

## A survey of the physicochemical properties of unsweetened chocolate enriched with whey protein, milk isolate, isomalt and grape syrup

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### ABSTRACT:

One of the major problems of chocolate consumption is its high sugar. Various efforts have been made to substitute sucrose of chocolate and most of them have not been accepted due to unsuitable texture and digestive effects. This study provided chocolate by alternatives of grape syrup, isomalt whey and milk powder with 21 other formulations. Physicochemical properties like ash, sugar percent, sucrose percent, reducing sugar after hydrolysis, protein percent, sensory, rheological and microbial properties including mold and yeast contamination, total microbial and coliform counts were evaluated. The number of treatments in this study was 21. Data were analyzed using multi-range Duncan test to determine the difference between the means at the confidence interval level of 0.05. The data were analyzed using SPSS software and Excel.

The results showed that there was a significant difference between all treatments in each of the properties ( $p < 0.01$ ). Generally, in all formulations of chocolate, sucrose percent was significantly different from that of the control group ( $p < 0.01$ ). The lowest sucrose was dedicated to treatment T17 with 6% of grape syrup, 6% isomalt, 15% milk protein isolate and 15% whey protein and T21 with 6% of grape syrup, 6% isomalt, 5% milk isolate protein and 5% whey protein. The increase of whey protein and milk powder in 10 and 15% respectively, increased the ash of samples. In samples with high percentage of grape syrup and isomalt, there were significant changes in ash. The increase of each of the compounds had significant impact on the total ash of chocolate. Also, the control group had the lowest total ash. Based on the results of study regarding pH and acidity measurement, the highest pH and the lowest acidity were dedicated to the control group and adding grape syrup to chocolate, reduced pH significantly and increased acidity. The comparison of the mean at the 99% level showed that pH reduction and acidity increased in all alternatives were significant compared to the control group. Totally, the substitution percent of 2% grape and isomalt syrup, 5% of desalinated whey powder and milk powder were good in optimal formulation and T1 treatment was the considered as best treatment.

### Keywords:

Milk powder, Whey protein, unsweetened chocolate, Grape syrup, Isomalt