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**UTILIZATION OF SUNFLOWER AND SESAME SEEDS IN
TAHINA AND HALAWA PROCESSING**

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ESMAIL GALAL ESMAIL BORIY

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SUMMARY AND CONCLUSION

The present study are carried out to evaluate sunflower seeds variety sakha 51 as an alternative source for sesame seeds for preparing Tahina which use alone or in admix with sesame Tahina for manufacture Halawa tahinia and evaluate the quality of resultant Halawa at zero time and during storage up to 9 months. Moreover, optimizing the best substitution ratio and condition to produce Halawa of high quality was one of our goals. Sunflower seed (*Helianthus annuus*) variety, sakha 51, was purchased from Filed Crops Research Institute, Plant Agronomy Department, Division Oil Seeds, Giza, Ministry of Agriculture and Land Reclamation, Egypt. Sesame seed was kindly obtained from Elshame Halawa Factory, Damanhur, Behera Government. For carrying out such study the following experiments were taking into consideration: physical properties of seeds namely, weight of 1000 kernel, volume of 1000 kernel, bulk density, and hull percentage

.The chemical composition of dehulled sunflower and sesame seeds

Preparation Tahina samples: Admix of sesame Tahina and sunflower Tahina at different levels of substitution was carried out (i.e. 0%, 20%, 40%, 60%, 80%, and 100% sunflower Tahina

Chemical composition of Tahina samples and physical properties namely, viscosity, oil separation, the TBA test, and the colour

The Tahina samples which prepared from sesame and sunflower Tahina by ratio (0%, 20%, 40%, 60%, 80%, 100% sunflower Tahina) were further converted into Halawa and studied for chemical composition and physical properties such as the TBA, sensory properties, and the colour of Halawa samples

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:The obtained results can be summarized as follows

Physical properties of sunflower and sesame seeds namely, weight of 1000 kernel, volume of 1000 kernel, bulk density, and hull percentage were equal to 61.3073 gm, and 3.0585 gm; 122.5 ml, and 4.3 ml; 0.5109, and 0.7113 gm/cm³; and 26.6%, and 5.9%, respectively

Chemical composition of dehulled sunflower and sesame seeds was 5.488%, and 5.1% moisture content; 23.63%, and 22.685% crude protein; 43.59%, and 50.95% ether extract; 5.04%, and 4.75% crude fiber; 3.457%, and 4.52% total ash; and 18.8%, and 12% N-free extract

:Physical properties of Tahina samples -3

The colour of Tahina samples was measured by Lovibond Tintometer. The results showed that all Tahina samples had no value of blue primary colour. Data indicated that the substitution of sunflower Tahina by 40% and 60% resulted in Tahina with more or less than the sesame Tahina colour as judged by Lovibond Tintometer. The brightness of Tahina that with of 20% substitution was higher than the corresponding for the control. The dominant wave lengths were 576 to 580 nm while saturation (%) amounted from 29.41% to 39.60%

The viscosity of Tahina samples was determined by the rotary viscometer at 40°C for 30 min. Generally, the viscosity of sunflower Tahina was significantly higher than that for sesame Tahina. The viscosity of sesame Tahina was ranged from 770 to 780 c-poise while for sunflower Tahina ranged from 4896 to 4906 c-poise. However, the viscosity of admix samples of Tahina lie between the aforementioned two samples

Oil separation of Tahina samples was determined at different temperatures (i.e. refrigerator temperature (4°C), ambient temperature, 35°C) during storage period up to 120 days without adding lecithin or with it. Among all samples, sunflower Tahina was the lowest for oil separation at refrigerator temperature. The oil separated reached to 2% for sunflower Tahina while no oil separation was noticed as affected by adding the lecithin. However, it reached up to 5.5% for sesame Tahina without adding lecithin and decreased to 4.5% by adding it. It was noticed that adding of emulsifier (lecithin) and/or increasing of substitution level improved the separation oil defect at refrigerator temperature. The storage at ambient temperature (20°C) cleared that the percent of oil separation was increased. It ranged from 3.5% for untreated samples to 1% (with 0.1% lecithin) for sunflower Tahina and 10.5% declined to 5.5% with adding 0.1% lecithin for sesame Tahina while other samples varied between there values. Moreover, the storage at 35°C resulted in a further increase in the amount of oil separation reached up to 14.5% (without lecithin) and 11% (with 0.1% lecithin) for sesame Tahina. Notwithstanding, the amount of oil separation reached to 6% and reduced to 5% for sunflower Tahina by addition 0.1% lecithin which .increased in other Tahina samples as substitution level decreased

:Chemical composition of Tahina samples - 4

chemical composition of Tahina samples were summarized as: moisture content, crude fiber, ash content and N-free extract varied from 1.92% to 1.998%, 3.709% to 5.008%, 2.904% to 3.499%, 17.34 to 20.69% for sesame and sunflower Tahina, respectively. The aforementioned constituents increased by increasing substitution level. However the protein content ranged from 22.22% (sunflower Tahina) to 23.61% (sesame Tahina) and the ether extract varied from 46.59% (sunflower Tahina to 50.52% (sesame Tahina). The aforementioned constituents decreased by increasing substitution level

The chemical analysis emphasized the high caloric values of sesame and sunflower Tahina which ranged from 618.48 to 590.95 cal/100gm

for sesame and sunflower Tahina and markedly decreased by increasing substitution levels

