Evaluating the Dermal Properties of Toilet Soaps Incorporated with Different Herbal Extracts

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Abstract
Toilet soaps were produced with the incorporation of three herbal extracts from basil, aloevera and guava leaves singly and in combination. Volunteers were drawn from Community Secondary School Ehandiagu, Nsukka, Enugu State, Nigeria, to use the soaps and provide feedback on their qualities and various properties. The research was experimental, however the major instrument used in collecting information (data) needed was questionnaires. The population from which the data was drawn involved 400 students under which 150 students were used as the population sample size. The data collected was statistically analyzed by the use of percentage and mean values of user's response. The findings in the experiment involved discovery of the effectiveness of various herbal soap on skin infection, smoothness of skin, the highest cleaning tendency and the best combination of local herbal extracts for quality toilet soap most suitable to various skin. The required information was gotten from the answers supplied by the voluntary users of these soaps. From the result of this research, the most effective herbal extract incorporated soap on skin infection was that containing guava leaves with percentage and mean values of positive respondents as 16.8% and 4.2 $\pm$ 0.92, the best herbal extract incorporated soap responsible for skin smoothness was combined herbal extract soap (Guava, Aloevera & Basil leaves extract) with 16.79% positive response or mean $\pm$ standard deviation value of 3.0 $\pm$ 0.08. Moreover, in the cleansing aspect, it was observed that soaps incorporated with aloevera had the highest percentage positive response as the best cleansing soap with percentage and mean value of 14.11% and 3.5 $\pm$ 0.74. Lastly, the soap produced by combination of the three local herbal extracts (guava, basil leaf and aloevera) was most suitable to various skin types with positive respondent values of 15.2% or 3.8 $\pm$ 0.69 (mean $\pm$ standard deviation). The toilet soaps containing herbal extracts generally gave better result than that without incorporation of the herb(s) (control) from the response of the users.
Keyword: herbal soap, incorporated, extract, skin, aloevera, basil leaves, guava leaves.

INTRODUCTION

Indigenous plants are now finding new uses given a renewed appreciation for natural products. Spices and herbs can be used in household and personal hygiene products (Matthews and Jack, 2011). Soap, both hard and soft, as it is well known, is produced by the union of the fats and the alkalis; by hard soap, we mean such as have soda, and by soft soap is understood that which has potassa for its basis (Adolph, 1867). Water alone will not remove oily substances from any surfaces to which they may adhere, but a solution of soap, being always more or less alkaline, though its constituents may be united in their number of equivalents, will, nevertheless, render the oil freely miscible with water, so that it can be easily erased (Adolph, 1867). Based on its chemical properties as an anionic surface active agent (surfactant), soap is used to clean and wash skin and clothing. The chemical characteristics of soap depend on several factors: the strength and purity of alkali, the kind of oil used, completeness of saponification and age of the soap (Mak-Mensah, and Firempong, 2011). In Africa, despite progress in the soap industry, people are still using soap made traditionally, which remains cheap and have specific virtues (Coulibaly *et al*., 2012). Soap preparation in Africa is traditionally made from crude palm oil and potash extracted from wood ashes (Caubergs, 2006). Integration of herb in soap increases it cleansing properties due to the antimicrobial properties of the various herbs found in the environment.

Aim of Research

The aim of this research is to produce effective and less expensive toilet soaps using aloe-vera, basil and guava leaves extracts with dermal care properties. These herbs contain major antioxidant pigments, antimicrobial properties, carotene and polyphenols giving them high dietary antioxidant values among plants. The benefit in

using these herbs in soap production is that they have properties that can prevent and care for many chain infections and dermal diseases. They also have the capability of restoring healthy skin in individuals whose skins are diseased.

Specifically, the study intends:
(1)   To discover simple methods of producing cheap and effective toilet soap containing herb extracts.
(2)   To find out the best combination of local herbal extract for producing quality soap must suitable to various skin types.
(3)   To know the effect of the various herbs in treatment of skin rashes, blemishes and infections.
(4)   To identify herbs that has skin smoothness and cleansing properties.

