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Essential metal transfer from nutrient supplement to serum *in vitro*

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Slow healing wounds are a major medical problem and may even be life threatening. Most acute and chronic wounds are on poor healing mechanism due to lack of necessary nutrients mainly the essential metal elements. Nutritional factors, including trace elements have been shown to play an important role in wound-related complications. Investigations have demonstrated the adverse effects, which trace metal deficiency can exert on healing together with the beneficial effects of supplementation. *Aloe vera* gel in various forms has been used as a topical wound application to moisten wounds for many years. The gel form of the *Aloe vera* is capable of metal impregnation. This study was conducted to determine the capability of a metal impregnated *Aloe vera* formulation to transfer essential metals to serum *in vitro* with the intention developing a gel for applying to healing wounds.

The *Aloe vera* gel was impregnated with essential metals by placing a sack of gel in a stirred metal ion solution, having the concentrations of metal ions similar to intravenous body fluids. Then the impregnated gel formulation was exposed to serum, representing wound fluid, through a dialysis membrane. The concentrations of metal ions in the gel were analyzed, before and after impregnation. Determination of the concentrations of Mg⁺², Zn⁺², Ca⁺², Cu⁺² and Mn⁺² was carried out using Flame Atomic Absorption Spectrophotometric (FAAS) method. The concentrations in mg/L of essential metals in impregnated *Aloe vera* formulation was Mg⁺²(min 341, max 541.2, mean 493 ± 48.2), Zn⁺²(min 196, max 321.1, mean 302.8 ± 41.2), Ca⁺²(min 231, max 303, mean 298.4 ± 21.6), Cu⁺²(min 281, max 357, mean 336.4 ± 20), Mn⁺²(min 185.6, max 230, mean 224.2 ± 10.2). The values of the treated serum were Mg⁺²(min 168.3, max 254.1, mean 224.5 ± 21.4), Zn⁺²(min 184, max 221, mean 190.4 ± 14.3), Ca⁺²(min 34.5, max 41.3, mean 39.9 ± 2.5), Cu⁺²(min 112, max 156, mean 130.6 ± 17.4), Mn⁺²(min 141.5, max 190, mean 175.5 ± 13.2). Metals in *Aloe vera* gel before the impregnation were Mg⁺²(min 156.4, max 309.4, mean 218.4 ± 80.9), Zn⁺²(min 137.2, max 217.6, mean 172.6 ± 41.1), Ca⁺²(min 205.6, max 301.0, mean 268 ± 54.1), Cu⁺²(min 29.7, max 51.2, mean 40.8 ± 10.8), Mn⁺²(min 158.8, max 187.4, mean 173.6 ± 14.3). Metals in serum before the mixing were Mg⁺²(min 458.9, max 555.9, mean 511.6 ± 49), Zn⁺²(min 386.6, max 486.6, mean 424.8 ± 54.2), Ca⁺²(min 399.2, max 645.6, mean 528 ± 123.5), Cu⁺²(min 116.6, max 123.7, mean 119.8 ± 3.2), Mn⁺²(min 52.1, max 75.6, mean 64 ± 11.7).

The results show that the *Aloe vera* gel is capable of transferring metal ions to serum by impregnating with essential metals.