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# Innovative approaches to improve the quality attributes of halva: A review

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***Abstract***

The purpose of this work was to scan the literature data in the topic of halva production to find out relevant information for improving the quality of halva products. A major problem that affects the halva quality upon storage is represented by emulsion instability. Consequently, we are facing with the oil separation, toughness of the halva, the contamination of packaging materials with oil and a more reduced marketability. Moreover, the rancidity of the lipid fraction during storage represents a shortcoming that must be worldwide prevented in the halva production. So far, there were suggested several ways to solve these limiting factors and to improve the halva quality, especially the emulsion stability and texture, by incorporating of various ingredients such as dietary fiber, especially those resulted as by-products in the agro food processing, palm oil and emulsifiers. In addition, flavoring agents, nuts, dehydrated fruits and other additives can be added in the halva for both reasons to improve the nutritional value and to satisfy the consumer preferences. The available data are useful to improve the nutritional and sensory properties of halva and to develop innovative halva formulas with health-promoting properties.

***Keywords***: halva, oil separation and rancidity, dietary fiber, emulsifiers, unconventional ingredients.

## 1. Introduction

Halva, one of the most popular confectionary products in the world, is traditionaly obtained from cooked sugar, tahini (sesame paste) and *Saponaria officinalis* root extracts [1, 2]. Aditionaly, nuts, dehydrated fruits, flavoring agents and other additives may be added in the halva recipe for both reasons to improve the nutritional value and to satisfy the consumer preferences [3, 4].

It can be said that, halva has been produced using a wide range of recipes, ingredients and methods [5, 6]. In the industrial processing method the halva is obtained from sesame paste and a clear syrup obtained from a sugar solution which is concentrated and partially converted to invert sugar by addition of citric acid, mixed with glucose and then bleachedrby addition of *Saponaria officinalis* root extract. The sesame paste is mixed with this clear syrup, kneaded, molded and pressed into containers or whatever shape is prefered and finally packaged [7].

Sunflower halva, appreciated in Eastern European countries, is made of sunflower tahini whereas the sesame tahini is involved in the production of sesame halva [4, 8]. Whether we are referring to sesame halva or sunflower halva, the oil separation represents a major problem that broadly affects the halva quality causing an obvious toughness of the products and the contamination of packaging materials with the oil separated from the products [1, 6, 9]. Also, the rancidity of the lipid during halva storage it was a problem that has been for long time in the hands of specialists [10].

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The objective of the studies carried out in this field was to investigate the improving of halva quality in terms of emulsion stability and texture by using various additives such as fibers, especially those resulted as by-products in the agro food processing, vegetable oils, emulsifiers and flavoring agents.

Oil separation has been also notified in the peanut butter and this problem was prevented by adding of un-hydrogenated palm oil [11, 12] or by addition of palm oil and hydrogenated vegetable oils [13].

The palm oil was used in the halva production and its addition increased the viscosity of the oil phase and contributed to improving the emulsion stability [1, 14].

The increasingly demand for healthy food products led to design and develop new halva formulas enriched in fibers, as functional ingredients [15-17]. The processing of fruits and oilseeds generates huge amounts of by-products that can be recovered and used as value ingredients in the halva production. They are used as a valuable source of dietary fiber and bioactive compounds, especialy polyphenolic compounds with antioxidant properties [15, 18]. The fibers are known for their capacity to increase the oil content hold in the food formulas [19].

Also, there are many concerns for evaluation the impact of different concentrations and types of emulsifiers on oil separation and quality attributes of halva during storage [15, 20].

Due to the fact that halva is a high calorie product, in the last years relevant results have been reported by Racolta *et al.* [21] about designing dietetic halva formulas in response to consumers demand for a sugar free formula of this confectionery product. The reported data have proven that the dietetic formulas possess sensory attributes very similar with the conventional halva and might represent an efficient alternative for high caloric conventional halva.

Taking into consideration the main shortcomings of the traditional halva production, the goal of this work was to describe the current state of knowledge in order to highlight the new concerns in this research topic for solving the above mentioned issues and to design novel halva formulas with fortified properties.

## 2.Practical applications to improve the nutritional and sensory properties of halva

Recently, an increasing interest has been shown to supplementation of halva with dietary fiber resulted as by-products combined with emulsifiers. As a result, there were obtained halva formulas with improved palatability and technical properties such as stability, homogeneous texture, physiological functionalities and the supplemental medicinal and nutritional benefits of polyphenolic antioxidants.

In this direction, in agreement with the research performed by Elleuch *et al.* [15] the halva was supplementated with defatted sesame seed coats and date fibre concentrate resulted as by-products of agro food proccesing in order to improve its nutritional and organoleptic attrributes. Also, industrial mono-acylglycerols of fatty acids was used as emulsifier to prevent the oil separation. The different halva formulations were prepared base on defatted sesame testae, date fiber concentrate, emulsifier, tahini and nougat. The by-products used in the halva formulations show functional properties promoting the nutrition and health, are rich in dietary fiber and have technological potential for retaining water and fat. The reported results showed that the addition of both fibers together with emulsifier improved the emulsion stability and significantly enhanced the and nutritional properties and sensory attributes, especially the hardness of halva.

