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Design of Hyacinth Dressings as an Alternative to Sterile Wound Covers in Diabetes Mellitus Wounds

Desyta Dwiyana Aviyanti[1], Tri Cahyo Sepdianto[2], Agus Khoirul Anam[3*]
[1,2,3]Department of Nursing, Malang Health Polytechnic, Indonesia
aguskhoirulanam@gmail.com

ABSTRACT

Diabetic Wounds are a complication of diabetes that requires optimal care in a hospital and can cause serious complications and require significant costs. The method used in this study is Research and Development, the research procedure uses the ADDIE model which consists of 5 stages including Analysis, Design, Development, Implementation. The number of participants was 14 people consisting of 2 diabetic wound patients, 10 nurses from the Mitra Medika Clinic, 2 expert validators, namely doctors from the Mitra Medika Clinic and a supervisor of a diploma three Nursing lecturer in Blitar. Based on the results of the research conducted in stages, in the final stage the expert validator assessor stated that the product was suitable for use with a criterion value of 81%-100%. So that the product resulting from this study can be an Alternative Sterile Wound Cover for Diabetic Wounds so as to accelerate wound healing that is easily available, affordable and environmentally friendly.

Keywords: hyacinth dressing, diabetes mellitus wound treatment, sterile wound dressing

Background

Diabetes mellitus can cause complications to various organs of the body. Complications that occur on the skin of DM patients are the onset of DM wounds or gangrenous wounds. This condition causes the skin and tissue around the wound to die, rot, emit odor and turn black. DM conditions with poor blood circulation can make diabetic feet unable to fight infection and lack the ability to heal wounds (1).Wound care is a series of actions taken to prevent trauma or injury to the skin and mucous membranes of other tissues due to trauma, fractures, and surgical wounds that can damage the skin surface. Generally, wound care is still done simply and generalized with a certain pattern for various wound conditions and problems(2). The process of wound healing consists of 3 phases, namely: inflammation, proliferation, maturation(3).

In 2016, the World Health Organization recorded that the prevalence rate of diabetes in Indonesia was 7% of the total population. The prevalence of diabetic foot wounds in Indonesia is around 13% of hospitalized patients and 26% of outpatients (4). In 2018, the International Disease Foundation (IDF) stated that there were 194 million people suffering from diabetes mellitus. This figure is expected to increase to 333 million by 2025. According to the Aminah Hospital Profile in 2020, it was concluded that Diabetes Mellitus disease was not specific and included Diabetes mellitus with diabetic foot complications entering the 7th place of the top ten treatment diseases in 2019 with a percentage of ICD Code E14, a total of 424 with a percentage reaching 5.98% of 10 other diseases (5).

Diabetes Mellitus wounds are a complication of diabetes that requires optimal care in

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the hospital. Ulcers, infection, gangrene, amputation, and death are serious complications and require a lot of money and longer treatment. Diabetics with ulcers spend 5.4 times more than people with diabetes. Patients with diabetic ulcers in Indonesia require high costs of 1.3 million to 1.6 million rupiah per month. Diabetologists estimate that ½ to ¾ of amputations can be avoided with good foot care (6). Wound care requires high costs due to prolonged wound care and expensive dressings (7) .Choosing the right wound care method should basically be based on cost, comfort, and safety considerations(8).

Water hyacinth (Eichhornia crassipes) is a floating aquatic weed that contains secondary metabolites such as tannins, saponins, flavonoids, steroids, terpenoids, phenols, quinones, anthraquinones and alkaloids. Water hyacinth has antioxidant, antitumor, wound healing, anti-inflammatory, anti-aging, antialga, antifungal, antibacterial activities (9). The abundant availability of water hyacinth and the presence of antibacterial compounds (10). People in the village of Spirit Within, utilize water hyacinth for skin health by making water hyacinth herbal soap beauty products(11). Making creams made from ethanol extracts of water hyacinth (E. crassipes) which can function as antibacterial against S. aureus bacteria that are practical and easy to clean or wash (12). combination of ethanol extracts of water hyacinth leaves (Eichhornia crassipes) and celery leaves (Apium graveolens L.) against cut wounds in mice (Mus musculus). Water hyacinth leaf extract (Eichhornia crassipes) heals wounds faster than celery leaves (Apium graveolens L.) (13). Utilization of water hyacinth extract as a natural hand sanitizer that is environmentally friendly and can make hand sanitizer products independently (14).

