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**Chemical Studies, Antioxidant and
Antimicrobial Activities of Pomegranate and it's
possible use some food production**

A THESIS

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SUMMARY

Pomegranate (*Punica granatum*, Punicaceae) is known to have considerable health-promoting properties with antimicrobial, antiviral, anticancer and antioxidant.

The objective of this study was the evaluation of two varieties pomegranate peels powder (Manfaloty and Wonderful), seeds and juice.

Extraction of phenolic compounds from peel powder, seeds and juice as well as fractionation and identification of these phenolic compounds, Antioxidant activity were also studied.

Biscuits of pomegranate husk powder and potato flour were prepared.

The peel powder application in food to increase nutrition value specification potatoes flour by 10%, 15%, 20% peel powder in biscuits.

Probiotic (Fermented juice of pomegranate juice and lactic acid) was prepared and assessed the qualities and microbiological examination as well as sensory evaluation of the product.

- ***The chemical composition of fresh pomegranate (*Punica granatum L.*) (Peels powder, seeds and juice).***

The chemical composition of the two varieties (pomegranate peels powder Manfaloty and Wonderful) had a different chemical constituents.

- ***Total phenolics, total flavonoids contents and antioxidant activity of the two varieties of pomegranate peel powder, seeds and juice extract.***

Total phenols were identified for both water and organic solvent extract (hexane - acetone -methanol- ethanol). Organic extracts of pomegranate peel powder (Manfaloty and Wonderful) were the highest phenolics content (3075.6 and 2375.6 mg/100g), respectively. The highest total phenolic content in Manfaloty peel and Wonderful peel powder in ethanol then water extracts (3075.6 and 355.6 mg/100g) respectively.

The highest total flavonoids content was found in Manfaloty peel in acetone extract (131.79mg/100gm) compared with other fractionation (Wonderful pomegranate juice and pomegranate seed).

Antioxidant activities of pomegranate Manfaloty peel powder extract by water had higher value (91.82%) than

Wonderful peel powder (62.43%), pomegranate seeds (34.26%) and pomegranate juice (31.48 %).

- ***Quantitative and Qualitative analysis of polyphenolic compounds by High - Performance Liquid Chromatography (HPLC):***

The two varieties pomegranate contains high phenolic compounds. The composition of poly phenolic compounds of Manfaloty peel powder and Wonderful peel powder pomegranate, which were fractionated into 20 different components, by HPLC showed that pyrogallol had the highest composition for Manfaluty peel powder (2.609%), while iso-ferulic acid for Manfaluty peel powder showed the lowest value (0.002%). The highest composition for Wonderful is Pyrogallol (2.231%) and the lowest value Alpha-coumaric acid (0.002%). It is clear that pomegranate seeds and juice had the highest composition of Pyrogallol (0.253%), (0.144%) and the lowest composition was of Cinnamic acid (0.001 %),

- ***Flavonoid compounds analysis by High performance liquid Chromatography (HPLC).***

The flavonoid compounds of the varieties of pomegranate (Manfaloty and Wonderful) peel powder were higher than pomegranate seeds and pomegranate juice which were fractionated into 16 different components, by HPLC. The most

common flavonoid compounds were apig.7-o-neohespiroside(69.995 mg/100g) in Mafaloty peel powder and Hesperidine and *Hespirtin* (152.995mg/100g) for Wonderful. While flavonoid compounds of seeds were (17.219mg/100g) *Hespirti* and of juice was Kaemp.3-(2-p-comaroyl) glucose (5.333mg/100g).

- ***Vitamin contents by High Performance Liquid Chromatography (HPLC)***

Was the highest Vitamin C in Manfaloty peel powder (37.025 mg/100g) compared with Wonderful peel powder(23.117mg/100g), juice (11.04 mg/100g) and seeds (3.103 mg/100g).Pomegranate juice had the highest vitamin K (18.56 mg/100g) while Vitamin K of Manfaloty pomegranate peel powder, seeds, Wonderful peel powder were (3.032,2.987and 0.248mg/100g), respectively.Vitamin A of pomegranate peel powder (Manfaloty and Wonderful) were (0.593,0.537 mg/100g)respectively. But Vitamin A of pomegranate juice and seeds were 0.377 and 0.070 mg/100, respectively.

- ***Sugar contents by High Performance Liquid chromatography (HPLC).***

The Manfaloty peel powder had the highest content of sucrose (26.812%) followed by Wonderful peel powder

(13.393%). seedshad the highest content of fructose (14.403%) followed by juice 7.320%.