RESEARCH METHODOLOGY AND DESIGN

The research was designed to involve the production of toilet soap with different herbal extract integrated into them and distributed to a number of students together with questionnaires. The respondents were instructed to use the soap for two weeks and then fill the questionnaires based on their observations of the properties of the soaps. The questionnaires were recovered and data analyzed based on volunteer's response.

Extraction of the Herb and Soap Production

Three herbs were selected and used in the soap production. The herbs used were guava, basil and aloevera. For aloevera, its flirts served as the leaves which were extracted by cutting and pressing out the aloevera juice or fluid for soap production. Guava and Basil leaves had the same extraction method which was by aqueous extraction.

Different soaps were produced from the following ingredients: Soap Base- 1kg, Palm Kernel Oil- 76ml, Foaming agent- 216ml, Hardener- 59g, Glycerine- 85ml, Herb extract- 91ml, water and fragrance.

Area of the Study and Population Studied

The area of study was Community Secondary School Ehandiagu in Nsukka Local Government Area, Enugu State, Nigeria.

The population for the study was drawn from students in Community Secondary School Ehandiagu that had various skin infections and blemishes in June 2012. A study population of 150 students were carefully selected from a total population of 400 students both male and female from the senior secondary school classes. The students were divided into 5 groups and 30 toilet soaps involving control and those with different herbal extract incorporation administered to each group.

Research Questions

1.   What are the effects of various soaps on skin infections?
2.   What are the effects of the various soaps on the smoothness of the skin?
3.   Which of the soap has the highest cleaning tendency?
4.   What herbal incorporated soap(s) is most suitable to various skins?

Analysis of Research Question

Personal profiles of the respondents were collected from this study. The questionnaires given to the volunteers contained items designed to answer the various questions about soap properties (see Appendix). The data were collected and analyzed with reference to research questions that were answered and presented in tables. Similar questionnaire but different soap codes: A, B, C, G and H_3 (codes tagged to soap given to respondents to avoid biased response – as seen in appendix) were collected from volunteers and analyzed after using soap for 14 days by volunteers. Number of respondents was (150) one hundred and fifty.

In general, SA (Strongly Agreed) and A (Agree) were the positive responses, SD (Strongly Disagree) and D (disagree) were the negative responses.

The analysis carried out was based on five different soaps produced which include: Soap A (soap incorporated with aloevera extract), soap B (soap incorporated with Basil leaves extract), Soap C (Normal soap without herbal extract incorporation ie control), soap G (soap incorporated with Guava leaves extract) and soap H_3 (soap incorporated with combined Guava, Basil and Aloevera extracts).

RESULT

Table 1: Statistical table in response to question 1

What are the effects of the various soaps on skin infection?	Positive response Mean $\pm$ SD	%	Negative responses Mean $\pm$ SD	%
Soap A = Soap incorporated with Aloevera extract	3.8 $\pm$ 0.72	15.2	1.2 $\pm$ 0.82	4.8
Soap B = soap incorporated with Basil leaves extract	4 $\pm$ 1.08	16	1 $\pm$ 0.82	4
Soap C = Toilet soap with no extract (control)	1.5 $\pm$ 1.03	6	3.5 $\pm$ 1.23	3.2
Soap G = Soap incorporated with Basil leaves extract	4.2 $\pm$ 0.92	16.8	0.8 $\pm$ 0.75	3.2
Soap H_3 = combined herbal extract soap (Guava, Aloevera & Basil leaves extract).	3.8 $\pm$ 0.910	15.2	1.2 $\pm$ 0.64	4.8
Total Mean	17.3		7.7	