Based on the description above, the researcher is interested in researching "Designing Water Hyacinth Dressing as an Alternative Sterile Wound Cover for Diabetes Mellitus Wounds" is a wound cover that comes from nature which is useful for accelerating wound healing in diabetes mellitus patients.

Methods

This study uses the Research and Development (R&D) method research design. The research procedure used is the ADDIE development model which consists of 5 stages, including; analysis, design,development, implementation, and evaluation. This study took 14 subjects consisting of 1 supervisor, 10 Mitra Medika Clinic nurses, 2 trial participants, namely Mitra Medika Clinic patients, while the object under study was the quality of water hyacinth dressing products including; product analysis, product design, product feasibility. Data collection in this study was conducted on 15 January – 29 February, 2024 at the Mitra Medika Clinic.

This study used a set of instruments, namely an interview guide, a checklist for media experts, a checklist for participants, electronic media for documentation during data collection, and stationery. Data were collected through interviews and product assessments by expert validators, namely practitioners and material experts. Analysis of water hyacinth dressing product design is an activity to distinguish and sort data to be regrouped into certain criteria for further study. Analysis of product planning such as analyzing product needs, benefits and effectiveness of products such as analyzing target needs, analyzing existing product weaknesses with measuring instruments interview sheets. Designing water hyacinth dressings is an activity of designing products that are needed and attractive according to the benefits and functions of the product. Indicators of product design are design and development, for product design including design drawings, design elements, design principles, and development including product manufacturing, validation and revision with checklist sheet measuring instruments. The feasibility of designing water hyacinth dressing products is a series of studies conducted to

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determine whether the product is beneficial to the community and has an economical price. Indicators of product feasibility assessment are implementation, including; expert validation, field trials, and revisions with checklist sheet measuring instruments.

Results

Based on the research and design carried out, the following results were obtained:

Analysis Stage

Based on interviews from resource persons, information was obtained:
Results of product design analysis of interviews with doctors and nurses of Mitra Medika Clinic can obtain information that patients with diabetes mellitus wounds usually use dressings sold in pharmacies but the use of these dressings is less effective because of the high price, sometimes not available in pharmacies, the dressing material is not environmentally friendly for patients with diabetes mellitus wounds, because it requires routine wound care.
Results of product needs analysis, the hope of doctors and nurses for the next innovation is to create hyacinth dressing as an alternative to sterile wound coverings for diabetes mellitus wounds because it is environmentally friendly, easy to obtain, and affordable

Design Stage

Product design results include:

Designed product specifications

The product designed is a hyacinth dressing as an alternative to sterile wound coverings in DM wounds as an effort to prevent and reduce complications in dm wounds. Hyacinth dressing is designed with a special model that ensures the dressing does not shift easily, environmentally friendly. The water hyacinth dressing is square-shaped and measures 16cmx16cm and can change according to the size of the patient's wound so that the water hyacinth dressing is effective to carry everywhere. The thick water hyacinth dressing design is designed to minimize fluid discharge in DM wounds that cause odor, as well as accelerate the healing of DM wounds, preventing infection

Product design

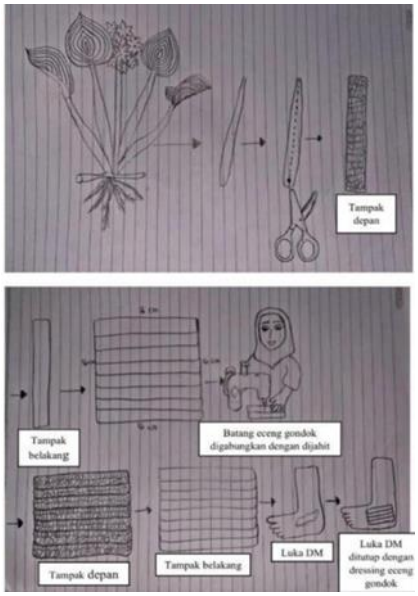

Figure 1. Revision of the design of the hyacinth dressing

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The previous product design used the first design, but after revisions by expert validators, the researcher made a hyacinth dressing packaging design to make the dressing practical and easy to use.

