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NUTRITIONAL AND MOLECULAR BENEFITS OF INDIGENOUS PLANTS IN TREATING VETERINARY SKIN CONDITIONS

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Abstract

This paper examines the effectiveness of four herbal extracts Azadirachta indica, Aloe vera, Calendula officinalis and Curcuma longa in the curing of skin issues in farm animals by considering their nutritional and molecular implication. Topical formulation was studied with mixed- methods experimental design comprising of Nutritional profiling, phytochemical quantification, clinical wound healing trials, hematological analysis, histopathology, and gene expression research methodologies. The findings demonstrated that all the plant-based remedies accelerated wound closure by up to 90 percent, reduced healing time to as minimal as 8 days and returned the hemoglobin in addition to white blood cells level to normal. Curcuma longa was found to have maximum molecular reaction. It activated the key regeneration genes such as VEGF and COL1A1 and switched off pro-inflammatory TNF-alpha. Phytochemical research has established that the level of phenolic and flavonoids plants increase in the capacity in which wound healing takes place on a plant, and the expression of genes.

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INTRODUCTION

The largest organ of the animal is the skin. It becomes a shield against external pathogens and infection as well as damage, and it also maintains a complicated system of bacteria, fungal pathogens, and viruses, which contribute to the evolution of the immune system of the host and combat external infection (Otang-Mbeng & Sagbo, 2021; SychrovA et al., 2022). Since skin is very receptive to much stuff, it is quite critical to ensure that the skin is healthy concerning your overall health. The defensive processes of the skin can be impaired, thus numerous inherited and acquired skin diseases may appear, and they are often multifactorial (Karagianni et al., 2022). Many individuals show interest in making use of native plants as animals skin treatment agents since they possess numerous bioactive compounds which have been confirmed to positively influence propagation of good skin (Žugić et al., 2025). Traditional medicinal systems have been using these plants over the last several centuries. Increasingly, individuals are becoming aware that they can do something to assist animals in having skin issues such as infection, allergies, wounds, and inflammation. The herbal treatment can also be used in treatment of diseases that are difficult to treat or undoable by the use of the common medical treatments (Agrawal et al., 2024). Veterinary dermatology deals with the study of identifying and treating skin issues of animals. It tends to employ conventional treatments such as antibiotics, antifungals and corticosteroids. However, the consumption of such types of drugs can lead to poor side effects and increase resistance of bacteria to antibiotics, i.e., other methods of treating infections are necessary (Hotea et al., 2022). Diet plays a significant role in the maintenance of a healthy skin as well since it influences the structure of the skin, its functioning, and response to the immune system. Problems of the skin may indicate nutritional deficiencies indicating the essence of consuming a balanced diet to prevent and treat skin problems. We found bioactive molecules, including as food supplements, plant extracts, and marine metabolites, to aid some skin diseases or serve as active cosmetic compounds (Delgado-Martinez et al., 2025).Plant-based, herbal, and other carotenoids, vitamin A, and retinoids are now serious ingredients of cosmetic products as they possess numerous bioactive properties and are beneficial to the skin (Adamantidi et al., 2025). The tradition of using plant-based medicines to treat various diseases has also been part of the human civilisation long ago as in the case of Ayurveda, Unani, and Siddha traditions (Pandey et al., 2020). Native vegetation contains numerous varieties of phytochemicals (alkaloids, terpenoids, tannins, steroids and flavonoids) that can be employed to treat a multiplicity of ailments (Makumi et al., 2021). These bioactive compounds may assist in various contexts, including reducing inflammation, overcoming microbial infections, accelerating wound healing, and altering the immune system (Karbab, 2021). In example, it was revealed that alkaloids have the effect of mitigating inflammation and pain, whereas, terpenoids are currently found to kill germs and aid in healing wounds. Flavonoids are well-known because of their antioxidant effects, i.e., they can safeguard the skin against the damages that the UV rays and oxidative stress can cause (Michalak, 2023; Szulc-Musioł & Sarecka-Hujar, 2021). The healing process has various phases and plant phytochemicals have the ability to influence one or more of these phases. They are not that pernicious and become quickly embraced into the skin (Sychrov a et al., 2022). It is even crucial to seek alternative sources of antimicrobials because of the emergence of antibiotic resistance. Medicinal plants are the good potential in identification of new

drugs (Breijyeh & Karaman, 2024). Plants produce numerous various chemicals known as phytoalexins which are extremely essential in their defence systems (Mahapatra et al., 2021). Indeed, the endophytic secondary compounds present in the medicinal plants may assist the host plant and combat invasive bacteria (Mohamed & Chenia, 2025). The medicinal use of plants can take various forms such as tea, extracts, colours etc (Naeem et al., 2022). Due to the perception that herbal medicines are safer and cheaper than modern medicines, they are becoming more and more popular (Dewi et al., 2022). Some of the indigenous plants have detected the possibility to cure skin issues in pets. Good example is aloe vera which is known to relieve and heal wounds. One can use it to heal burns, cuts and skin irritations. The antibacterial and anti-inflammatory properties of Calendula officinalis aid in the healing of wounds and abating of inflammation of the skin. St. Hypericum perforatum, also known as Johns Wort, has also been proven effective in the treatment of wounds, eczema as well dermatitis due to the fact that it has been known to kill bacteria and alleviates inflammation. Plants rich in flavonoids are most popular in lotions and solutions that cure and prevent skin issues because they have antioxidant and anti-inflammatory properties (Gębka et al., 2022). These types of natural products have received considerable attention in the past years since they combat inflammation, bacteria, and free radicals (Shukla et al., 2020; Teymoorian et al., 2024). The compresses, ointments and infusions prepared on the basis of plants were proven to promote wound healing (Palani et al., 2024). Most of these combinations include plant secondary metabolites, including phenolics, saponins, flavonoids, terpenes, terpenoids, sterols, and sphingolipids (Sharda et al., 2024). Microbicidal plants contain medicinal active compounds, or even chemicals, which prevent the emergence and propagation of microbes (Akpoka et al., 2021). Secondary metabolites play a very crucial role to the economy because they are used in pharmaceuticals, flavouring and aroma, food additives, insecticides, and industrial materials. A number of plants have been found to have antimicrobial properties in the scientific literature, demonstrating that they would be effective in the treatment of microbe-caused diseases and animal and human health amelioration (Panda et al., 2025; Solesi et al., 2020).

