



Sensory Properties of Chocolate Truffles and Peanut Butter as Affected by Onion Skin Powder Addition

* Celale KIRKIN^a , Merve ÇINAR^b , Bade DERİNDERE^b , Keri ERIKMAN^b ,
Naz ONURAL^b 

^a Istanbul Technical University, Faculty of Chemical and Metallurgical Engineering, Department of Food Engineering, Istanbul/Turkey

^b Özyeğin University, School of Applied Sciences, Department of Gastronomy and Culinary Arts, Istanbul/Turkey

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Abstract

Onion skin is a valuable waste product with good bioactive properties, and its utilization as an ingredient in foods would be beneficial. Thus, chocolate truffles added with 5% and 10% onion skin powder (OSP), and peanut butter samples added with 3% and 6% OSP were prepared. The effects of the OSP on the sensory properties were investigated. The flavor and overall acceptance of chocolate truffles decreased as OSP content increased. The OSP addition decreased the internal color and oiliness of chocolate samples. The bitterness of the control was not different from that of 5% OSP containing chocolate truffles. The addition of OSP to the chocolate truffles did not affect the odor and sweetness. The odor, color, oiliness, and texture of peanut butter added with OSP did not change. The OSP addition of up to 3% did not affect the sensory properties of peanut butter, while 6% OSP decreased the flavor, sweetness, and overall acceptance compared to the control.

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* Corresponding Author
E-mail: kirkin@itu.edu.tr (C. Kirkin)

INTRODUCTION

Onion (*Allium cepa* L.) is one of the most cultivated agricultural products (Benítez et al., 2011). It is a major ingredient for many food formulations around the world and is used every day in both homes and professional kitchens (Bello, Olabanji, Abdul-Hammed & Okunade, 2013). The consumption of onion has been increasing, and consequently, the production of onion waste has also been increasing (Benítez et al., 2011). It has been stated that the average annual onion skin waste production is over 500,000 kg in Europe and is an important concern for the environment (Choi, Cho, Moon & Bae, 2015). Thus, the utilization of onion waste is crucial.

Even though many types of food waste can be used as animal feed, onion was reported that may cause toxicity in animals (Cope, 2005; Salgado, Monteiro & Rocha, 2011). Thus, utilization of onion waste as a component of food products may be beneficial due to its good bioactive and high fiber content (Benítez et al., 2011; Downes, Chope & Terry, 2009; Jaime et al., 2002). Moreover, Škerget, Majhenič, Bezjak and Knez (2009) claimed that the antioxidant and antimicrobial properties of extracts obtained from onion skin were better compared to the extract of the edible parts of the onion. The greater part of the onion waste consists of its skin.

As a consequence of antioxidant capacity, onion skin can limit lipid oxidation (Gawlik-Dziki et al., 2013) and expand the shelf life of the product by decelerating rancidity. Therefore, foods that are high in fat content, such as chocolate and peanut butter, can be considered as proper options to test the utilization of onion skin. Besides the fat content and ease of access, they are both liked and preferred by many people frequently for their pleasant flavor.

The effects of onion skin addition on some quality characteristics of some food products were investigated earlier. For instance, Gawlik-Dziki et al. (2013) reported that up to 3% onion skin addition to bread formulation maintained the sensory acceptability and improved antioxidant properties at doses 2-3%. Moreover, it was reported that addition of replacement of wheat pasta flour with OSP (2.5-7.5%) improved the contents of dietary fiber, phenolics, and flavonoids, and antioxidant properties of the pasta samples depending on the dose (Michalak-Majewska, Teterycz, Muszyński, Radzki & Sykut-Domańska, 2020). However, the authors also added that the sensory scores of 2.5% OSP containing samples were lower compared to control (0% OSP). Similarly, increases in antioxidant activity and phenolic and flavonoid contents of pizza base with OSP addition (2-5%) were reported by Sagar & Pareek (2020). They also suggested that 2% OSP addition provided better sensory acceptability.

It should be noted that earlier studies mainly focused on the effects of onion skin addition in cereal food products (Gawlik-Dziki et al., 2013; Michalak-Majewska et al., 2020; Sagar & Pareek, 2020). However, we believe that the combination of onion with chocolate and peanut at proper doses can be helpful in the develop a surprising and pleasant novel functional product. To the best of our knowledge, there have been no studies evaluating the effects of onion skin addition on chocolate or peanut butter products. Thus, the aim of this study was to evaluate the effects of onion skin powder addition on the sensory properties of chocolate truffles and peanut butter.

Materials and Methods

Material

Yellow onion bulbs were purchased from a local market (Adapazarı, Turkey). Cream and butter were purchased from Rama (Hamburg, Germany) and Sütaş (Bursa, Turkey), respectively. The dark couverture chocolate was obtained from Altınmarka (Istanbul, Turkey), and caster sugar was obtained from Bal Küpü (Kocaeli, Turkey).