Most of the studies performed to solve the issue regarding the halva oil separation were carried out in laboratory conditions [1, 15, 20]. Their results have stated that, the emulsion instability is the problem that affects mostly confectionary products based on oleaginous seeds and crops.

Aloui *et al*. [17] reported the results obtained when the halva has been prepared at industrial scale by using various concentrations of soya lecithin and two monoglycerides as commercial emulsifiers in order to increase the emulsion stability. Also, commercial fibers derived from corn were added considering the fibers capacity to increase the oil retention in the food preparations [19]. It has been shown that by increasing the monoglycerides concentration up to 2.25% resulted in enhancing the oil retention in the halva products obtained in laboratory conditions or at industrial scale, without negatively impact on the texture or on the color of the products.

This finding could be explained by increasing the viscosity of the oil phase and by a more homogenous dispersion of the oil droplets in the aqueous phase.

A number of studies were focused on using several unconventional ingredients such as wheat bran and soybean for halva preparation. In this purpose, Kumar *et al*. [16] reported data about including wheat bran in the halva formulation and optimization of ingredients levels for the development of instant wheat sooji halva mix using response surface methodology. The optimised instant halva mix was evaluated for its shelf-life by monitoring different physico-chemical characteristics and sensory attributes. The shelf-life studies showed that the halva mix remained stable and acceptable for 12 months, irrespective of packaging materials. The registered chemical changes and overall acceptability scores have been negatively correlated during halva storage.

Khan *et al*. [22] included virgin coconut meal in the halva formulation, developing an instant sooji halva mix with better nutritional attributes. The fatty acid composition of instant halva mix prepared with virgin coconut meal was not changed during storage. The major fatty acid identified in the fat extracted from halva mix was oleic acid followed by palmitic and lauric acids. Also, the developed instant halva mix remained stable and acceptable for one year under ambient temperature conditions.

Yadav *et al*. [23] has investigated the development of instant halva mix by incorporating soy sooji (semolina) in the recipe. The utilization of soy represents a promising way to increase the protein content of the halva products. The reported data showed that the soy sooji with similar mesh size as wheat sooji can be used as ingredient in the halva formulation to increase its protein content. The results of this study revealed that the optimized instant halva mix fortified by soy addition had three times higher protein content than wheat sooji halva. Also, the products packaged in polypropylene pouches can be stored in ambient temperature conditions for more than 6 months.

According to data reported by Yadav *et al*. [24] the Indian halva was developed from pearl millet grains. This study emphasis a way to exploit the nutritive potential of pearl millet for developing instant pearl millet halva mix with acceptable sensory attributes up to 6 months of storage in ambient temperature conditions. The developed formula of pearl millet halva is gluten free and can be recommended for consumers suffering from gluten intolerance.

It is known that the traditional Indian halva is a delicious sweet, rich in nutrients, especially fat and carbohydrates. Although this confectionary product may be flour-based or nut-based, the most common recipes of halva are based on wheat flour semolina and the product is known as wheat sooji (semolina) halva. Since 1986, Arya & Thakur [25] have reported data about developing instant sooji halva mix having shelf-life of 1 year.

The obtaining of multigrain composite mixes that could be used for instant preparation of halva has been reported by Itagi & Singh [26, 27]. The developed mixes consisting of various cereals, millets, legumes and spices were evaluated for physico-chemical properties, nutritional composition, functional properties and antioxidant activity. The reported data highlighted the potential of obtained mixes to be used for halva preparation.

The research concerning the preparation of shelf-stable halva starting from multigrain mixes has been continued by Itagi *et al*. [28]. In this study were developed four types of ready to cook multigrain halva mixes from different combinations of food grains such as cereals, millets, legumes along with nuts and spices. Also, the storage conditions of the developed mixes were investigated. Further, four types of halva were prepared starting from the developed mixes and the cooked halva samples were investigated in terms of proximate composition, texture, sensory characteristics and their shelf-life. The obtained results revealed that the multigrain mixes can be stored in low-density polyethylene pouches of 75 µm thickness for 180 days under ambient conditions and for 75 days under accelerated conditions. The halva samples were acceptable under ambient conditions. The overall quality of cooked halva samples ranged from 8 to 9 based on quantitative descriptive analysis method used for evaluation of sensory attributes with an intensity scale.

