Review Article

Treating Minor Burns with Potato Peel Dressings

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ABSTRACT

Background

The use of natural products to enhance the wound healing is a common practice in many parts of the world. Potatoes (Solanum tuberosum), as raw, boiled, peeled, or mashed have medicinal properties. Potato peels as a by-product from potato processing are available in large amounts and contain a wide variety of compounds that could be used in foods and also in non-food applications. Management of the burn wound still remains a matter of debate, and an ideal dressing for burn wounds has not yet been discovered. Prevention of infection and treatment of infection in burn wounds are major aims of treatment. Many systemic and topical regimes are in use, but none is completely satisfactory. Wounds epithelialise more rapidly in moist environment. For burn wounds, homografts and xenografts are ideal for covering these wounds to prevent infection and rapid epithelialsation. Potato peels resemble skin and it has an outer and inner surface. Potato peels with the outer surface in contact with the burns can be used to cover the burn. Boiled potato peels have been used to cover the fresh burns wounds. This article reviews the use of potato peels in burn wounds.

Introduction:

Potatoes (Solanum tuberosum L) are one of the most important staple crops for human consumption along with wheat, rice and corn. Presently the global potato sector is undergoing major changes. While fresh potato consumption which used to be the mainstay of potato utilization is continuously decreasing especially in developed countries and increasing quantities are currently processed into value-added products to meet the demand especially of the fast food and convenience food industries.

Potatoes are a source of dietary energy due to their carbohydrate levels and also contain a high value protein. However, their overall protein content is generally low.

Potatoes are usually peeled during processing which may be accomplished either by steam, abrasive, or lye peeling depending on the product to be produced. Abrasion peeling is typically applied in chips production, whereas, steam peeling is used for frozen and dehydrated potato products. The use of lye necessitates a neutralization step after peeling, which creates large amounts of salt as secondary disposal issue.[1] Burn injury is a common type of traumatic injury, causing considerable morbidity and mortality. Moreover, burns are also among the most expensive traumatic injuries, because of prolonged hospitalization and rehabilitation, along with costly wound and scar treatment. Worldwide, an estimated 6 million patients seek medical help for burns annually, but the majority are treated in outpatient clinics. Whether inpatient treatment in a specialized burn unit is required depends principally on the severity of the burn, the concomitant trauma, and the general condition of the patient.[2] Management of burn wounds has improved with enhanced understanding of pathology of burns and wound healing mechanisms over the last two decades. The mortality and morbidity from burns has greatly reduced due to better appreciation of the working of the immune system and advances in diagnostic microbiology and tissue engineering and biological dressings. The site of the wound being ideal for

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the growth of the infecting organisms, the wound environment must be kept free from the infecting micro-organisms. The immuno-suppressed status of the patient allows the micro-organisms to freely multiply. A variety of factors contribute to this development of infection in the burn patients. Among these are the roles of wound management procedures, risk factors associated with infection, virulence factors of isolated pathogens, current problems with antibiotic resistance as well as wound sampling. An optimal dressing for burn wounds should be cheap, easily available, that prevents infection and minimizes scarring is yet to be identified. The medicinal properties of potato have long been known and has been tried in the treatment of wounds.[3] Recent studies have shown that potato peels may help healing in burns wounds.[4,5,6] This review discusses the role of potato peels in the management of burns using an evidence based approach.

Potato peels

Potato peels as a by-product from food processing are available in large amounts and contain a wide variety of compounds that could be of use in food and non-food applications.

In a study conducted by Singh and Raini the antioxidant potency of freeze-dried aqueous extract of potato peel was investigated by employing various established in-vitro systems such as lipid peroxidation in rat liver homogenate1,1-diphenyl-2c-picrylhdrazyl 9DPPH) superoxide/hydroxyl radical scavenging reducing power, and iron ion chelation. Freeze-dried aqueous extract of potato peel powder (PPE) showed strong inhibitory activity toward lipid peroxidation of rat live homogenate induced by the FeCI2-H2 O2 system. Furthermore, PPE exhibited a strong concentration-dependent inhibition of deoxyribose. Oxidation PPE also showed a considerable strong reducing power superoxide scavenging ability and also ferrous ion chelating potency the data obtained in the in vitro models clearly establish the antioxidant potency of freeze -dried extract of potato peel. Considering that potato peels are discarded as waste and not effectively utilized these in vitro results suggest the possibility that potato peel waste could be effectively employed as an ingredient in health or functional food to alleviate oxidative stress. However, comprehensive studies need to be conducted to ascertain the in vivo safely of such extracts in experimental animal models.[7]