Overall total mean of both positive and negative responses = 25

% = Mean Responses on items of each soap type

      Total mean of both positive and negative response   X 100

Explanations based on positive response

Considering the positive response values depicted in table 1 in answer to the question: 'What are the effects of the various herbal extracts soap on skin infection?' The most effective herbal extract soap on skin infection was soap G (soap with guava leave extract) with positive percentage respondent value of 16.8 and mean $\pm$ SD value of positive response 4.2 $\pm$ 0.92, this was followed by soap B (soap with basil leave extract) with positive percentage respondent value of 16 and mean $\pm$ SD value of 4 $\pm$ 1.08. The next are soap H_3 (combined herbal extract soap) and soap A (aloevera incorporated soap) with percentage value of 15.2 each and mean $\pm$ SD positive value 3.8 $\pm$ 0.910, 3.8 $\pm$ 0.72 respectively. Lastly, soap C (soap without any extract) with percentage value of 6 and mean $\pm$ SD value of 1.5 $\pm$ 1.03, had the least effect on skin infection from the response.

Table 2: Statistical table in response to question 2

What are the effects of the various soaps in skin smoothness?	Positive response Mean $\pm$ SD	%	Negative responses	%
Soap A = Soap incorporated with Aloevera extract	3.0 $\pm$ 0.08	12.59	0.83 $\pm$ 0.75	3.48
Soap B = Soap incorporated with Basil leaves extract	3.8 $\pm$ 0.91	15.95	1.2 $\pm$ 0.64	5.04
Soap C = Toilet soap with no extract (control)	1.5 $\pm$ 0.91	6.30	3.5 $\pm$ 1.09	14.69
Soap G = Soap incorporated with guava leaves extract	3.8 $\pm$ 0.77	15.95	1.2 $\pm$ 0.69	5.04
Soap H_3 = combined herbal extract soap (Guava, Aloevera & Basil leaves extract).	4 $\pm$ 1.06	16.79	1 $\pm$ 0.0	4.19
Total Mean	16.1		7.73	

Overall total mean of both positive and negative responses = 23.83

% = Mean Responses on items of each soap type

      Total mean of both positive and negative response   X 100

Explanations based on the positive responses

The herbal extract that had the highest smoothing effect on skin as shown in Table 2 above was soap H_3 (combined herbal extract soap) with positive percentage value of respondent as 16.7% and mean $\pm$ SD value 4 $\pm$ 1.06, followed by soap B (soap incorporated with basil leaves extract), soap G (soap incorporated with guava leaves extract) with positive percentage values 15.95%, each and mean $\pm$ SD of 3.8 $\pm$ 0.91, 3.8 $\pm$ 0.77 respectively. The others were soap A (soap incorporated with aleovera extract) with percentage positive response of 12.59% and mean $\pm$ SD value 3.0 $\pm$ 0.08 and soap C (soap without incorporation of herbal extract) with percentage value of 6.30% and mean $\pm$ SD value of 1.5 $\pm$ 0.91.

Table 3: Statistical table in response to question 3

Which of the herbal soap has the highest cleansing tendency?	Positive response Mean $\pm$ SD	%	Negative responses	%
Soap A = Soap incorporated with Aloevera extract	3.5 $\pm$ 0.74	14.11	1.5 $\pm$ 0.91	6.05
Soap B = soap incorporated with Basil leaves extract	3.2 $\pm$ 0.6	12.9	1.8 $\pm$ 0.59	7.26
Soap C = Toilet soap with out herbal extract (control)	2.3 $\pm$ 0.81	9.27	2.5 $\pm$ 1.1	10.08
Soap G = Soap incorporated with guava leaves extract	3.2 $\pm$ 0.75	12.	1.8 $\pm$ 0.79	7.26
Soap H_3 = combined herbal extract soap (Guava, Aloevera & Basil leaves extract).	3.3 $\pm$ 0.83	13.31	1.7 $\pm$ 0.78	6.85
Total Mean	15.5		9.3	

Overall total mean of both positive and negative responses = 24.8

% = Mean Responses on items of each soap type   X 100
        Total mean of both positive and negative response