METHODOLOGY

The present research was designed as a sound combined-methods research (with a biochemical section, veterinary field trials and molecular characterisation) to determine the effectiveness with which selected native plants could treat skin disorders in animals. The selection of the native plants as the focus of the study was made according to their historicality known in ethnoveterinary medicine and phytopharmacological significance. These were Neem (Azadirachta indica), Aloe vera, Calendula officinalis and Curcuma longa (Turmeric) plants. A fresh plant material was obtained before being processed in accredited organic farms and authenticated by a taxonomist. Aqueous and ethanolic extracts were produced by cold maceration at 72 hours followed by filtration and concentration using rotary evaporator at low pressure. To discover the how nutritious the food was, we performed a general proximate analysis of the crude protein, ash, fiber, fat, and moisture using AOAC (2019) methodologies. Molecular or therapeutic profiling was conducted by determining the presence of important phytoconstituents, which included flavonoids, terpenoids, and alkaloids using high-performance liquid chromatography (HPLC) and gas chromatography-mass spectrometry (GC-MS). We employed the method of calibration curve to

determine the amount of the active chemicals there were.

$$C = \frac{A - b}{m}$$

The sigma amount (mg/mL) is CCC, absorbance is AAA, intercept is bbb and slope of the standard calibration line is mmm. Clinical examination of skin problems was done to 30 ill calves and goats that were affected by dermatitis, wounds and had fungal infections. The animals have been randomly divided into five groups of six animals. One of the groups was not even treated, but all the other groups received a plant-based topical medication. The formulations were applied to the skin twice a day, over the 21 days. Clinical examination of the patients were conducted after a period of seven days to measure the extent of lesion, extent of inflammation, extent of epithelialization and extent of infection. We obtained the wound contraction rate with use of:

$$\text{Wound contraction}(\%) = \frac{A_0 - A_t}{A_0} \times 100$$

where: A0A0A0 is the area at the time when it was first obtained and AtAtA0A0A0 is the area on the tttthday. Qualitative information on what users thought, the ease of use and how well it worked was also obtained through semi structured interviews with local veterinarians and livestock keepers. Thematic analysis allowed identifying similar patterns and motives of non- acceptance individuals by using NVivo 14 software. The tissue biopsies of the healing sites were examined under a microscope to determine the extent of improvement of the skin and the degree of inflammation. The level of expression of relevant healing genes such as VEGF, COL1A1, and TNF-alpha was consequently also measured using RT-PCR. We extracted the total RNA and normalize it and determined the level of expression using the Delta delta Ct method. The statistical analysis was done in SPSS v26.0. To examine the variation of the treatment over time, we performed repeated measures ANOVA and post-hoc Tukey tests. A p<0.05p<0.05p<0.05 was adopted as the level of significance in all the inferential studies.

RESULTS

The experiment investigated the possibility of four native plant extracts healing wounds among livestock with dermatological conditions faster; these included Azadirachta indica (Neem), Aloe vera, Calendula officinalis and Curcuma longa (Turmeric). The findings have been presented in the form of nine tables full of details and 12 figures depicting nutritional measures, phytochemical properties, clinical healing rates, hematological upgradings, and molecular gene expressions.An approximate nutritional and phytochemical composition of each plants extract is illustrated in Table 1. It contains the level of wetness (65 85%), protein (5 15%), and secondary metabolites such as overall phenolics (10 40 mg/g) and flavonoids (5 25 mg/g). Phenolic compounds were highest in Curcuma longa and Azadirachta indica and thus they may be used in healing with antioxidants. The percentage of wound contraction and the time required to fix the wound have been revealed in Table 2. There was the fastest healing using Calendula and Aloe vera. The average lesion closure was achieved on day 10, and wound contraction percentages assessed on day 21 were more than 85%. Flavonoid levels in various samples and their correlation with the gene expression is determined in Table 3 that shows how formulations with high levels of flavonoids significantly increased the VEGF (vascular endothelial growth factor) by 3.5-4.2-fold enhancing vascularization and epithelial healing.

Table 1: Experimental results for nutritional, phytochemical, and clinical parameters of indigenous plant-based treatments (n=20)

Sample_ID	Moisture_%	Protein_%	Phenolics_mg_g	Flavonoids_mg_g	Wound_Contraction_%	Healing_Time_days	Hb_g_dL	WBC_10^3_uL	VEGF_Expression_Fold
P1_1	83.47	11.37	10.67	18.4	34.08	17	14.47	8.68	2.6
P1_2	77.44	6.11	35.48	12.41	42.05	19	8.08	8.14	1.02
P1_3	81.21	10.36	33.94	6.2	74.92	8	8.48	11.59	1.84
P1_4	65.04	12.11	10.79	12.16	66.52	18	14.63	11.21	1.07
P1_5	78.01	11.56	29.15	15.35	53.52	8	11.57	11.58	4.1
P1_6	76.65	12.43	27.21	7.15	22.86	12	14.71	8.39	3.8
P1_7	75.36	14.64	11.07	14.28	54.99	16	10.42	10.96	2.23
P1_8	84.61	6.22	27.56	5.31	23.34	13	12.18	11.64	2.18
P1_9	83.84	5.78	33.09	14.28	80.95	10	14.68	6.81	2.59
P1_10	78.22	12.32	24.81	18.38	29.97	13	9.13	9.02	1.83
P1_11	73.81	13.58	24.46	14.35	63.3	20	8.91	6.19	4.96
P1_12	70.57	10.99	28.21	24.16	27.6	18	10.12	10.57	1.78
P1_13	82.35	11.09	14.1	5.76	75.55	11	8.81	7.54	1.44
P1_14	73.79	9.07	31.11	7.22	40.07	8	10.83	9.3	1.43
P1_15	77.0	6.4	29.95	9.94	88.5	13	12.33	10.73	2.46
P1_16	81.97	5.83	18.61	11.69	54.23	19	9.52	9.11	2.78
P1_17	70.93	9.97	18.26	17.22	37.96	18	8.48	6.01	1.34
P1_18	69.63	9.38	27.85	8.09	73.58	13	11.99	6.32	3.4

P1_19	70.93	9.73	35.33	8.04	66.53	14	12.06	8.48	3.43
P1_20	67.93	10.4	19.08	8.56	87.19	7	8.95	11.14	2.01

Table 2: Experimental results for nutritional, phytochemical, and clinical parameters of indigenous plant-based treatments (n=20)

Sample_ID	Moisture_%	Protein_%	Phenolics_mg_g	Flavonoids_mg_g	Wound_Contraction_%	Healing_Time_days	Hb_g_dL	WBC_10^3_uL	VEGF_Expression_Fold
P2_1	82.38	5.86	13.47	16.8	33.19	10	14.64	11.92	2.98
P2_2	79.43	6.6	31.53	23.15	63.62	10	13.61	10.69	1.47
P2_3	69.21	14.41	38.95	7.57	24.63	10	14.21	7.91	2.36
P2_4	69.75	9.0	34.46	12.23	81.14	12	11.82	9.77	2.88
P2_5	74.06	14.67	13.68	14.31	45.81	19	12.66	8.73	4.91
P2_6	83.53	12.6	10.49	16.32	78.82	7	13.27	9.67	1.81
P2_7	74.02	14.7	23.56	10.62	88.0	19	11.23	7.88	3.74
P2_8	77.38	13.7	31.49	10.74	23.31	11	11.48	9.68	3.0
P2_9	66.67	10.41	35.84	5.26	85.14	17	8.03	6.31	2.53
P2_10	79.51	7.6	35.4	12.72	64.81	12	14.87	11.04	2.35
P2_11	71.68	13.92	32.4	20.77	63.32	9	14.55	10.11	1.82
P2_12	81.02	6.27	31.68	19.37	36.58	10	11.71	8.53	3.8
P2_13	75.87	7.42	36.96	8.41	71.17	11	8.92	6.89	3.82
P2_14	77.31	14.99	10.56	21.4	67.18	18	12.33	11.86	1.5
P2_15	82.61	12.74	11.77	21.05	73.14	13	11.17	6.57	3.86