Development Stage

This stage aims to develop the product that has been designed

Initial product manufacturing

The researcher made the initial product from the results of analysis and design. The first product is made according to the designed design and uses the first design

Assessment by expert validators

Table 1. Expert validator assessment results

Assessed aspects	Total score
Design drawings	4
Elements of design	12
Design principles	23
Convenience aspect	8
Practicality aspect	9
Comfort aspect	13
Total	**74**

Based on the data from the table 1, it can be seen that the total score is 74, to determine the quality and feasibility of the product, the criteria are obtained by comparing the total score (74) with the maximum score (85). **P/85= 74 x 100 % = 87%**

Based on the results of the expert validator's assessment of the water hyacinth dressing above, the criteria are 81% - 100%, so the qualified product is very feasible to use. However, at this stage, responses, criticisms and suggestions from expert validators are still accepted by researchers as evaluation materials

Results of product revision phase 1

Figure 2. Given attractive packaging before revision

Revision of the design of the hyacinth dressing Dressi ng water hyacinth size 16 cm x 16 cm. With a thickness of 2 layers of the outer stem of water hyacinth and 2 layers of inner stem of water hyacinth

Figure 2. Given attractive packaging after revision

Attractive and practical water hyacinth dressing packaging can be carried everywhere

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Assessment by 2 expert validators

Table 2. Expert validator assessment results 2H

Assessed aspects	Total score
Design drawings	4
Unsur desaian	12
Elements of design	25
Convenience aspect	9
Practicality aspect	14
Comfort aspect	13
Total	**77**

Based on the data from the table, it can be seen that the total score is 77, to determine the quality and feasibility level of the product, the criteria are obtained by comparing the total score (77) with the maximum score (85**). P/85= 77 x 100 % = 90%.**

Based on the results of the expert validator's assessment of the water hyacinth dressing above, the criteria are 81% - 100%, so the qualified product is very feasible to use. The results of the analysis are included in the classification of very feasible and there are no revisions from expert validators

Implementation Stage

Expert validator test results

Table 3. Expert validator test assessment results

Participants	Total score	Eligibility Standard Criteria	Information
Nurse 1	82	P= 82/85 x 100% = 96%	Very worthy
Nurse 2	68	P= 68/85 x 100% = 80%	proper
Nurse 3	54	P= 54/85 x 100% = 63%	proper
Nurse 4	65	P= 65/85 x 100% = 76%	proper
Nurse 5	79	P= 79/85 x 100% = 92%	Very worthy
Nurse 6	85	P= 85/85 x 100% = 100%	Very worthy
Nurse 7	68	P= 68/85 x 100% = 80%	proper
Nurse 8	75	P= 75/85 x 100% = 88%	Very worthy
Nurse 9	84	P= 84/85 x 100% = 98%	Very worthy
Nurse 10	65	P= 65/85 x 100% = 76%	proper
Doctor	74	P= 74/85 x 100% = 87%	Very worthy
799		**P= 799/1023 x 100% = 78%**	**proper**

Based on the data from table 5, it can be seen that the total score is 799, to determine the quality and feasibility level of the product the criteria are obtained by comparing the total

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score (799) with the maximum score (1,023). P/1.023=799 x 100 % = 78%

Based on the results of the expert validator's assessment of the water hyacinth dressing above, the criteria are 61% - 80%, then the qualified product is suitable for use. The results of the analysis are included in the feasible classification and there is a revision from the validator expert.

Results of field trials

Table 4. Results of field trials

Participants	Total score	Eligibility Standard Criteria	Information
patient1	54	P= 54/85 x 100% = 63%	Proper
patient 2	60	P= 60/85 x 100% = 70%	Proper
Sum 114		**P= 114/133 x 100% = 85%**	Very worthy

Based on the data from table 4., it can be known that the total score is 114, to determine the quality and feasibility level of the product criteria are obtained by comparing the total score (114) with the maximum score (133). P/133 = 114 x 100 % = 85%

Based on the results of the expert validator's assessment of the water hyacinth dressing above, the criteria are 81% - 100%, so the qualified product is very feasible to use.