Peanuts were purchased from Çerez Pazarı (Istanbul, Turkey). Sunflower oil, honey, and salt were purchased from Yudum (Balıkesir, Turkey), Balparmak (Istanbul, Turkey), and Billur (Izmir, Turkey), respectively.

Preparation of onion skins powder

The outer skins of the yellow onion bulbs were separated from the flesh, then washed twice with cold water and rinsed. The washed onion skins were dried in an oven (Air-O-Steam 10 gn, Electrolux, Malmö, Sweden) at 105 °C for 40 min. Then the dried onion skins were ground in a grinder.

Preparation of the samples

A chocolate ganache was prepared by melting a 400 g of the couverture chocolate added with 400 g of cream over a bain-marie. Then, a 100 g of butter was melted in another pan and added into the ganache. The prepared ganache was added with the onion skin powder to a final concentration of 5% (w/w) or 10% (w/w). Samples without the OSP were used as control. All samples were kept at room temperature for 30 min and rolled into small balls with 2.5 cm diameter. Then, the chocolate truffles were covered with melted dark chocolate twice in order to mask the color difference due to the OSP addition.

An 850 g of raw and peeled peanuts, 28 g of sunflower oil, 22 g of honey, and 10 g of salt were mixed into a paste in a food processor (Food Processor K35, Electrolux, Malmö, Sweden). A 250 g of the paste was further mixed with a 20 g of sugar syrup (50% (w/w) table sugar in water) and 5 g of cacao powder). Then the samples were added with OSP to a concentration of 3% and 6% (w/w) and rolled into 2.5 cm diameter balls. Samples without OSP were used as the control.

Chocolate truffle and peanut butter samples prepared with OSP (at the higher dose) are shown in Figure 1.



Figure 1. Chocolate truffle samples with 10% OSP (above) and peanut butter samples with 6% OSP (below).

Sensory analysis

Sensory analysis of the chocolate was conducted with 16 panelists (aging 21-30 years; 9 females, 7 males; none of them were pregnant or have allergy to the ingredients), who were the students or staff members of the gastronomy department with basic sensory analysis training. The panelists were asked to assess the samples for odor, internal color, flavor, sweetness, bitterness, oiliness, texture, and overall acceptability. The peanut butter samples were assessed for odor, color, flavor, oiliness, texture, and overall acceptability by another panelist group of 17 (aging 18-30 years; 9 females, 8 males). A 9-point hedonic scale (1: dislike extremely, 9: like extremely) was used for sensory evaluations.

Statistical analysis

All treatments were replicated twice in the study. Data were evaluated by analysis of variance (ANOVA) using Minitab 17 statistical software. Differences between the levels of OSP addition were analyzed by Tukey's multiple comparison test.

Results and Discussion

The addition of OSP decreased the sensory acceptability of the chocolate truffle samples (Table 1). The internal color and oiliness scores of OSP added samples were lower than the control ($P < 0.05$); however, the samples containing 5% OSP were not different from those of the 10% OSP containing samples ($P > 0.05$). In addition, 10% OSP added samples had lower bitterness values compared to the control and 5% OSP added samples ($P < 0.05$). Moreover, flavor, texture, and overall acceptability of the samples were decreased with the addition of OSP, and higher levels of OSP resulted in lower values ($P < 0.05$). On the other hand, the effects of OSP addition on the odor and sweetness of the chocolate truffles were not significant ($P > 0.05$).

Table 1. The effects of OSP addition on the sensory properties of chocolate truffles.

Sample	Odor	Internal Color	Flavor	Sweetness	Bitterness	Oiliness	Texture	Overall acceptability
0% OSP	7.5±0.1 ^a	7.9±0.0 ^a	8.0±0.2 ^a	8.1±0.4 ^a	7.5±0.0 ^a	7.5±0.4 ^a	7.9±0.3 ^a	8.0±0.4 ^a
5% OSP	7.1±0.2 ^a	6.9±0.3 ^b	6.8±0.6 ^b	6.6±0.4 ^a	6.8±0.4 ^a	6.1±0.5 ^b	6.4±0.9 ^b	6.2±0.6 ^b
10% OSP	6.8±0.2 ^a	6.4±0.3 ^b	5.0±0.4 ^c	6.6±1.3 ^a	5.4±0.8 ^b	5.5±0.5 ^b	5.4±0.7 ^c	4.5±0.8 ^c

Values in each cell are the mean of three replications \pm standard deviation. Values labeled with different superscript letters in a column are significantly different ($P < 0.05$).

The odor, color, oiliness, and texture of the peanut butter samples were not affected by the addition of up to 6% OSP ($P > 0.05$) as shown in Table 2. The flavor, sweetness, and overall acceptability of the samples with 6% OSP were lower compared to the control ($P < 0.05$); however, those of the 3% OSP added samples were not significantly different from the control ($P > 0.05$). In addition, the flavor and sweetness scores of 6% OSP added samples were lower than that of the 3% OSP added samples ($P < 0.05$).