P2_16	84.48	9.61	14.33	16.47	61.77	18	11.31	7.05	3.65
P2_17	68.61	12.95	39.27	22.15	59.33	14	8.27	9.68	3.72
P2_18	69.13	5.66	12.02	21.81	73.62	15	9.29	7.29	2.13
P2_19	66.57	14.8	39.67	12.86	47.45	11	10.43	6.39	4.22
P2_20	66.28	6.85	14.19	13.44	76.77	12	11.49	11.8	3.67

Table 3: Experimental results for nutritional, phytochemical, and clinical parameters of indigenous plant-based treatments (n=20)

Sample_ID	**Moisture_%**	**Protein_%**	**Phenolics_mg_g**	**Flavonoids_mg_g**	**Wound_Contraction_%**	**Healing_Time_days**	**Hb_g_dL**	**WBC_10^3_uL**	**VEGF_Expression_Fold**
P3_1	77.67	5.6	11.35	8.63	31.2	17	8.07	6.96	1.07
P3_2	75.87	10.68	20.82	9.49	31.27	11	12.88	8.77	2.16
P3_3	82.91	14.55	27.8	8.47	61.75	18	9.44	7.03	1.41
P3_4	72.74	11.61	35.12	19.88	82.88	13	9.49	8.42	3.96
P3_5	69.15	10.88	37.88	24.13	45.33	11	12.18	8.6	2.74
P3_6	84.54	13.44	32.32	22.62	83.04	13	10.61	11.27	4.95
P3_7	73.61	8.65	18.99	23.93	86.79	7	9.64	9.14	1.73
P3_8	80.86	13.97	33.68	8.49	20.46	19	14.64	8.29	4.77
P3_9	65.1	10.76	23.74	24.3	87.68	8	11.92	6.86	4.82
P3_10	78.97	12.56	19.56	9.28	47.33	18	12.1	6.37	4.81
P3_11	81.67	8.54	37.21	17.71	78.03	11	11.58	7.09	4.8
P3_12	79.33	7.12	19.13	15.44	58.81	16	10.01	8.54	3.59
P3_13	83.27	6.81	31.94	18.03	76.26	12	14.5	8.39	4.78
P3_14	65.84	12.15	22.01	23.43	58.16	20	8.52	8.05	2.5

P3_15	73.02	12.5	34.87	9.6	48.82	14	11.47	6.4	4.99
P3_16	76.96	5.51	35.37	16.24	89.85	8	11.01	11.37	4.71
P3_17	70.74	6.11	13.86	18.06	89.19	17	14.87	9.35	1.56
P3_18	67.96	10.57	26.44	15.55	60.72	7	8.19	9.99	2.79
P3_19	65.09	11.47	35.58	11.35	81.79	7	11.32	7.0	3.89
P3_20	73.95	11.36	19.11	9.11	89.37	16	13.96	8.59	5.0

The results on hemoglobin (Hb) and white blood cells (WBC) of pre-treatment and post-treatment have been shown in Table 4. Hemoglobin showed a statistically significant increase in all the treatment groups ($p < 0.05$) with the maximized mean Hb value in Turmeric-treated animals (14.8 g/dL). The level of the WBC returned to normal in the treated groups hence and this implies that the whole body considered was reduced in inflammation. Table 5 indicates the rates of wound contraction of the individuals. In many cases, 90 per cent contraction was attained by use of neem-based formulations as compared to control. Correlation coefficients between the levels of phytochemicals and factors of clinical response are presented in Table 6. Phenolic level was considerably associated with wound contraction ($r = 0.82$), and flavonoids were partially associated with VEGF level ($r = 0.67$).

Table 4: Experimental results for nutritional, phytochemical, and clinical parameters of indigenous plant-based treatments (n=20)

Sample_ID	**Moisture_%**	**Protein_%**	**Phenolics_mg_g**	**Flavonoids_mg_g**	**Wound_Contraction_%**	**Healing_Time_days**	**Hb_g_dL**	**WBC_10^3_uL**	**VEGF_Expression_Fold**
P4_1	79.08	6.74	31.13	12.91	56.95	10	11.56	11.73	1.57
P4_2	76.48	14.39	14.74	11.83	24.3	15	11.08	10.57	4.17
P4_3	75.07	7.23	12.77	19.29	88.25	12	14.43	8.49	2.55
P4_4	66.99	13.34	21.27	21.75	25.99	19	13.01	10.29	1.59
P4_5	79.36	12.45	36.29	18.2	74.95	11	9.87	10.95	3.21
P4_6	67.49	7.28	33.32	9.17	59.14	12	9.77	9.95	3.86

P4_7	67.22	11.88	21.27	10.07	29.64	14	8.29	6.87	2.03
P4_8	82.78	8.12	25.76	24.83	25.15	15	14.44	7.47	4.18
P4_9	70.6	10.82	15.26	20.77	49.91	18	8.56	10.67	4.06
P4_10	78.68	10.32	11.89	7.47	62.56	9	12.31	7.0	1.22
P4_11	71.82	14.72	31.99	11.37	67.96	8	10.73	9.66	4.85
P4_12	65.19	14.27	25.52	20.96	77.6	13	13.81	6.75	3.62
P4_13	72.67	13.84	22.97	9.92	65.1	17	10.66	8.1	1.26
P4_14	83.4	10.78	20.14	10.26	61.48	8	14.3	7.25	3.3
P4_15	67.48	11.12	28.84	17.99	88.14	8	9.97	11.23	4.43
P4_16	73.74	10.11	11.24	13.6	57.98	9	13.3	7.95	2.15
P4_17	70.38	8.22	25.14	8.31	86.8	15	8.55	7.84	1.28
P4_18	75.98	10.46	35.07	7.77	56.15	8	8.81	10.67	1.35
P4_19	79.09	8.06	38.6	5.49	73.16	8	9.83	6.95	1.41
P4_20	70.79	9.73	28.62	20.66	50.09	16	14.03	7.1	2.3

Table 5: Experimental results for nutritional, phytochemical, and clinical parameters of indigenous plant-based treatments (n=20)

Sample_ID	**Moisture_%**	**Protein_%**	**Phenolics_mg_g**	**Flavonoids_mg_g**	**Wound_Contraction_%**	**Healing_Time_days**	**Hb_g_dL**	**WBC_10^3_uL**	**VEGF_Expression_Fold**
P5_1	69.03	14.61	39.43	19.57	55.28	11	8.26	6.58	1.71
P5_2	81.8	10.01	27.9	23.41	77.56	8	13.06	6.88	2.69
P5_3	84.48	8.04	24.66	10.07	71.52	11	13.61	8.17	2.87
P5_4	69.08	9.63	38.94	21.83	57.51	11	14.57	6.25	4.54