Phase 2 product revision

Table 5. Results of product revision phase 2

Responses	Before revision	After revision
Dressing made a little thin and not too wide	 Water hyacinth dressing 2 layers of outer stem and 2 layers of inner stem	 Water hyacinth dressing 1 outer layer and 2 inner layers
Trimmed edges minimize sharp edges	 Rough edges	 Edges are smooth

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Discussion

Product Analysis of Water Hyacinth Dressing

a. Planning Analysis

In accordance with the data obtained based on interviews with doctors and nurses at the Mitra Medika Clinic, information was obtained that one of the actions to prevent and reduce the risk of diabetes mellitus wound complications is to optimize wound care if wound management is carried out properly by maintaining wound moisture by using moisture retaining dressing, So that wound healing and tissue growth can occur naturally and if the wound is handled incorrectly, the wound will experience infection, ulceration and gangrene (15). The use of ordinary dressings as diabetes mellitus wound covers is less effective, because usually the material is made of plastic and cannot absorb sweat, as well as less fluid absorption and results in the dressing not sticking, so that the dressing is easy to shift and then open and the wound is contaminated with dirt, water, air, as well as thin ordinary dressings, unaffordable prices, sometimes in pharmacies are also not available and are not environmentally friendly. Based on the data and opinions above as an alternative to prevent the risk of complications in diabetes mellitus wounds, so the researcher wants to make a water hyacinth dressing product as an alternative to sterile wound cover in diabetes mellitus wounds which is useful to help accelerate wound healing because the product contains antioxidants, antitumor, wound healing, anti-inflammatory, anti-aging, anti-algae, antifungal, antibacterial (16). Water hyacinth dressings are expected to be sturdy, practical, comfortable, not easy to shift, thick and effective in use as an alternative to wound healing(17),(18).

b. Product needs analysis

In accordance with the data obtained based on interviews with patients, doctors and nurses of the Mitra Medika Clinic, information was obtained that participants were comfortable when using hyacinth dressings. However, the disadvantages are thick dressings, sterilization and unattractive shapes. The advantages of this hyacinth dressing are that it is easy to use, sturdy, comfortable, not easy to shift, thick and effective to use as an alternative to wound healing and has packaging to maintain product hygiene, and is easy to carry everywhere. Apart from dressings, water hyacinth is also effective as a topical medicine for wounds(19).

Product Design of Water Hyacinth Dressing

a. Design

At the design stage, researchers began designing products that would be used in accordance with the analysis stage that had been carried out and compiling product assessment sheets. At the design stage is known as making a design. This stage designs a model that is still conceptual and will later underlie a better product development process. At this stage researchers begin to design product specifications, design designs, and compile product assessment instruments (20). At the design stage, researchers began designing products that would be used in accordance with the analysis stage that had been carried out and compiling product assessment sheets. There are several suggestions from validation experts regarding product design, namely the initial product design does not have packaging then after receiving criticism and input from expert validators, a second product design is made by making attractive, practical packaging that can be carried anywhere and maintaining the cleanliness of water hyacinth dressing.

b. Development

At this stage the researcher begins to develop the product that has been designed previously. This stage involves printing or producing the initial product, then conduct validator trials before the product is ready to be implemented to participants.

c. Implementation

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At the implementation stage, the revised product was then field tested on people with diabetes mellitus wounds and product assessment was carried out on a sheet provided by the researcher. Then revisions were made according to the suggestions of media experts and participants in this study.

Product Feasibility of Water Hyacinth Dressing

a. **Media expert validation results**

Based on the results of the calculation of the questionnaire 2 expert validators obtained a score (799) with a maximum score (1023) so that the calculation got a value (78%). If the analysis results get the standard (61%-80%), then the product is included in the classification worthy of use, it can be concluded that the water hyacinth dressing product is included in the decent classification so that it can be used for the next stage of trial.

b. **Participant validation results**

In the field trial, the product was assessed by 2 participants, namely people with diabetes mellitus wounds. Based on the results of the assessment of water hyacinth dressing products in the field trial, the product received a total score of (114) from the maximum score (133), so that in the calculation of the standard criteria for product feasibility it received a score of (85%). If the analysis results obtain the standard (81% - 100%), then the product is included in the classification very suitable for use. According to the researcher, the results of this field test assessment show that the product can be developed better. As for some additional suggestions from respondents in the field trial, researchers can accept them as evaluation material to further develop the products that have been made.

Conclusion

The water hyacinth dressing design was developed using the ADDIE model. The ADDIE method has been achieved with good assessment results, but it has not been carried out at the evaluation stage because this product is still not produced in factories in large quantities. However, the results of the feasibility test by expert validators obtained a value of (78%) the level of validation of the product is feasible to use, at the field trial stage conducted in 2 participants obtained results (85%) into a product very feasible to use.

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