Zahedi & Mazaheri-Tehrani [29] developed a novel spreadable sesame paste fortified with soy flour. The spreadable halva formula can solve the difficulty occuring with the consumption of a molded halva. The presence of natural antioxidants in sesame seeds such as sesamol, sesaminol and tocopherols confer a high oxidative stability to sesame paste and extend its shelf-life [30]. To

optimize the halva formulation, a mixture experimental design was used to investigate the impact of soy flour and mono and diglycerides addition on the emulsion stability, color, textural properties and sensory characteristics of spreadable halva. The reported results have shown that the emulsion stability of all investigated samples increased depending on the emulsifier amount. By increasing the temperature, the emulsion stability decreased and the oil separation was intensified. Based on the reported results, it has been noted that the addition of soy flour had no significant effect on hardness and adhesiveness of the halva samples. Also, there were no significant differences in the color parameters of most samples. Regarding the sensory properties, there were no detected significant differences among most investigated halva samples. It can be said that the spreadable halva can be considered an excellent carrier for nutraceutical components such as soy flour or other ingredients in order to develop innovative food formulas.

The study performed by Manickavasagan & Al-Sabahi [31] emphases a possibility to reduce the content of dietary saturated fat from ghee halva, which is a traditional confectionary product from Asia, very popular in the Gulf countries, by replacing ghee, one of the high saturated fat types having around 60% saturated fat, with other healthy vegetable oils which were tested for their acceptability in the halva formulation. Three types of halva such as olive oil halva, sunflower oil halva and a control sample of ghee halva have been obtained and investigated for their textural and sensory attributes. The reported data showed that the modified halva formulas had acceptable sensory qualities. Thus, there are opportunities to modify the traditional food products rich in saturated fat by replacing with healthy vegetable oils.

As it was reported by Aloui *et al*. [17], various flavoring agents such as almond or pistachio nuts, dehydrated fruits and chocolate can be used in the halva production. These ingredients improve the nutritional value of the products and help to satisfy the consumer preferences.

Throughout time, several efforts have been made to improve the emulsion stability in peanut butter considering that the most serious problem occurring in the case of natural peanut butter is the tendency of oil separation [12, 32, 33]. Among the studies done to address this particular problem, the partially or fully hydrogenated vegetable oils were incorporating into peanut butter as stabilizing agents [32]. The hydrogenated vegetable oils are usually suggested for peanut butter stabilization because of their proven homogenization and crystallization proprieties [11-13].

Starting from the findings of the researches carried out for preventing oil separation in peanut butter, a number of recent studies have been shown that the supplementary fat addition, especially palm oil in the halva production could have a beneficial impact on emulsion stability.

A very interesting study carried out in this area by Muresan *et al*. [14] investigated the influence of palm oil addition at a level of 1, 2, 3, 4 and 5% (w/w) on sunflower halva stability and texture. After storage at 1-2°C, there were no recorded significant differences between halva samples, the percentages of separated oil being below 0.6% while during storage at 15-20°C, the lowest oil separation was shown in the halva sample containing 3% palm oil. The reported results revealed that a level of 3% palm oil was the most favorable regarding both the textural properties as well as the colloidal stability of prepared halva samples. A level more than 3% palm oil had a negative impact on halva stability and texture.

The research performed by Al-Mahasneh *et al*. [34] has been conducted to investigate the potential of palm oil and distilled monoglycerides to reduce the sesame oil separation from sesame paste during storage. The monoglycerides were added at three levels of concentration, respectively 2, 4 and 8% (w/w) while the palm oil was added at two level, respectively 1 and 2%. Monoglycerides are food additives acting as both emulsifiers and binders. In this study, they were used for prevention or reducing the oil separation in sesame paste. The results revealed that a majority of oil separation from sesame paste occurred during the first 40 days of storage. It is believed that the oil separation in sesame pasta occurs as a result of protein-oil network disintegration which leads to the separation of oil particles. The addition of distilled monoglycerides was responsible for increasing the viscosity of sesame paste as compared to palm oil. It was reported that the emulsifying properties of both palm oil and distilled monoglycerides were responsible for retarding the oil separation from sesame paste during storage. The addition of distilled monoglycerides to a level of 8% was

effective in reducing the oil separation in sesame paste. The results reported in this research support the previous studies on oil separation and emulsion stability of sesame paste and halva. The monoglycerides were recommended to be used as food-grade additives to reduce sesame oil separation from sesame paste in commercial production.

Further studies are needed for a better understanding the effect of properties and composition of emulsifiers on the oil stability in confectionery products like halva.

## 3.Conclusions

On the light of the reviewed studies, it can be said that the results available so far provide us valuable information about improving the emulsion stability and solving the rancidity problem to obtain shelf-stable halva formulas. Among them, the combined use of emulsifiers with some unconventional ingredients rich in dietary fiber in the halva recipe is of the great importance to obtain products with improved sensory, technical and functional properties. At the present, simple methods to obtain convenience halva mixes using various raw materials locally available in large quantities and at a low cost are necessary. For our future work, several research directions are considered regarding the evaluation of including unconventional ingredients and waste coming from agro food processing as a source of antioxidant dietary fiber and polyphenolic compounds to develop innovative halva formulas with improved quality as well as nutritional benefits.

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