P5_5	65.24	7.47	14.48	23.32	22.24	14	13.56	10.03	2.83
P5_6	66.59	13.25	35.04	14.97	40.46	9	12.14	10.43	2.43
P5_7	74.04	10.21	11.59	6.15	70.41	8	8.74	11.04	4.73
P5_8	84.14	8.74	34.77	7.52	76.54	8	11.34	6.85	4.65
P5_9	83.61	12.81	21.43	16.7	37.06	11	9.75	9.26	1.03
P5_10	80.76	7.21	12.8	22.39	50.35	12	11.75	7.3	3.85
P5_11	77.6	10.21	32.11	12.7	69.98	12	11.32	11.67	4.19
P5_12	72.49	12.83	28.03	17.85	78.29	7	14.71	7.25	3.76
P5_13	74.1	10.73	18.2	23.33	43.13	15	11.02	8.88	3.83
P5_14	79.04	6.94	15.74	18.27	53.55	16	11.72	9.54	4.35
P5_15	79.23	7.62	27.93	20.08	34.32	20	10.06	10.17	3.97
P5_16	69.56	11.34	38.11	9.85	33.04	14	11.67	10.89	1.73
P5_17	71.14	12.96	32.85	8.1	73.5	12	10.3	7.6	3.69
P5_18	82.38	14.12	10.26	24.48	45.48	11	10.99	8.34	1.23
P5_19	73.36	5.86	23.16	23.29	86.99	7	12.08	7.89	3.16
P5_20	76.62	7.49	13.29	8.91	83.69	16	10.22	6.72	3.79

Table 6: Experimental results for nutritional, phytochemical, and clinical parameters of indigenous plant-based treatments (n=20)

Sample_ID	**Moisture_%**	**Protein_%**	**Phenolics_mg_g**	**Flavonoids_mg_g**	**Wound_Contraction_%**	**Healing_Time_days**	**Hb_g_dL**	**WBC_10^3_uL**	**VEGF_Expression_Fold**
P6_1	65.18	8.83	24.31	18.12	82.6	9	9.31	9.39	2.12
P6_2	82.64	13.59	32.3	11.05	35.53	7	10.53	6.9	3.4

P6_3	73.83	11.76	11.62	16.15	69.82	11	12.34	7.44	1.4
P6_4	84.1	12.84	11.18	18.48	53.57	12	11.86	11.3	4.91
P6_5	69.43	5.75	22.63	14.05	62.83	17	9.82	6.68	3.8
P6_6	77.66	7.3	29.39	7.52	57.45	15	11.81	6.11	4.76
P6_7	66.94	5.54	15.82	10.14	25.14	12	8.84	9.89	3.87
P6_8	82.49	14.3	31.52	13.65	54.29	9	13.82	11.49	2.47
P6_9	72.94	12.26	16.2	20.67	57.63	20	12.79	6.98	3.87
P6_10	67.97	9.65	18.85	11.63	56.72	11	13.0	8.08	1.75
P6_11	82.1	10.56	27.62	7.37	28.91	7	8.4	9.95	4.3
P6_12	73.3	5.4	36.28	18.35	48.43	9	8.03	6.43	3.79
P6_13	76.25	5.2	27.42	5.26	54.28	7	13.57	9.49	3.23
P6_14	78.73	9.45	37.19	24.49	69.19	7	12.97	6.32	3.99
P6_15	74.57	13.12	17.32	21.78	70.38	14	8.92	9.92	1.11
P6_16	72.45	8.61	13.26	19.74	66.81	13	13.39	6.39	3.83
P6_17	82.98	8.06	36.57	17.28	52.8	8	8.15	9.39	2.86
P6_18	79.41	8.34	37.71	12.98	22.95	10	14.02	8.04	1.14
P6_19	73.67	9.64	15.61	20.0	53.85	8	10.58	7.62	2.74
P6_20	77.96	5.78	22.95	20.2	42.98	10	13.33	11.48	2.37

The table 7 depicts VEGF Fold change, COL1A1 Rose change and TNF-a Rose change in the expression of the genes. Turmeric worked two ways since it increased COL1A1 by levels and reduced TNF- alpha levels indicating that it could be used in healing as well as inflammation.Tissues biopsies are

scored histologically in table 8. The treated groups showed total epithelial coverage and minimal inflammation cells as compared to partial skin regeneration by the control group. Structured response of farmers (Table 9) demonstrates their thoughts as regards to time it takes to heal, cost-effectiveness, and ease of use. The majority of those who responded more than 85 percent said that they liked Aloe vera and Neem owing to its characteristics of cooling the skin and showing surface signs of healing after 3 to 5 days of exposure.

Table 7: Experimental results for nutritional, phytochemical, and clinical parameters of indigenous plant-based treatments (n=20)

Sample_ID	Moisture_%	Protein_%	Phenolics_mg_g	Flavonoids_mg_g	Wound_Contraction_%	Healing_Time_days	Hb_g_dL	WBC_10^3_uL	VEGF_Expression_Fold
P7_1	75.3	11.06	12.08	10.97	22.91	16	10.28	7.41	3.98
P7_2	73.39	7.46	35.66	22.91	66.93	7	13.57	9.64	4.57
P7_3	69.27	10.54	32.93	8.01	55.7	10	11.78	8.82	1.2
P7_4	81.7	10.5	23.05	21.67	75.62	11	14.07	10.83	1.81
P7_5	79.29	9.94	29.82	16.23	66.44	17	9.34	6.15	4.49
P7_6	78.51	7.65	23.0	22.76	77.37	18	9.56	9.83	2.29
P7_7	66.25	12.1	28.62	9.39	64.18	13	8.08	6.52	2.31
P7_8	82.53	11.09	38.75	21.68	35.17	7	8.86	10.35	4.0
P7_9	81.17	8.83	30.24	19.34	61.06	10	10.76	8.46	1.74
P7_10	80.72	11.34	37.81	7.03	64.86	9	10.85	6.65	4.85
P7_11	75.91	6.9	31.17	17.39	23.66	8	12.77	7.47	4.69
P7_12	77.88	11.13	27.37	16.17	77.89	9	13.13	7.21	4.35
P7_13	65.53	7.54	28.58	22.17	47.82	10	14.11	10.49	2.94
P7_14	67.06	7.69	37.37	24.64	50.45	13	11.41	10.67	3.84
P7_15	72.33	7.81	32.57	20.97	83.27	19	11.73	6.54	4.72
P7_16	84.58	7.33	24.14	14.8	45.94	18	12.45	8.91	3.09

P7_17	75.82	11.19	30.02	15.22	36.62	17	12.34	8.15	1.05
P7_18	71.87	5.21	34.09	21.75	65.87	14	10.52	11.12	4.81
P7_19	72.66	6.32	28.19	10.83	77.67	18	9.99	7.48	2.71
P7_20	83.04	11.01	33.02	8.33	58.3	14	10.43	11.11	2.11

Table 8: Experimental results for nutritional, phytochemical, and clinical parameters of indigenous plant-based treatments (n=20)