In study conducted in Fargo, USA, the effects of freeze-dried extracts from the peels of six potato varieties as antioxidants in pure soy oil were investigated using the active oxygen method (AOM) procedure, carotene bleaching and linoleic acid oxidation experiments on thin-layer chromatography (TLC) plates. At 9 h under AOM conditions 20 g soy oil treated with 0.05 g of these extract attained lower peroxide values (PV, 22/0-28.0 meq kg-1) than the control oil sample (PV, 109.0 meq kg-1) indicating very strong antioxidant activities. Oils treated with the same amount of tertiary butylhydroquinone, butylated hydroxyauisol-butylated hydroxytoluene mixture and rosemary extract attained PV of 10,19.0 and 16.0 meq kg-1, respectively. Results of the carotene bleaching and lionoleic acid oxidation experiments on TLC plates indicated that the antioxidant acitvities of these extracts were due to the presence of phenolic acids. Among the phenolic acids separated and identified by both high-performance liquid chromatography and TLC chlorogenic, proto-catechuic and caffeic acids were predominant and appeared to be mainly responsible for the strong antioxidant activities of the extracts. Peels from the red potatoes contained more polyphenols than those from the brown-skinned varieties, but their oil contents were similar.[8]

The potato peels contain an array of nutritionally and pharmacologically interesting components, such as phenolic compounds, glycoalkaloids, and cell wall polysaccharides, which may be used as natural antioxidants, precursors of steroid hormones, and dietary fibre. Tsao and Yang in their study found that free leutin content was very low (0.4 mg /100gfw) in potato peels.[9] Okeke and Frankenberger used potato peel waste in combination with starch as a substrate for amylolytic bacteria in the bio-reduction of perchlorate. The rate of perchlorate reduction was dependent on the amount of potato peels with over 90% removal

being achieved in 4 days with 2%(w/v) peels.[11]

Potato peels are a source of phenolic anti-oxidants and have been shown to significantly reduce plasma glucose levels in streptozotocin-induced diabetic rats and to ameliorate anti-oxidative stress.[11-14] Studies have also been conducted to see the effect of potato peels on skin conditions[3] burns wounds.[4,5,6] Particularly in burns, studies were conducted to assess the benefit of potato peel dressings.

Burn Wound Infection

Infection and in some cases septicemia is an important cause for mortality during the early phase in burn patients. Immunocompromised state also contributes towards the development and persistence of infection. Prevention of infection is essential for optimal regeneration of the epithelial cells and /or lost dermis to occur. Pseudomonas spp. and Staphylococcus aureus are the most commonly isolated organisms in burn wounds.[15]

Ideal Dressing for a Burn Wound

Epidermal regeneration in a burn wound is a complex process in which residual epithelial cells proliferate in a coordinated manner to form an intact epidermis. In superficial and partial-thickness burns, there are still a sufficient number of epithelial cells that survive within the hair follicles and sweat glands. A moist environment is the best suited for epithelialisation and wound healing. Thus the key lies with dressings that are easy to apply, painless, simple to manage and widely available. To reduce bacterial growth under the burn surface and facilitate wound healing, various agents such as 1% silver sulfadiazine[16] 5% silver nitrate[17], sulfamylon18 and various synthetic and biological dressings with live cultured fibroblasts within the matrix have been used.[19] However, none of these agents effectively control infection furthermore the emergence of antibiotic -resistant pathogens makes it necessary to identify an alternative to counter these multi-drug resistant organisms.

Potato Peels as Burn Wound Dressing

For burn wounds, homograft's and xenografts are ideal for covering these wounds to prevent infection and rapid epithelialsation. When these are not available, as in developing countries, other options like naturally occurring substances have a role and potato peels are one of therm. In burns, potato peels can be used by preparing the potato peels in the form of bandages or directly they can be placed on the wound like split thickness skin grafts. Potato peels are obtained from hotels or house hold, in which the potatoes are boiled in boiling water. When the temperature is reduced, the peels are separated and the potatoes are used for cooking the dishes. The potato peels after washing with water, are pasted on a gauze bandage cloth after spreading starch paste to the gauze piece, on the inner side, then they are dried. These peels gets stuck to the bandage cloth, they are folded and prepared as bandages. Various sizes can be made. These are autoclaved and used when required. Alternately, they can be directly used after washing with normal saline ,and spread on the wound like postage stamps as in the case of split thickness skin grafts. These dressings are opened on the second day and after confirming that there is no wound infection, the wounds are closed and dressings are repeated. Figure 1 shows the boiled potato peel dressing ready for use. Figure 2 shows the dressing just being peeled off after the wound healed.

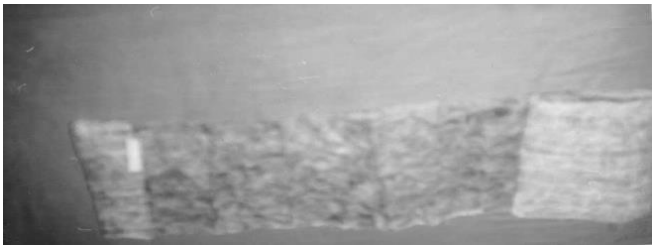

Figure 2. Boiled potato peel dressings ready for use

Figure 3. Potato peel dressing being removed after wound healed

Evidence for Potato Peels as Burn Wound Dressing

In a study conducted by Subrahmanyam[20] on 50 patients with less than 40% of superficial or partial thickness burns, treated by potato peel bandages wounds healed in four patients by 7 days, eight patients by 10 days, in 28 patients between 11and 15 days and in 10 patients between 16 and 21 days (mean 16.2 days).

