freshly Prepared Candy

Parameters	Controlled sample	Sample with *D. kaki*
pH	6.6±0.01	6.7±0.01
Colour	Light brown	Reddish golden
Calories (kcal/5g)	43.6±1.2	47.14±1.9
Moisture Content(%)	7.5±0.04	7.9±0.05
Ash(%)	2.77±0.03	2.82±0.02
TSS (^{o}Brix)	66.5± 1.00	62.7± 1.2
Titrable Acidity%	0.10± 0.05	0.17± 0.02
Crude Protein%	1.3 ± 0.05	1.95 ± 0.03
Crude Fiber%	0.45 ± 0.01	0.75 ± 0.01
Carbohydrate%	50.5 ± 1.05	54.5 ± 0.94
	Microbial Analysis	
Standard Plate Count	< the Detection Limit	< the Detection Limit

The calorific values indicate that the candy contains only 47.14%, therefore, it can be easily utilized with the confidence of not gaining weight. Food quality can be maintained by maintaining less moisture content in the food commodities; that will reduce the deterioration of food by decreasing microbial growth. In the current study the moisture content is found to be lesser which ascertains the quality of good product. The ash content in the controlled sample is found to be less than the ash contentin the sample with *D. kaki.* It is mainly because *D. kaki* extract is obtained from a plant source which could be the reason of higher value in the later product. The ash content in both of the samples is found to be in acceptable limits, which make the product with *D. kaki* acceptable. The TSS content of product with *D. kaki* (62.7^{o}Brix) was found to be less than of that control sample (66.5 ^{o}Brix).The titerable acidity (TA) were found to be 0.10% in the controlled sample and 0.17% in the final product (Table 3).

Plate count value was found to be less than the detection limit. Confections are generally resistant to bacterial growth, but pathogens (if present) survival in the product for a long time is possible (Lund, Baird-Parker *et al.* 2000).

The constituents of the product produced in the current study are natural, no artificial colour and flavour is added to prepare the candy. The addition of corn syrup to the composition of product has positive effects on Texture, transparency, gloss and storage stability. Starch improves the water retention that is very important for better shelf life otherwise growth of molds and some microbes will occur.

Conclusion

In the present study a new migraine headache reducing candy was produced by incorporating of a fruit plant persimmon i.e. *D. kaki*. Among the various combinations, the *D. kaki* mixed candy containing 80mg/5g was found better than other combinations in respect to organoleptic properties and nutritional quality. The addition of 80mg/5gm of *D. kaki* to produce candy imparts migraine reducing impact. The candy samples were wrapped in metallic coated polythene wrapper, packed in 50-micron polythene bags and stored at ambient condition. There are several confectionery products sold in the market and are

happily consumed by the consumers and few of them have medicinal properties, but no hard boiled candy with migraine headache reducing properties have been reported in the literature earlier. Therefore, the introduction of this first ever candy as remedy of migraine headache in the market will improve the health of consumers as well as the product cycle of the industry. It also has the market competent price therefore the product is likely to gain the attraction of consumer and improves the market trends.

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