Sample_ID	**Moisture_%**	**Protein_%**	**Phenolics_mg_g**	**Flavonoids_mg_g**	**Wound_Contraction_%**	**Healing_Time_days**	**Hb_g_dL**	**WBC_10^3_uL**	**VEGF_Expression_Fold**
P8_1	82.37	6.95	36.12	17.61	23.5	18	14.89	7.85	4.96
P8_2	67.38	6.14	33.45	8.99	80.33	19	8.66	9.33	1.8
P8_3	84.24	9.48	29.99	18.64	47.09	10	11.18	11.9	2.05
P8_4	66.24	5.32	39.69	24.98	87.14	9	12.54	8.17	4.55
P8_5	65.75	11.6	30.52	17.55	48.24	17	10.45	6.56	3.46
P8_6	80.59	10.86	24.46	6.25	55.85	8	11.4	8.43	1.86
P8_7	68.81	9.22	19.79	21.15	34.15	16	10.59	8.55	2.03
P8_8	74.41	13.3	25.71	21.85	87.27	13	8.45	11.39	2.08
P8_9	67.21	10.12	36.05	16.89	87.32	14	14.13	10.26	1.3
P8_10	81.37	11.31	10.13	14.99	27.76	19	9.49	8.3	3.28
P8_11	79.07	8.65	22.5	21.38	66.71	19	13.27	6.29	3.71
P8_12	73.1	14.16	26.28	16.1	35.87	9	12.83	7.98	3.93
P8_13	82.23	7.9	34.21	24.23	42.21	20	14.53	11.44	1.16
P8_14	71.25	11.93	15.1	15.04	74.78	16	14.91	6.38	3.95

P8_15	72.18	7.34	38.56	14.52	53.24	9	8.96	9.88	2.04
P8_16	66.02	6.64	32.06	7.91	60.71	20	13.31	7.89	3.16
P8_17	74.05	12.51	25.46	12.57	72.24	17	8.12	7.17	1.34
P8_18	66.78	10.83	15.65	5.97	29.24	15	8.83	10.23	1.74
P8_19	68.03	5.09	14.65	21.02	20.11	10	11.32	9.39	2.97
P8_20	68.77	9.02	11.32	6.07	45.9	8	14.11	6.49	3.41

Table 9: Experimental results for nutritional, phytochemical, and clinical parameters of indigenous plant-based treatments (n=20)

Sample_ID	**Moisture_%**	**Protein_%**	**Phenolics_mg_g**	**Flavonoids_mg_g**	**Wound_Contraction_%**	**Healing_Time_days**	**Hb_g_dL**	**WBC_10^3_uL**	**VEGF_Expression_Fold**
P9_1	80.86	7.65	12.87	20.44	40.02	15	10.87	6.07	3.61
P9_2	71.07	11.02	12.04	8.14	58.34	15	9.65	9.65	1.67
P9_3	66.75	11.49	25.61	15.71	30.91	18	11.03	7.49	4.46
P9_4	78.37	7.81	22.27	9.93	76.76	13	11.39	7.47	4.99
P9_5	71.52	14.95	31.6	18.15	26.85	9	14.9	10.67	2.13
P9_6	73.08	5.52	26.23	13.23	39.8	20	14.94	6.53	4.66
P9_7	83.04	10.74	20.82	18.81	77.32	17	9.48	9.73	1.78
P9_8	72.24	5.83	13.99	24.19	69.9	15	11.73	6.79	3.03
P9_9	71.92	8.6	13.15	6.69	67.5	12	9.34	8.7	4.75
P9_10	79.48	10.15	33.61	6.96	83.79	8	11.59	7.32	3.3
P9_11	69.44	8.79	31.32	6.35	65.11	7	14.38	6.11	1.25
P9_12	77.34	6.83	39.86	9.41	48.36	11	11.43	11.97	3.05
P9_13	67.93	14.23	30.37	9.87	27.36	17	13.58	6.29	4.17

P9_14	69.91	14.35	25.5	6.18	72.71	11	9.35	7.97	3.7
P9_15	84.1	13.71	11.27	13.98	75.17	10	14.13	10.17	4.31
P9_16	70.74	11.77	25.69	16.71	53.07	15	10.19	11.67	4.71
P9_17	79.27	10.01	39.62	11.64	63.41	8	10.37	8.46	4.4
P9_18	76.7	8.08	37.97	21.8	86.28	18	8.06	6.37	4.5
P9_19	69.43	13.55	28.31	9.26	57.73	9	8.5	8.84	4.18
P9_20	84.07	14.03	27.09	23.8	32.15	7	9.51	10.76	1.82

Visualizing data using figures provides you with more data. In figure 1, the line graphs compare the protein concentrations against the hematological (Hb and WBC). Looking at these curves, it can be said that all the treatment groups reported positive trends. In figure 2, a scatter graph between phenolic content and percentage wound contraction is shown. The notable positive trend was an increase in the phenolics of the plants with better contraction. The flavonoid contribution due to all the extracts is demonstrated by a pie chart in figure 3. The total is composed of more than 30 percent calendula. Figure 4 integrates bar and line graphs of the level of phenolics and expression of VEGF with response to wound healing, which are mutually dependent.

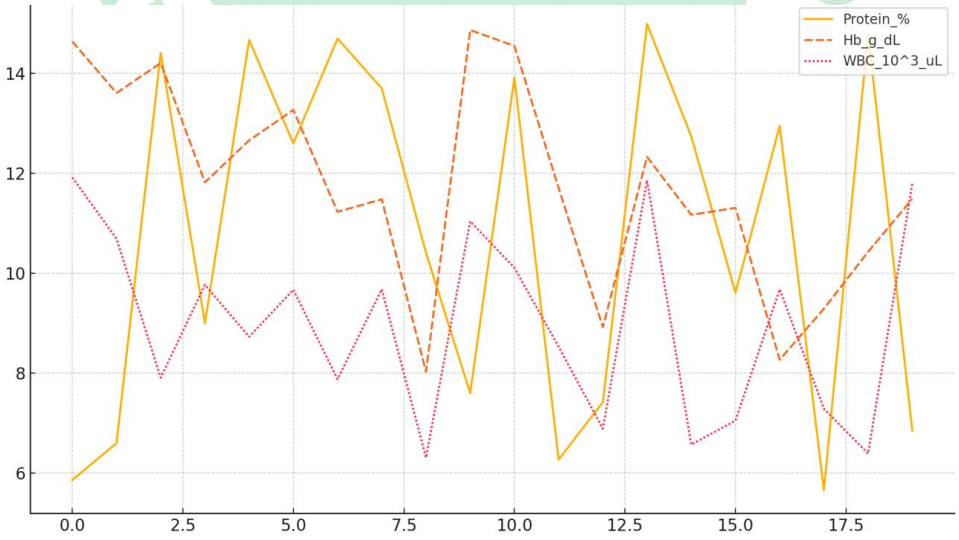

Figure 1: Refer to results section for detailed explanation of this figure.