Of the 42 who had positive swab culture at the time of admission, showed persistent infection after 1 week. The organisms isolated were Staphylococcus aureus (12), Escherichia coli (4), Pseudomonas sps. (10), Citrobacter sps. (6), Klebisella sps. (8), and Proteus sps. (2). Thus the potato peels are found to be useful in treating minor burns (Table 1).

Potato peels did not show any antibacterial activity as evidenced by the persistence of the organisms in culture swab study. Potato peel dressings appeared to have conferred on the wound the advantage found with cadaver homograft. The mechanism of action seems to be similar to that of a biological membrane.

Freeze dried aqueous potato peel extracts containing chlorogenic, caffeic, gallic and protocatechuic acids were investigated for their mutagenic and antimicrobial activities. While the extract was not found to be mutagenic in the S.typhimurium-E coli microsome assay, antibacterial activity was observed only at high dosage (105 ug/mL extract against E.coli, B.cereus and S. typhimurium.[21]

Further studies using various concentrations may help in detecting anti bacterial effect of potato peel bandages. Potato peel dressings were also compared with honey, banana leaf, and plain gauze dressing. In some studies, silver sulphadiazine was also applied over which the potato peel bandages were placed but did not show much change in terms of healing.(Table2). Among the comparators honey has better wound healing rate, less pain relief as compared to potato peels.

The evidence presented is all from burns units in areas of the world where skin homografts and xenografts are rarely available and is therefore not directly applicable to settings in which such grafts are common. Furthermore, all the studies use sterile potato peel dressings, not rough cut potato peel as set out in the clinical scenario.

The value of potato peel seems to be in reducing desiccation and thereby maintaining moist environment which promotes wound healing and there is little evidence of independent antibacterial activity. There is no evidence to suggest that potato peel is effective as a burns dressing in the acute phase. Sterile potato peel dressings are better than gauze alone during the healing phase.

Table 2 shows results of comparative studies in terms of wound healing, pain relief, etc., which shows honey has antibacterial effect and also promotes rapid wound healing.Since the potato peels are found to be having anti-oxidant effect as well as antibacterial effect in-vitro at higher concentrations, further research is required to reassess the beneficial effects of potato peels in burns.

Table 1. Details of 50 patients of burns treated with potato peel dressings

Age in Years	Sex		Mechanism of injury	Burn surface Area (%)	Time taken for healing		Wound swabs for culture
Mean 27.5	Male	Female	Scald 15	Mean 17.2	Days	no.of pt	Day 0&7
Range (5-5.9)	28	22	Flame 22	Range (10.5-40)	0-7	4	42+ve
			Contact burn 13		8-10	8	and 8-ve
					11-15	28	
					16-21	10	

Conclusion

Table 2. Results of comparative studies in terms of wound healing, pain relief, etc.

Author, date and country	Patient group	Study type (level of evidence)	Outcomes	Key results	Study Weaknesses
Gore and Akolekar, 2003, India[4]	30 patients aged <40 years with a burn size <50% of body surface area. Gauze with potato peel vs gauze with banana leaf. Potato peel applied to the left side and banana leaf dressing to the right.	Cross over trial	Days until complete epithelialisation	No significant difference	No statistics performed; blinding is not clear; no control group (crossover trial).
			Eschar formation	No significant difference	
			Number of areas requiring skin grafting	No significant difference	
			Pain	No significant difference	
			Patient comfort	No significant difference	
			Dressing handling	No significant difference	
Subrahmanyam et al, 1996, India[20]	100 patients with partial thickness burns over <40% of body surface area treated within 6 h. Potato peel vs honey.	Randomised controlled trial	Days for complete healing	16.2 vs 10.2 days ($p<0.001$).	Randomisation not clear; blinding not reported
			Persistant infection at day 7	10% vs 100% ($p<0.001$).	
			Adverse effects	There were no adverse effects in either of the groups.	
			Subjective relief of pain	No significant difference	
Keswani et al, 1990, India[6]	17 hospital patients aged 1.5–45 years with burns between 5% and 42% of body surface area (mean 18.6%). Gauze with potato peel vs gauze alone in similar burns on each patient. All patients had silver sulfadiazine applied below the dressing.	Clinical trial	Bacterial growth	No difference in bacterial growth	Much of the data here is histological; there are no patient outcomes. No statistics performed. Blinding and follow-up are not clear.
			Epidermal regeneration	Epithelial regeneration in potato peel dressing.	
			Formation of exudates	Prevention of dessication in potato peel dressings.	
			Survival of superficial skin cells	Increased survival of superficial skin cells in potato peel dressings.	

Based on current scientific evidence, potato peel dressings are effective as a burn wound dressing. though not found to be comparable with other other standard treatments like Silver sulphadiazine.

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