



Effects of Ispharzeh hydrocolloids seeds (*Plantago ovata* L.) and basil gum (*Ocimum basilicum*) on physicochemical and sensory properties of ketchup sauce

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Introduction: Ispharzeh is a plant from genus *Plantago* whose seeds are used commercially for the production of mucilage. The plant is mainly cultivated in Iran and Middle East. Psyllium is mainly used as a dietary fiber to relieve symptoms of both constipation and mild diarrhea and occasionally as a food thickener. Research has also shown benefits in reducing cholesterol levels. Basil seed gum is a novel hydrocolloid extracted from *Ocimum basilicum* L. seeds. It has shown promising stabilizing and emulsifying properties, which makes it a potential functional ingredient for the food industry. Previous works pointed out that these gums can be used successfully for food industry. However, a detailed study on Ispharzeh hydrocolloids seeds and basil gum has not yet been done. Therefore, the objective of this study was to evaluate the ability of using Ispharzeh hydrocolloids seed and basil gum as replacing with imported gums as well as to evaluate physicochemical, and sensory properties of ketchup sauce contain these gum were evaluated.

Materials and methods: Mixture design was employed to investigate the variation of ketchup properties with respect to operating parameters including xanthan, Ispharzeh seeds and basil gum in the range of 0 to 0.1 % using design expert software. Experiments were randomized in order to minimize the effects of unexplained variability in the observed responses due to extraneous factors. The treatments were selected regarding combination of xanthan, Ispharzeh seeds and basil gum in the range of 0 to 0.1 % using Design expert software. After extraction of gums, ketchup formulation was prepared with the treatments contain Ispharzeh hydrocolloids seeds and basil gum. Control sample contained ketchup formulation without gums. pH, apparent viscosity, syneresis, color and sensory properties of produced ketchup were evaluated.

Results and discussion: The impact of Ispharzeh seeds and basil gum addition on the pH of ketchup showed that all the treatments were in the standard pH range (3.67-3.74) according to the Iran national standard of ketchup. In addition, the results showed that addition of these gum were not significantly effect on pH. The regression coefficients were calculated according to the multiple regression coefficients and a polynomial regression model equation was fitted as quadratic equation. Regarding syneresis, all the treatments were stable with no syneresis except K₂ (1% Ispharzeh) and K₄ (1% basil gum). Addition of Ispharzeh and basil alone, were not significantly effect on syneresis but when they used in combination and with xanthan, prevent syneresis significantly. The highest and the lowest viscosity were related to K₄ (1% basil gum) and K₁₀ (0.5 % xanthan+ 0.5% Ispharzeh), respectively. The regression coefficients were calculated according to the multiple regression coefficients and a polynomial regression model equation was fitted as quadratic equation. Hunter Lab colorimeter analyzing L*, a* and b* showed that K₂ and K₅ (1% xanthan) had the lowest and highest L* index. Variance analysis showed that quadratic model was fitted for L* value and coefficient correlation (0.9943) was satisfactory. In addition of effects of single gums, interaction of gums also had significant effect on lightness of ketchup. According to the results obtained from the sensory analysis, overall acceptability of K₄ (1% basil gum) gained the highest scores. K₂ (1% Ispharzeh) had the highest firmness so, led to unpleasant mouth feel in panelists. In addition, the presence of impurities in Ispharzeh seeds which not removed in centrifuge may darkening the produced ketchup hence got lower scores by panelists. Optimization evaluation by RSM evaluated the effects and interactions of the Ispharzeh hydrocolloids seeds and basil gum concentration to optimize ketchup

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properties. Optimized treatments were 0.42% Ispharzeh hydrocolloids seeds gum and 0.58% basil gum. Therefore, the values for stability tests are very close to the experimental values demonstrating that the model are applicable, which showed determination coefficient (R^2) of 0.99. The formulation optimization showed that combination of 0.58% Ispharzeh and 0.42% basil gum as stabilizing agents in ketchup sauce, was a suitable replacer for imported commercial gums. Future studies on the Ispharzeh seeds and basil gum in other foods as well as the stabilization of these systems during the digestion process may help to understand the mechanism behind the functionality of these gums in food products.

Keywords: Ispharzeh seed, Basil gum. Hydrocolloid, Syneresis, Ketchup.