- ***Fatty acid content.***

Fractionation of oil by Gas Liquid Chromatography (GLC) revealed that Oleic acid (18:1) was the predominant fatty acids for Pomegranate seeds (83.240 %) of Punicic acid (9, 11, 13, C18:3), (83.483%). In addition, the PSO contained a considerable contents of Palmitic (18:0), Stearic (18:0) and Behenic (22:0) fatty acids (2.360, 1.777 and 2.80), respectively.

- **Application of pomegranate peels and juice:**

- ***The different percent pomegranate peels powder (0%, 10%, 15% and 20%).in biscuits.***

From the previous results, it can be concluded that the peel powder contain highest nutrition value and can be applied by 10%, 15%, 20% peel powder in biscuits. to increase nutrition value specification of potatoes flour.

- ***The chemical properties of biscuits:***

The chemical composition of biscuits with potato flour of supplementation different percent (T1 (10%), T2 (15%) and T3 (20%) of pomegranate peel powder was carried out. The fiber content increased by increase percent addition of pomegranate peel powder from T0, T1, T2 and T3 biscuit increased from

1.04±0.04%, to 1.08±0.01%, 1.37±0.32% and 2.43±0.301% respectively. And the highest ash for T3 (20%) Pomegranate peel powder fortification followed by T2 (15%) and T1 (10%). The increase in ash content is due to higher ash content in pomegranate peel powder.

▪ ***The total phenolic, Total Flavonoid and Antioxidant Activity content of biscuits:***

The total phenolic contents and antioxidant activity of pomegranate peel and peel powder supplemented biscuits increased by the increase amount of pomegranate peel powder from 0%, to 10%, 15% and 20%. Total phenolic contents of biscuits were increased from 112.50±1.0, to 230.38±1.0, 253.15±1.01 and 320.51±0.99 mg/100g, flavonoid from, to 63.30±1.0, to 75.90±1.1, 80.64±1.03 and 91.39±0.83 mg/100g expressing a linear trend with gradual increments of pomegranate peel powder concentration in potato flour i.e. from 0%, to 10%, 15% and 20%. And Antioxidant activity increased from 9.72±0.53, 54.39±0.72, 65.77±0.58 and 87.40±0.61 %, respectively.

▪ ***Sensory evolution of biscuits:***

Sensory development was not significantly acceptable among all sample compared to control biscuits; the results showed general acceptance of biscuit samples. All sensory grades of overall appearance, color and overall acceptability were not

important among all biscuits and analysis of texture contrast revealed that there was no significant effect on biscuit texture when peel powder was added to potato flour. Pomegranate (20%, 10%, and 15%). Flavor characteristic analysis revealed a change in biscuit flavor due to the addition of pomegranate peel powder. The addition of pomegranate peel powder at 20% level did not add any undesirable sensory response and the product remained acceptable.

▪ ***Effect of storage on biscuits:***

During 1 year and 18 month of storage no growth of microorganism was not detected (total bacterial count, Yeasts and molds counts) this is due to the presence of high amount of phenolic compounds and antioxidants, After 24 months the growth appeared the total count 2.2×10^2 CFU, yeast and mould 1×10^2 CFU without any growth of Salmonella, Colform, Bacillus cereus, Escherichia coli, and Staphylococcus.

• ***Preparation of probiotic pomegranate beverage:***

Total phenols and flavnoids in probiotic juice were the highest amounts (203.30, 110) than control (135.4, 35.24), respectively. Probiotic juice had highest antioxidant activity than control (85.69, 59.12) after fermentation process.

- **Effect of storage on viability of probiotics:**

It was observed that the probiotic cultures were capable of surviving in the product at 4°C for 28 days.

- **Microbial analysis of probiotic pomegranate beverage:**

There was no yeast/mold colonies detected in sample (B) stored at 4°C. On the other hand, no colony of coli-form bacteria was detected in both the samples over the entire storage period.

- *The effect of storage on the viability of probiotics*

It was observed that probiotics were able to survive in the product at 4°C for 28 days. Yeast mold colonies were not detected in the sample stored at 4° C. Other, colony was not detected in both samples during the entire storage period. Yeast and mold count were observed in the sample (A) stored at room temperature and in probiotics based products; the growth of microbes other than the added culture is considered to be undesirable. During the second week, the probiotic culture count reduced significantly due to the stressful conditions of low pH in sample (A) due to lactic acid accumulation.