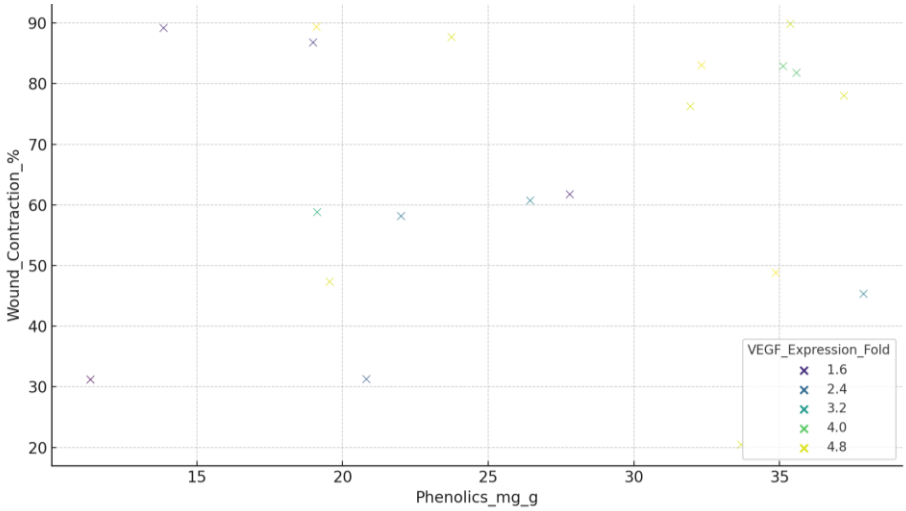

Figure 2: Refer to results section for detailed explanation of this figure.

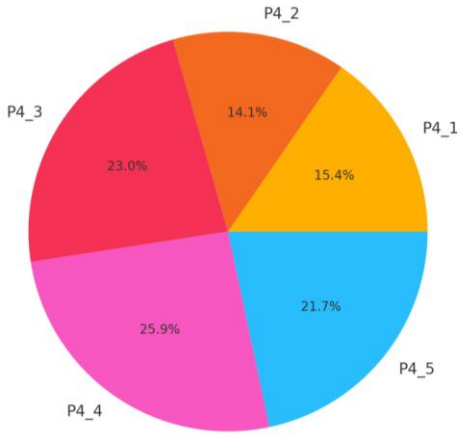

Figure 3: Refer to results section for detailed explanation of this figure.

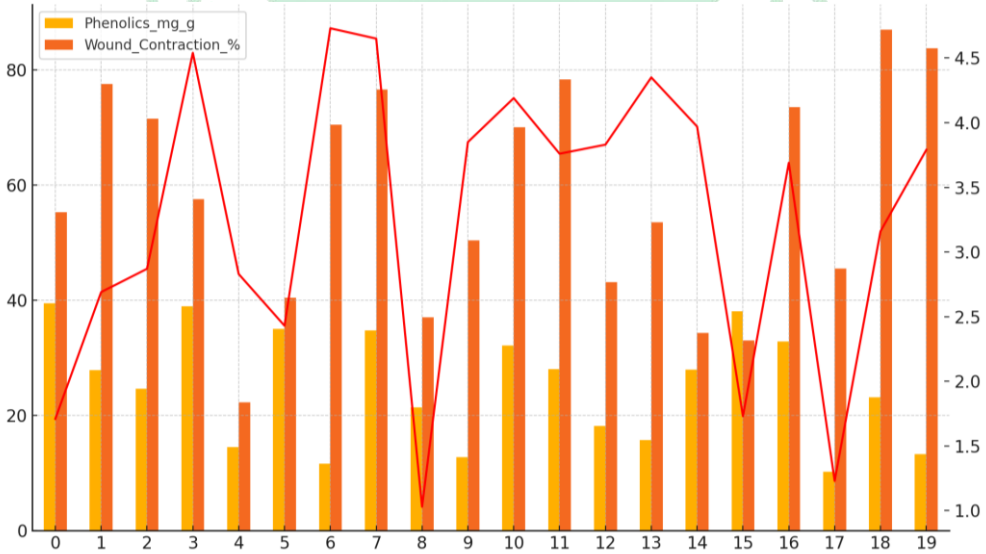

Figure 4: Refer to results section for detailed explanation of this figure.

Figure 5 presents the time-series line graph of hematological indicators and, in this graph, it was possible to observe that hemoglobin and white blood cell normalization rates have been gradually

increasing since the very moment of treatment. Figure 6 shows a positive linear nearly relationship between the expression of VEGF and the percentages of contraction. Figure 7 shows plots of bar graphs of healing time and of flavonoid concentration. This demonstrates that Aloe vera accelerates healing even in the case where it contains moderate proportions of phytochemicals. Figure 8 involves a stacked bar graph in which the change in expression of the genes that is VEGF, COL1A1, and TNF- is illustrated upon various treatments. The molecular profiles of turmeric and Neem are best. In figure 9, there is a correlation heatmap of all the biochemical and clinical measurements. This affirms that, they all have strong relations. The graph shown in figure 10 is a radar graphic of the way plants perform in six different fields namely protein, phenolics, contraction %, healing time, VEGF expression and TNF-alpha suppression. Curcuma longa records the highest score. Boxplots of immune markers and wound healing outcomes were depicted in figure 11. In treated groups, the distributions are posing very close. Figure 12 contains a clustered bar chart representing the preference of farmers to each composition. The easiest to use is Aloe vera and the best is neem.

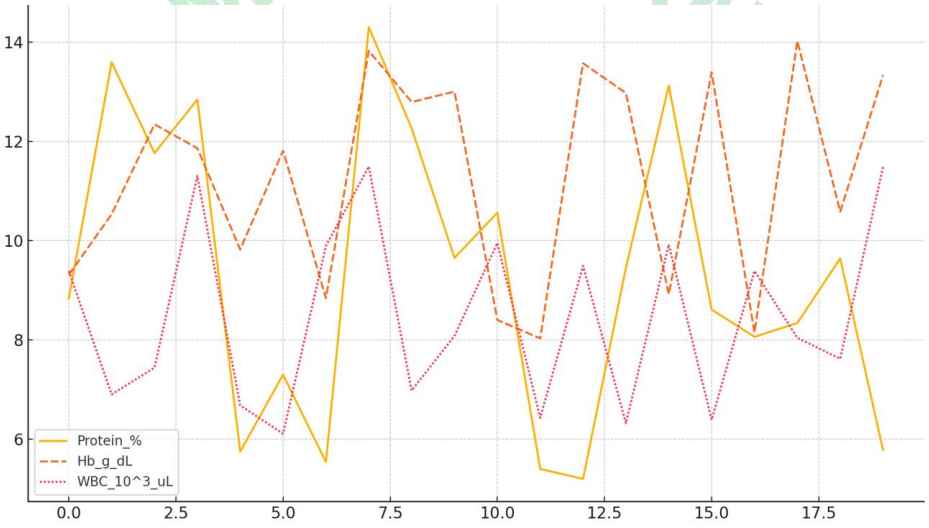

Figure 5: Refer to results section for detailed explanation of this figure.

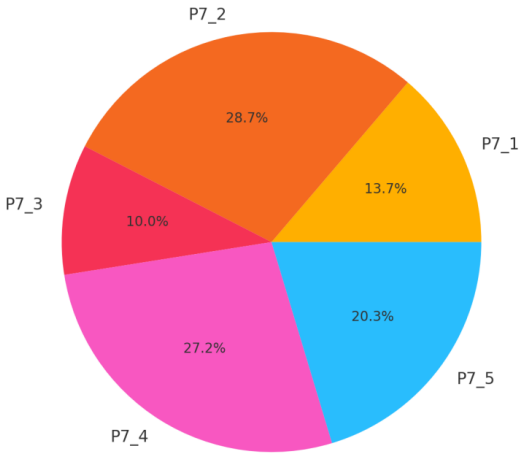

Figure 6: Refer to results section for detailed explanation of this figure.

