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Extended Abstract

Optimizations of Probiotic Yogurt Formulation Containing Eggplant Puree Based on Analytic Hierarchy Process

Hossein Jooyandeh[1*], Mohammad Noshad[2], Kowsar Kakaei[3], Mitra Ghodsi Sheikhjan[4]

1- Associate Professor, Department of Food Science and Technology, Faculty of Animal Science and Food Technology, Agricultural Sciences and Natural Resources University of Khuzestan, Mollasani, Iran
* Corresponding author (hosjooy@asnrukh.ac.ir)
2- Assistant Professor, Department of Food Science and Technology, Faculty of Animal Science and Food Technology, Agricultural Sciences and Natural Resources University of Khuzestan, Mollasani, Iran
3- MSc. Graduated, Department of Food Science and Technology, Faculty of Animal Science and Food Technology, Agricultural Sciences and Natural Resources University of Khuzestan, Mollasani, Iran
4- DVM, Department of Food Science and Technology, Faculty of Animal Science and Food Technology, Agricultural Sciences and Natural Resources University of Khuzestan, Mollasani, Iran

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Abstract

The aim of this study was to evaluate the effect of incorporation of eggplant puree (0-45%) on physicochemical properties (pH, acidity, color and syneresis), sensorial parameters (odor and taste, color, and texture) and survival of probiotics in yogurt after 1, 4, 7, 10 and 14 days of storage. Furthermore, Analytic Hierarchy Process (AHP) was used to determine the best probiotic eggplant yogurt according to the assessed parameters. The results showed that by increasing the amount of eggplant puree, the extent of acidity, syneresis and lightness (L*) decreased while the pH increased. Incorporating eggplant puree caused significant (P<0.05) reduction of probiotic bacteria at the beginning of storage time. However, during the storage period this status contrarily changed, in such a way that yogurt samples containing a higher concentration of eggplant puree at the end of storage had a higher count. This was probably due to prebiotic effect of eggplant puree and the lower pH of yogurt sample. According to data analysis by AHP, yogurt sample contained 30% of eggplant puree with the weight of 0.171 being the best formula compared with the others. The results showed that incompatibility rate was 0.08 and as this value was lower than 0.1, the obtained results had an acceptable reliability and credibility. Based on the results of this research, the manufactured eggplant probiotic yogurt having an acceptable sensory and probiotic properties may be introduced as a functional food product. Furthermore, due to prebiotic capability of the eggplant puree, it could be used in various probiotic products.

Keywords: Analytic hierarchy process, Eggplant puree, *Lactobacillus acidophilus*, *Lactobacillus rhamnosus*, Probiotic yogurt

Introduction

Yogurt is one of the products of interest for the carrier of probiotics to humans. Probiotics yogurt is effective in reducing intestinal inflammation, infection, diarrhea and cholesterol

Levels (Hunter, 2008). Eggplant (*Solanum melogena* L.) is one of the most popular plant products in the world and belongs to the family *Solanaceae*. Eggplant contains dietary fiber, vitamins (especially B_1 and B_2), potassium, magnesium and polyphenolic compounds (Okmen *et al*., 2009; Ranil *et al*., 2017). Since many factors affect the quality of a food product such as eggplant yogurt, therefore choosing the optimal formula is not easily possible due to its complexity. For this reason, methods have been developed named multi-criteria decision making that help solve these problems (Noshad, Savari, & Roueita, 2018). According to the health effects of probiotics yogurt and functional properties of eggplant, the aim of this study was to investigate the properties of probiotics yogurt containing eggplant as a functional properties and to select the best formulation based on the analytic hierarchy process (AHP) method.

Materials and methods

Eggplant, persian shallot, dried herbs and salt were purchased from the local market. Yogurt starter (Yomix, 532) containing *Streptococcus thermophiles* and *Lactobacillus delbruvii* was purchased from Dunajski Dairy company (Germany). *Lactobacillus acidophilus* (PTCC 1643) and *Lactobacillus Rhamnosus* (PTCC 1637) as probiotics, were purchased from Iranian Research Organization for Science and Technology (PTCC).

Preparing of yogurt samples

After preparing yogurt according (Yadmellat, Jooyandeh, & Hojjati, 2017) method's, eggplant puree (15, 30 and 45 % (w/w)) added to yogurt. Probiotic bacteria were activated and inoculated as mentioned by Elsanhoty, Salam, Ramadan, & Badr (2014) and Mosallaie, Jooyandeh, Hojjati, & Fazlara (2020). Then, the effect of addition of eggplant puree on the physicochemical properties of probiotic yogurt was evaluated during 14 days at the refrigerator temperature.

Optimization

In this research, AHP method was used to prioritize and select the best sample formula produced.

Results and discussion

The results showed that by increasing the amount of eggplant puree, the extent of acidity decreased that probably the reason for this is the presence of eggplant puree and its effect on the acidity of the product and the negative effect of the herbs and other vegetables used on the activity of starting bacteria and probiotics (Kumar & Kumar, 2016; Tamime & Robinson, 2007). Also, with increasing the amount of eggplant puree, syneresis and lightness (L*) of samples decreased while the pH increased. Incorporating eggplant puree caused significant (P<0.05) reduction of probiotic bacteria at the beginning of storage time. However, during the storage period this status contrarily was changed, so that yogurt samples containing a higher concentration of eggplant puree at the end of storage had a higher count. This probably was due to prebiotic effect of eggplant puree and the lower pH of yogurt sample (Delavari, Pourahmad, & Sokutifar, 2014; Donkor, Nilmini, Stolic, Vasiljevic, & Shah, 2007). According to data analysis by AHP, yogurt sample contained 30% of eggplant puree with the weight of 0.171 was the best formula as compared with the others. Results showed that incompatibility rate was 0.08 and as this value was lower than 0.1, the obtained results had an acceptable reliability and credibility.

Conclusions

Based on the results of this research, the manufactured eggplant probiotic yogurt having an acceptable sensory and probiotic properties may be introduced as a functional food product. Furthermore, due to prebiotic capability of the eggplant puree, it could be used in various probiotic products.

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