Explanation on the Positive responses

The herbal extract that had the highest cleansing tendency was soap A (Soap incorporated with aloevera extract) with positive percentage response value of 14.11 and mean $\pm$ SD value of 3.5 $\pm$ 0.74, followed by soap H_3 (combined herbal extract soap) with the percentage value of 13.31% and mean $\pm$ SD value of 3.3 $\pm$ 0.83. The other herbal extract soap with good cleansing properties to soap H_3 are soap B and soap G with positive percentage response values of 12.90, 12 and mean $\pm$ SD value of 3.2 + 0.6, and 3.2 $\pm$ 0.75 respectively. Lastly, soap C which had the least positive percentage value of 9.27% and mean $\pm$ SD value of 2.3 $\pm$ 0.81 (Table 3).

Table 4: Statistical table in response to question 4

What herbal incorporated soap(s) is most suitable to various skins?	Positive response Mean $\pm$ SD	%	Negative responses	%
Soap A = Soap incorporated with Aloevera extract	3.3 $\pm$ 0.51	13.2	1.7 $\pm$ 0.93	6.8
Soap B = soap incorporated with Basil leaves extract	3.5 $\pm$ 0.72	14	1.5 $\pm$ 1.22	6
Soap C = Toilet soap with no extract (control)	1.2 $\pm$ 0.98	4.8	3.8 $\pm$ 0.46	15.2
Soap G = Soap incorporated with guava leaves extract	3.7 $\pm$ 0.29	14.8	1.3 $\pm$ 1.29	5.2
Soap H_3 = combined herbal extract soap (Guava, Aloevera & Basil leaf) extract.	3.8 $\pm$ 0.69	15.2	1.2 $\pm$ 1.35	4.8
Total Mean	15.5		9.5	

Overall total mean of both positive and negative responses = 23.83

% = Mean Responses on items of each soap type   X 100
        Total mean of both positive and negative response

Explanation on positive response

Soap H_3 (combined herbal extract soap) is the quality soap most suitable to various skin with positive response percentage value of 15.2% and mean $\pm$ SD values of 3.8 $\pm$ 0.69 followed by soap G (soap incorporated with guava leaves extract) with 14.8% and mean $\pm$ SD value of 3.7 $\pm$ 0.29 and the next is soap B (soap incorporated with basil leaves extract) with 14% and 3.5 $\pm$ 0.72 (mean $\pm$ SD) followed by soap C (Toilet soap with no extract ie. control) with 4.8% and mean $\pm$ SD value of 1.2 $\pm$ 0.98.

DISCUSSION OF RESULTS

In table one above, the respondents agreed that among the soaps given to them for use, the soap produced with guava leaves extract was the most effective against skin infection more than the others.

The percentage positive response of soap incorporated with guava leaves extract showed that it was most effective with a positive response value of 16.18% corresponding to mean $\pm$ SD value of 4.2 $\pm$ 0.95 followed by Basil extract soap with 16% or mean $\pm$ SD 3.8 $\pm$ 0.72 respectively. The combined herbal extract soap gained a positive response value of 15.2% or mean $\pm$ SD of 3.8 $\pm$ 0.91 and lastly toilet soap C (control) 6% or 1.5 $\pm$ 1.03.

Table two discussed the effects of the various herbal extracts on skin smoothness. The combined extract incorporated soap- H_3 had the highest positive response values of 16.79% or 4 $\pm$ 1.08 (mean $\pm$ SD); soap incorporated with guava leaves extract had positive response to its effectiveness in the smoothness of skin after use of 15.95% or mean $\pm$ SD of 3.8 $\pm$ 0.72. Positive response values of 15.95% or 3.8 $\pm$ 0.091 was gotten from those who used soap incorporated with basil leaves extract which is similar to that of response by respondents who used soap incorporated with guava leaves extract. This shows that the effectiveness of

combined herbal extract soap on skin smoothness is more than each of basil and guava leave extract soaps. Aloe Vera had 12.59 % or mean $\pm$ SD value of 3.0 ± 0.08 of respondents who agreed that it had good skin smoothness property. The toilet soap without herb extract (Soap C – control) had only 6.3% response or positive mean response of its smoothness property as 1.5 ± 0.91.