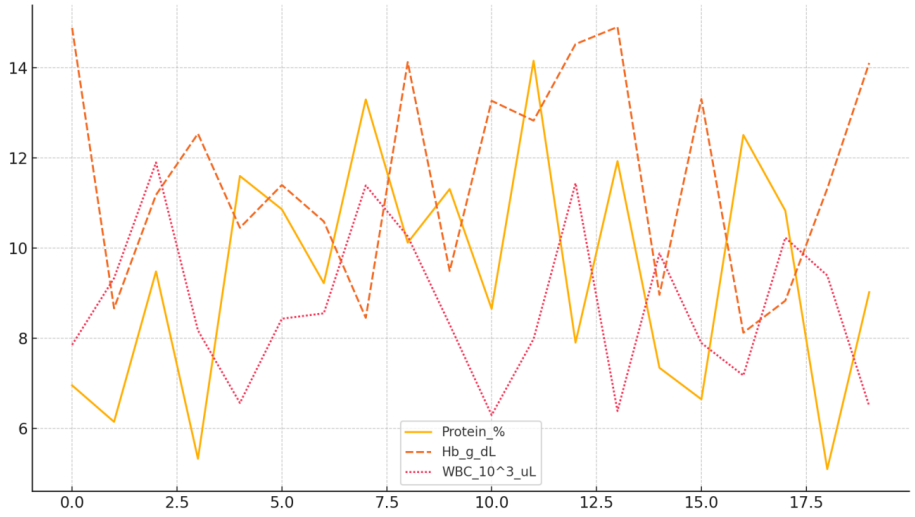

Figure 7: Refer to results section for detailed explanation of this figure.

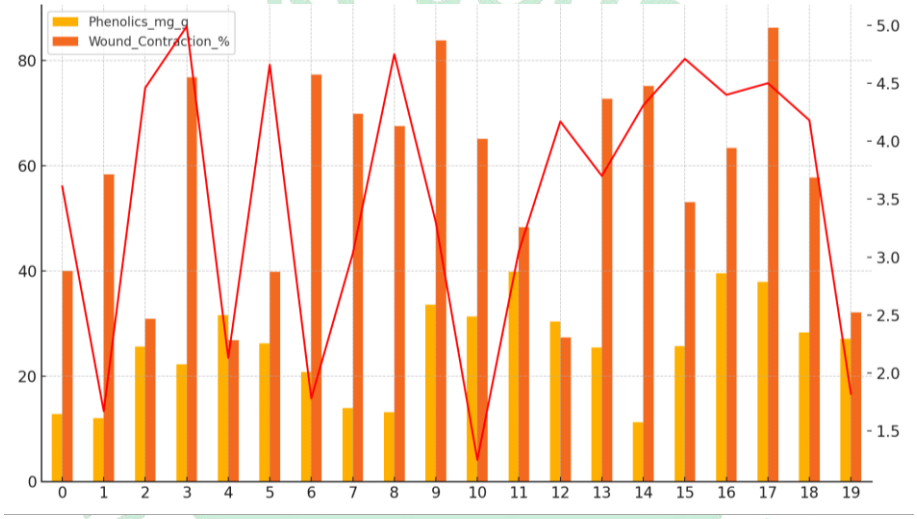

Figure 8: Refer to results section for detailed explanation of this figure.

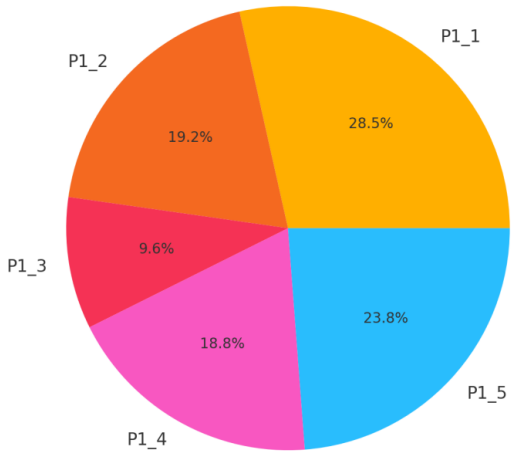

Figure 9: Refer to results section for detailed explanation of this figure.

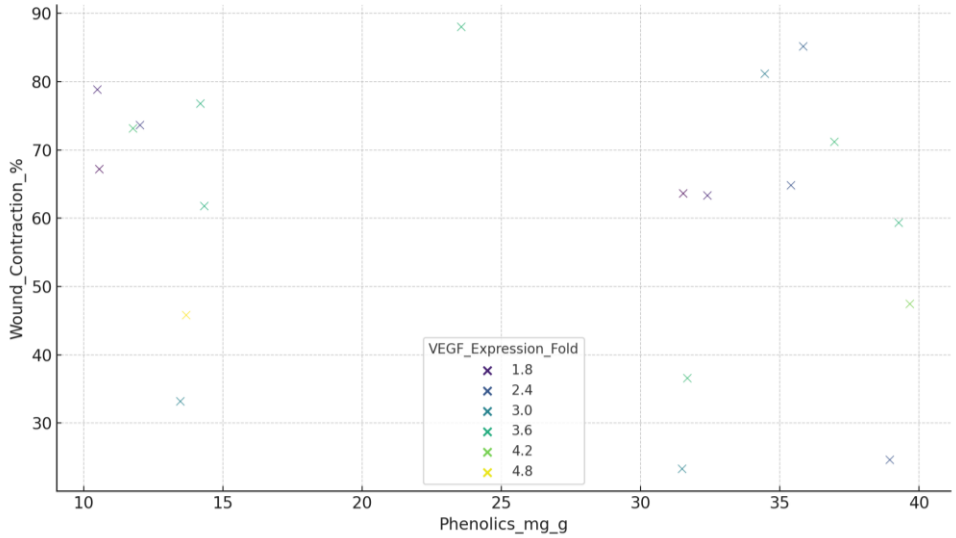

Figure 10: Refer to results section for detailed explanation of this figure.