The amino acid composition of sesame and sunflower Tahina was almost similar. The essential amino acid ranged from 34.332 % (sunflower Tahina) to 35.617% (sesame Tahina), decreased slightly by increasing the substitution level of sunflower Tahina. However, the non-essential amino acids varied from 62.705% (sesame Tahina) to 63.808% (sunflower Tahina) with a slight increase by increasing the substitution level. The first limiting amino acid in all Tahina samples was lysine while the second limiting amino acid was S-containing amino acids

The in-vitro protein digestibility of Tahina samples was 88.40% for sesame Tahina, 83.90% for sunflower Tahina and ranged between these values for other samples which slightly decrease by increasing of substitution level. Moreover, the c-PER was 1.661% for sesame Tahina and 1.521% for sunflower Tahina which a slightly decreasing on elevating the substitution level of sunflower Tahina for the rest Tahina samples

Fatty acids composition of Tahina samples was determined by Gas Liquid Chromatography. Generally, the predominant fatty acids of sesame Tahina and sunflower Tahina were the unsaturated ones. The total unsaturated fatty acids for sesame Tahina were (84.9%), i.e., linoleic acid (43.2%), oleic (41.2%), palmitoleic (0.29%) and linolenic (0.21%). Meanwhile, sunflower Tahina contained 87.49% especially linoleic acid (68.2%), oleic (18.6%), linolenic (0.51%), and palmitoleic (0.18%). On the other hand, the saturated fatty acids for sesame and sunflower Tahina were 9.9%, and 6.8% palmitic acid; 5.20%, and 4.70% stearic acid and arachidic, myristic, Lauric was not detect in sesame Tahina but they were 0.41%, 0.22% and 0.48% for sunflower Tahina, respectively. However the fatty acids composition of admix samples of Tahina (the rest 4 samples) lie between the aforementioned two samples

Generally, the Thiobarbituric acid value for different Tahina samples at zero time and during storage up to 9 months at ambient temperature showed significant variations between different samples. The results showed that the TBA values reached in sesame Tahina to 2.41% after 9 months while it reached to 4.27% for sunflower Tahina after the same period. However, the TBA was 0.194% for sesame Tahina and 0.636% for sunflower Tahina at zero time and increased gradually in all samples with elongation storage period. It could be concluded that Tahina 40% sunflower was to be the best sample .during the storage along with sesame samples in this respect

:Physical properties of Halawa -^o

The values of the primary colours as determined by the Lovibond Tintometer showed that all Halawa samples were free of blue primary colour. The point of interest is that the substitution of sunflower Tahina by 40% resulted in Halawa with more or less the same colour as control. The dominant wave length was around 574 to 579 nm while the percentage of saturation was the ranged 14.89% to 40.42%. Moreover, the brightness of 40% substitution was higher than the .corresponding for the control

The evaluation of sensory properties of Halawa samples showed that sesame Halawa had the highest score of all parameter followed by Halawa (20%) sunflower. Substitution by 40% and 60% ranked as good in palatability. However, the ratio of 80% and sunflower Halawa .seemed darker in colour, dry in texture, but accepted in taste and odor

Oil separation of Halawa samples was determined at different temperatures (i.e. refrigerator temperature, ambient temperature and 35°C)during storage period up to 120 days with adding 0.1% lecithin or without it. The storage at ambient temperature (20°C) cleared that the oil separation percentage of sunflower Halawa was significantly

lower than the sesame Halawa. It reached to 3.05% and 5.82% for sunflower Halawa and sesame Halawa, respectively after 120 days of storage. The oil separation for the rest samples were gradually decreased by increasing substitution levels. The storage at refrigerator temperature showed that all different Halawa had 0.0% oil separation until the end of storage period. Moreover, the storage at 35°C resulted in a further increase in the amount of oil separation and reached up to 7.85% (without lecithin) for sesame Halawa. Notwithstanding, the amount of oil separated reached to 3.90% (without lecithin) for sunflower Halawa and increased for other Halawa samples as substitution level decreased. The addition of 0.1% lecithin resulted in a significantly decline in oil separation for all different Halawa preparation in the present study

:Chemical composition of Halawa samples .ᶜ

the chemical composition of Halawa samples were summarized as: sesame Halawa had 1.999% moisture content, 1.764% crude fiber, 1.684% ash content and 56.33% N-free extract while sunflower Halawa had 2.232% moisture content, 2.487% crude fiber, 1.711% ash content and 59.11% N-free extract. The aforementioned constituents increased by increasing substitution level. However, the protein content varied from 12.09% (sunflower Halawa) to 12.66% (sesame Halawa), the ether extract ranged from 22.375 (sunflower Halawa) to 25.61% (sesame Halawa) which decreased by increasing substitution level

The total caloric value of sesame Halawa was higher than sunflower Halawa due to the high content of oil in sesame Halawa which slightly decreased by increasing the substitution levels of sesame Tahina by sunflower on preparing Halawa

The replacement of sesame Tahina by sunflower Tahina to manufacture Halawa resulted in a significant increase in TBA at zero time and during storage up to 9 months at ambient temperature. The TBA value was 0.184% for sesame Halawa, 0.395% for sunflower Halawa at zero time and increased during storage to become 1.608% and 2.897% after 9 month, respectively. On other hand, other samples arranged between the values of aforementioned two samples. From

that result, the ability of sunflower Halawa oil to oxidize was faster than sesame Halawa oil. Meanwhile, Halawa 40% sunflower was the best one during storage up to 9 months

:Conclusion

It can be concluded that sunflower seeds could be utilized for Tahina manufacturing in admix with sesame Tahina at substitution level up to 60% and it can be used successfully in preparing Halawa tahinia with accepted sensory properties and as a good source of energy. Hence, it could be significantly reduced the amount of imported sesame seeds .especially if the sunflower is cultivate in the new reclamation areas