Additionally, the third table has the result of items (appendix) answering the question of the soap that has the highest cleansing tendency. Soap incorporated with Aloe-vera extract had positive agreement of respondents to the question with the values of 14.11% or mean $+$ SD value of 3.5 ± 0.74. Combined herbal extract soap had positive response of 13.31% or mean $+$ SD values of 3.3 ± 0.83; Basil and guava extract soaps each had the same percentage positive response of their cleansing efficiency of 12.9% or mean positive response of 3.2 ± 0.6 and 3.2 ± 0.75 respectively. Then the control had the least percentage of response of its cleansing tendency of 9.2% or mean $+$ SD value response of 2.3 ± 0.81 from the users. This established the fact that soap incorporated with aloevera had the best cleansing property.

Lastly, the best combination of local herbal extract for quality soap most suitable to various skin in this research was the combined herbal extract soap (soap incorporated with basil, guava and aloevera extracts) with positive response of 15.2% or 3.8 ± 0.68 followed by soap incorporated with guava leaves extract which gained positive response of 14.8% or mean positive response value of 3.7 ± 0.29. Basil leaves extract had positive response value of 14% or mean $+$ SD value of 3.5 ± 0.72. The toilet soap without extract (control) has positive response values of 4.8% or 1.2 ± 0.98 from the users.

IMPLICATION OF THE STUDY

As we have seen in the aims of the research, manufacturers of soap in sourcing for raw materials should consider cost of raw materials and the effect of ingredients on properties of the soap. Thus, accuracy of the right raw material is a direct function of the soap quality. On the aspect of herbal extracts, researchers, government and manufacturers should encourage incorporation of herbal extracts in soap production after establishing the properties of the various herbal extracts on the skin.

Lastly, having obtained herbs that are good, funds are needed for the production of good herbal soaps to keep increasing skin beauty and healthy skin care products as well as looking for possibility of producing herbal toilet soaps in Nigeria and other parts of the world using high quantities of locally sourced and readily available raw materials in our environment so as to improve quality and reduce cost of production as well as to curtail pollution inflow into the environment due to non biodegradable chemical components used in soap production such as mercury and dye. The research generally showed that soaps incorporated with herbal extracts had better dermal maintenance properties than that without herbal extract addition, thus the herbs investigated should be used by soap producer as it will improve the quality of their soap.

ACKNOWLEDGMENT

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Appendix

Summarised Research Questionnaires

Research Question 1:

What are the effects of various herbal soaps on skin infections?

S/N	Item Description	SA	A	SD	D
	Analysis of soap A				
(a)	Soap A clear rashes	4	2	2	2
(b)	Soap A prevents skin infection	6	2	0	2
(c)	Soap A has an antiseptic quality	6	3	1	0
	Analysis of soap B				
(a)	Soap B clear rashes	5	2	1	2
(b)	Soap B prevents skin infection	7	1	0	2
(c)	Soap B has an antiseptic quality	6	3	1	0
	Analysis of soap C				
(a)	Soap C clear rashes	2	0	6	2
(b)	Soap C prevents skin infection	3	2	4	1
(c)	Soap C has an antiseptic quality	0	2	7	1

S/N	Item Description	SA	A	SD	D
	Analysis of soap G				
(a)	Soap G clear rashes	6	2	1	1
(b)	Soap G prevents skin infection	4	4	2	0
(c)	Soap G has an antiseptic quality	7	2	0	1
	Analysis of soap H_3				
(a)	Soap H_3 clear rashes	4	3	2	1
(b)	Soap H_3 prevents skin infection	5	2	2	1
(c)	Soap H_3 has an antiseptic quality	7	2	0	1

Research Question 2

What are the effects of the various soaps on the smoothness of skin?