Table 2. The effects of OSP addition on the sensory properties of peanut butter samples.

Sample	Odor	Color	Flavor	Sweetness	Oiliness	Texture	Overall acceptability
0% OSP	6.4±0.4 ^a	6.4±0.0 ^a	6.4±0.4 ^a	5.9±0.0 ^a	5.6±0.2 ^a	5.9±0.1 ^a	6.1±0.3 ^a
3% OSP	5.0±0.5 ^a	6.2±0.2 ^a	5.7±0.9 ^a	5.5±0.4 ^a	5.0±0.7 ^a	5.5±0.1 ^a	5.8±0.3 ^{ab}
6% OSP	5.8±0.0 ^a	6.2±0.4 ^a	5.0±0.7 ^b	4.6±0.7 ^b	4.8±0.7 ^a	5.2±0.7 ^a	5.0±0.9 ^b

Values in each cell are the mean of three replications ± standard deviation. Values labeled with different superscript letters in a column are significantly different ($P < 0.05$).

In contrast to our findings, there have been some studies reporting that the addition of onion powder did not affect the sensory property of cereal-based food products. For instance, Rajeswari, Susanna, Prabhasankar, & Venkateswara Rao (2013) reported that the addition of onion powder to the flour up to 10% did not negatively affect the sensory properties of the pasta. Moreover, Hwang (2013) claimed that 9% red onion powder addition to the Korean steamed rice cake provided the best overall taste. In another study, it was reported that onion powder addition to noodles up to 10% did not affect the sensory properties (Kim, Park & No, 2016).

It should be noted that the powder used in the above-mentioned studies included the flesh of the bulb, and the effect of onion skin powder can be different. For instance, it was reported that the crumb color, aroma, taste, and overall acceptability of bread samples were decreased by the addition of 1-5% OSP, while the texture was not affected (Gawlik-Dziki et al., 2013). The authors also reported that the consumer acceptability of 3% OSP containing samples was good but compromised by higher levels of OSP. They claimed that the high volatile content of OSP might have caused the flavor loss. Moreover, in accordance with our results, it was reported that the addition of wheat pasta semolina with 2.5% OSP resulted in better sensory scores compared to 5% and 7.5% OSP (Michalak-Majewska et al., 2020). However, the authors also added that the overall sensory scores of pasta samples prepared with 2.5% OSP containing semolina were lower compared to control (0% OSP). In another study, it was reported that OSP addition at 5% resulted in decreased scores of sensory color, odor, flavor, symmetry, mouthfeel, and overall acceptability in the pizza base samples (Sagar & Pareek, 2020). However, in that study, the flavor, mouthfeel, and overall acceptability scores of the pizza base samples with 2% OSP were higher than that of control (0% OSP) and samples with higher levels of OSP.

Even though the effects of OSP addition were mainly investigated on cereal foods, Chung, Choi, Yu, and Choi (2018) claimed that OSP addition to Hanwoo beef up to 0.6% did not negatively alter sensory properties but improved water retention and prevented lipid oxidation. Moreover, a similar finding to that in our study was reported by Kurt, Ceylan & Akkoc (2019). They reported that OSP addition at 6% decreased flavor and overall acceptability scores of chicken meat patties, whereas no negative effects on these properties were observed when the OSP level was 3%. In addition, Uçak (2019) reported that the sensory scores of shrimps added with onion skin extract (8%, v/w, in ethanol) were higher than the control and maintained during 8-d storage.

The addition of OSP to food products above 3% compromised sensory properties in several studies as summarized in the manuscript. Accordingly, 3% OSP addition to peanut butter samples in our study did not cause a change in sensory properties, whereas we observed a decrease in sensory acceptability of chocolate truffle samples as a higher level (5-10%) was used.

Conclusion

In conclusion, the sensory properties of chocolate truffles and peanut butter added with OSP as a way of waste utilization were investigated. The 3% OSP containing peanut butter samples were as acceptable as the control, although samples with 6% OSP were not acceptable. When it comes to chocolate, samples with OSP were not acceptable at both doses (5% and 10%). Thus, the amount of OSP added to the chocolate truffle samples may be decreased to the levels used in peanut butter samples in order to provide sensory acceptability. On the other hand, the antioxidant properties of each sample should be tested in order to evaluate the effectiveness of the level of OSP. The levels of mycotoxin and pesticide residues should be controlled before any industrial application of OSP for safety. It should also be noted that earlier studies on OSP addition were conducted on savory food products, and this study is the first (to the best of our knowledge) that reports OSP can be added to food products with a sweet taste. We believe the findings of this study can be a preliminary guide for the valorization of onion skins as common kitchen waste.

Declaration

The contribution of all authors of the article to the article process is equal. The authors have no conflict of interest to declare.

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