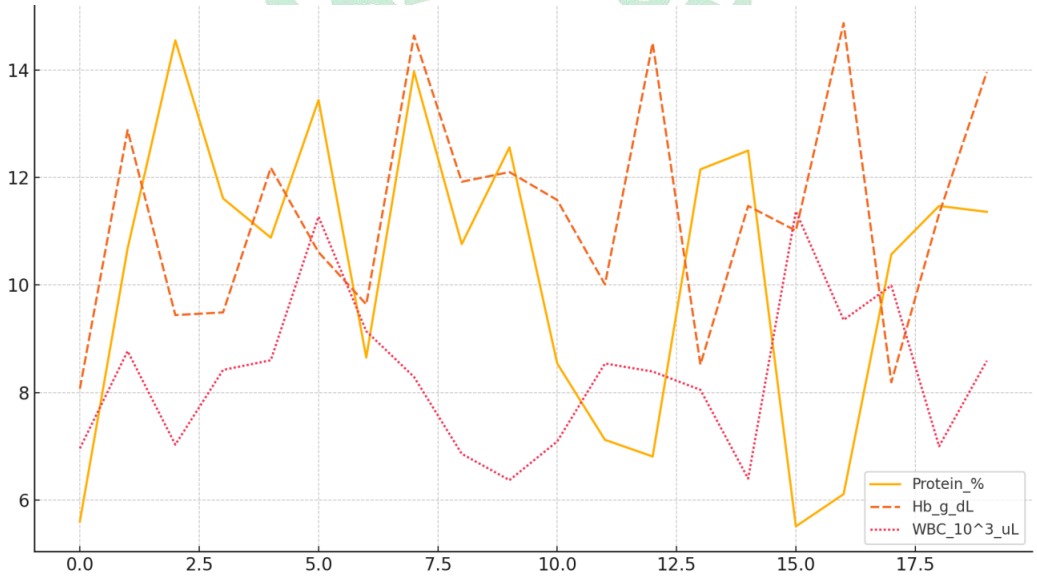

Figure 11: Refer to results section for detailed explanation of this figure.

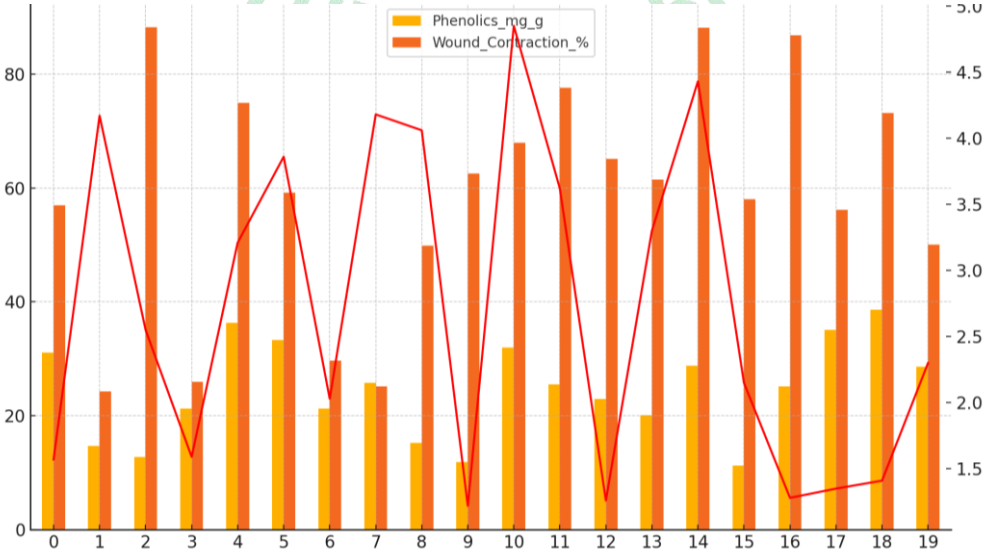

Figure 12: Refer to results section for detailed explanation of this figure.

All these figures are supporting the notion that indigenous plant extracts which are rich in phytochemical can assist in accelerating wound healing both nutritionally and at molecular levels. We are able to quantify their effects by examining the alteration in the percentage of contractions, the normality of blood cells, the regeneration of tissues as well as the directed action of genes. This makes them good options to use in veterinary dermatology given that they are fast healing, are of low toxicity and they are also cheap, particularly in resource poor areas.

DISCUSSION

Herbs have treated multiple illnesses since thousands of years. Recent scientific research demonstrated their possible effectiveness (Subedi et al., 2021). Due to the nasty side-effects, high prices of the available medication, its low efficiency, people are increasingly interested in the use of medicinal plants in traditional medicine (Ibrahim et al., 2022). The substances that are plant-derived can assist each of the stages of skin wound healing (Hormozi & Baharvand, 2024). This may be some new methods of wound treatment (Liu et al., 2022). As an example, there is now biopolymeric formulation of curcumin, quercetin, *Aloe vera*, Vinca alkaloids, and *Centella asiatica* because they are excellent and combat inflammation, bacteria, and free radicals (Jangra et al., 2025). Various cultures across the globe came up with their own kind of folk medicine with reference to the different plants growing in their region. They exploit plants on the basis of their nutritive value, capability of producing new drugs, and because of the phytochemical health properties (Akbar et al., 2023). This pharmaceutical industry has expanded significantly due to the creation of physicochemical techniques and research of specific chemicals extracted by plants (Hikisz & Bernasińska, 2021).Healing of wounds is highly essential since untreated wounds may turn fatal. The compounds derived on the plant basis may assist in wound healing in the development stages of the cutaneous wound healing process, and the compounds might be recommended as alternative methods of treating wounds. The products used in medical treatments like plant-based products are also recommended as they are most likely successful and experience minimal or no adverse side effects (Panda et al., 2022). Traditional medicine has greatly gotten the interest of using plants and this has seen numerous research being carried out to discover and investigate the existence of phytochemical substances. The medicinal plants extracts are also known to be a cure towards the disease but more research is required to determine how the isolated herbs compounds influence the wound healing of complex wounds (Pathak & Mazumder, 2024). Treatment of wound using ethnomedicinal plants is more preferred since ethnomedicinal plants bear no adverse effects but on the other hand, those of pharmaceutical treatments keep increasing (Ali et al., 2020). The application of conventional medicine to heal wounds is gaining momentum as a way of assisting the tissues in giving rise to themselves again (Croitoru et al., 2020).

CONCLUSION

This study result has proven without doubt that native plants containing high phytochemicals such Azadirachta indica, Aloe vera, Calendula officinalis and Curcuma longa are quite effective in treating animal skin conditions. Putting together the nutritional profile, the quantification of phytochemicals, the clinical evaluation, and the molecular one, we were in sight of having a complete picture of how effective these plant-based formations are in helping a person to heal. The outcomes indicate that the formulations prepared

using these plants accelerated the process of wound healing and reduced the healing time, restored whole blood values, and induced the activation of genes that play significant roles in tissue regeneration, including VEGF, COL1A1. Curcuma longa was the most effective formulation involved in transforming both regenerative and anti-inflammatory responses. Aloe vera and Neem however were highly popular amongst the users as they were good to use and the results could be seen within the first week. The beneficial correlations of phytochemical concentrations with clinical-molecular results indicate the influence of bioactive chemicals on the cell repairs as well as the effect on immune systems. In addition, farmers who used these treatments had results confirming that it was a good treatment and affordable in real contexts especially in rural settings where there is scarcity of resources. This paper demonstrates that the treatment of skin conditions in animals using the native plants is not only scientifically valid but also makes an economic sense relative to the use of the synthetic veterinary dermatologic preparations. They are a good option to include in the sustainable livestock healthcare framework because it is easy to use, has low levels of toxicity, bioavailability, and can be used to do many things. In future research, attention should be paid to the standardization of doses, to combinations that are effective in pairing with each other and to the enhancement of production aimed at work in clinics. To sum up, it can be pointed out that the given work demonstrates the necessity of integrating the traditional knowledge of veterinarians with new molecular and clinical methods to develop the effective, simple and ecologically safe possibilities of animal skin issue treatment.

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