S/N	Item Description	SA	A	SD	D
	Analysis of soap A				
(a)	Soap A is a skin aging preventive soap.	4	4	2	0
(b)	Soap A has a skin moisturizing effect	7	2	0	1
(c)	Soap A gives smoothness and suppleness to the skin after using.	6	2	1	1
	Analysis of soap B				
(a)	Soap B is a skin aging preventive soap.	4	3	2	1
(b)	Soap B has skin moisturizing effect.	5	2	2	1
(c)	Soap B gives smoothness and suppleness to the skin after using	7	2	0	1
	Analysis of soap C				
(a)	Soap C is a skin aging preventive soap.	0	2	6	2
(b)	Soap C has skin moisturizing effect.	3	3	3	1
(c)	Soap C gives smoothness and suppleness to the skin after using.	2	0	6	2
	Analysis of soap G				
(a)	Soap G is a skin aging preventive soap.	4	3	2	1
(b)	Soap G has skin moisturizing effect	6	3	1	0
(c)	Soap G gives smoothness and suppleness to the skin after using.	6	2	0	2
	Analysis of soap H_3				
(a)	Soap H_3 is a skin aging preventive soap.	5	2	1	2
(b)	Soap H_3 has skin moisturizing effect.	7	1	0	2
(c)	Soap H_3 gives smoothness and suppleness to the skin after using	6	5	1	0

Research Question 3

Which of the soap(s) has the highest cleaning tendency?

S/N	Item Description	SA	A	SD	D
	Analysis of soap A				
(a)	Soap A washes out sticky dirt traces from the skin	4	4	2	2
(b)	The foaming capacity of toilet soap A is good	2	3	0	0
(c)	Soap A removes body blemishes and skin spots after using	6	2	2	3
	Analysis of Soap B				
(a)	Soap B washes out sticky dirt traces from the skin	5	2	1	2
(b)	The foaming capacity of toilet soap B is good	4	3	2	3
(c)	Soap B removes body blemishes and skin spots after using	3	2	1	2
	Analysis of soap G				
(a)	Soap G washes out sticky dirt trace from the skin	5	2	3	2
(b)	The foaming capacity of toilet soap G is good	3	4	1	0
(c)	Soap G removes body blemishes and skin spots after using	1	4	3	2
	Analysis of soap H_3				
(a)	Soap H_3 washes out sticky dirt traces from the skin	6	2	2	0
(b)	The foaming capacity of toilet soap H_3 is good	2	4	0	3
(c)	Soap H_3 removes body blemishes and skin spots after using	2	4	3	2

Research Question 4

What herbal incorporated soap(s) is/are most suitable to various skins?

S/N	Item Description	SA	A	SD	D
	Analysis of Soap A				
(a)	Soap A has a pleasant smell on the skin	4	5	0	2
(b)	Soap A clears body odour	3	3	3	3
(c)	Soap A has a lasting effect on the general health care of the skin.	3	2	0	2
	Analysis of soap B				
(a)	Soap B has a pleasant smell on the skin	5	3	0	3
(b)	Soap B clears body odour	4	2	0	0
(c)	Soap B has a lasting effect on the general health care of the skin.	5	2	3	2
	Analysis of soap C				
(a)	Soap C has a pleasant smell on the skin	2	3	6	3
(b)	Soap C clears body odour	0	1	3	4
(c)	Soap C has a lasting effect on the general health care of the skin.	1	0	3	4

S/N	Item Description	SA	A	SD	D
	Analysis of Soap G				
(a)	Soap G has a pleasant smell on the skin.	5	2	2	0
(b)	Soap G clears body odour	4	5	0	4
(c)	Soap G has a lasting effect on the general health care of the skin.	3	3	0	2
	Analysis of Soap H_3				
(a)	Soap H_3 has a pleasant smell on the skin	4	2	0	1
(b)	Soap H_3 clear body odour	3	5	2	0
(c)	Soap H_3 has a lasting effect on the general health care of the skin.	6	3	0	4