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Quality Survey and Safety of Some Toilet Soaps in the Nigerian Market: A Case Study of B/Ladi, Bokkos and Pankshin, Plateau State.

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Abstract: *Soaps are cleaning agents that are usually made by reacting alkali with naturally occurring fats or fatty acids. The reaction produce salts of these fatty acids, which improve the cleaning process by making water better able to lift away greasy stains from skin, hair and clothes. In this work, samples of ten (10) different toilet soaps were each obtained form the open market in B/Ladi, Bokkos and Pankshin. These samples were then analyzed for % Total Fatty Matter (TFM), % Rosin TFM, % Free Fatty Acid (FFA) (as oleic acid), % Free Alkali (as Na_2O), % Chloride (as NaCl), % Unsaponified Fatty Matter (UFM), % Glycerol, % Total Insoluble, % Moisture, pH and microbial content, where the respective results obtained were 75.20 ± 5.25, 3.08 ± 0.58, 0.94 ±0.38, 0.22 ±0.40, 0.87 ± 0.42, 0.61 ± 0.32, 3.80 ±2.26, 5.68 ± 3.03, 9.63 ± 2.44, 8.19 ± 1.12 and negative results for the microbial content. Most of the products, although filled to some extent, were found to have high % Glycerol, % UFM and %Rosin TFM. Results were compared with the National Standards. It was discovered that the soaps worked on were mild on the skin of humans therefore safe for use since the result of microbial analyses were also negative.*

Key words*: Toilet soap, quality, safety.*

I. Introduction

Soap is undoubtedly the oldest product to be produced specifically as a surfactant and in its many forms continuous to play a major role today. The record of soap production dates back to around 2800BC in Ancient Babylon (Woodllatt, 1985; Butler, 1997; Hunt, 1999). Soaps are made from fats and oils or their fatty acids, by treating them chemically with a strong alkali (NaOH or KOH) through a process called saponification and these fats and oils could be obtained from animals or plants. Soaps can be of several forms and types depending on the make, finishing and packaging. Common of them all are the toilet, bar and liquid soaps.

Several scientific publications demonstrate the correlation between hand washing and decreased infection transmission. Well-conducted studies have shown the importance of putting in practice hand washing practices to reduce infection rates (Boyce et al, 2002; Nouira et al, 2008; Pettet et al, 2009) and the absolute majority of infection control specialists agrees that hand washing is the simplest and most effective way to prevent the transmission of micro-organisms in the care environment. The importance of this theme stands out even more as various international regulations and manuals on hand washing, elaborated by professional associations or international governmental entities (Boyce et al, 2002; Pettet et al, 2009; acknowledge evidence on the value of this basic control action, which can be achieved through the use of soaps, detergents or antiseptic agents. Recent studies reveal that liquid soaps contain certain bacteria such as Burkholderia cepacia (14); Pseudomonas putidas (9); Pseudomonas aeruginosa (3); Klebsiella pneumoniae (3); Enterobacter cloacae (2); Pseudomonas luteola (2) which could be a major source of skin infections (Joselany et al, 2011)

Studies have shown that soaps and detergents show antibacterial activities (Rama et al, 2011). It was found that Staphylococcus aureus was good bactericidal as it unable to grow in any of the detergent concentration and other species showed varied level of minimum inhibition concentration. It is possible that antibacterial soaps and detergents have the antibacterial agents that can either kill or inhibit the bacterial cells Each fat or oil is made up of a destructive mixture of several types of triglycerides, each consisting of its own particular combination of fatty acids (Hunt, 1999). Most good soaps are made by a combination of fatty acids or oils through a process of saponification. This method involves heating fats and oils and reacting them with a liquid alkali to produce soap, water and glycerol.

The other major process is the neutralization of fatty acids with an alkali to produce soap and water. When saponification takes place, an alkali or base reacts with a fat or oil. The fatty acids are separated from the

glycerol and the sodium or potassium component of the alkali bonds with the fatty acids. The product formed by the sodium or potassium and the fatty acid is an organic salt.

The totality of features and characteristics of toilet soap product that bears on its ability to satisfy stated or implied needs of a consumer is its quality. However, toilet soaps sold directly to consumer are usually made to manufacturers own formulations and specifications, rather than to any official quality specifications, although such specifications might perhaps be involved if questions of trade description arise. Thus the need for constant quality surveillance on the commercially available toilet soaps sold in the open markets is important.

Soaps are of different forms and types, depending on their uses, application and material composition. Examples of the types include laundry soap, toilet soap, toilet bar and medicated soaps. These could either be in liquid mousse, solid tablets or bars. Toilet bars are filled soap tablets but often mixed with synthetic detergents to give a rich creamy lather desired of most soap products. This also have the advantage of not leaving scum deposits in the bath or wash basin in hard water and is also cost effective (Butler, 1997). Toilet soap tablets are premium soap products that have strict specifications of fine texture free from objectionable odour and have good lathering and cleansing properties (Woollatt, 1985; SON, 1992).

Poor quality soaps can cause skin discomforts such as acne, eczema, hives, rashes, skin irritation and possibly lead to cancer (Butler, 1997; Encarta, 2009).

Although soap is effective in removing grime and is relatively inexpensive, alkaline soaps or those with high content of percentage free alkali can cause skin irritation, dryness and scaling which can predispose the skin to fungal attacks (Butler, 1997). This is because the excess alkali will saponify the fats and oils, normally found on the skin as a protective coat, to form soluble soap and therefore get washed away, thereby rendering the skin dry. Consequently, good toilet soap should contain little or no free alkali.

Super fatted products, which are mild to use on the skin are premium products. Indication f this is also high %UFM, %Rosin TFM and %Glycerol. However, products with very high glycerol will tend to be very soft and the economy of usage is placed at a disadvantage. This research work is therefore focused on the analysis of the available toilet soap products produce by different manufacturers found in the Nigeria open markets, which are used as bathing soaps. As a case study, the research work took three markets (B/Ladi, Bokkos and Pankshin) in Plateau state. Nigeria. and compare results with the National Specifications as set by the Standard Organization of Nigeria (SON) so as to establish whether these products are of standard quality and thus safe for the use and purposes they are made for.

II. Materials And Methods

Samples of the toilet soaps were obtained as finished products from the open markets under study within a period of three months. They were stored in separate containers and labeled according to their sources until ten (10) tablets of each sample were obtained.

2.1 Analysis Of Samples:

Samples were stored in a cool and dry place (SON, 1992; Butler, 1997) pending completion of physical and chemical analyses on each tablet. Determinations involving the soap mass were made by first scrapping the surface of the soap tablets to about 0.50-1.00 cm deep before portions of the subsequent mass were taken for analysis. Actual weight of each tablet was determined using Sartorious top loading weighing balance (sensitivity of 1.0mg) model BL 150 S, while pH was determined using a HANNA pH 210 with microprocessor pH meter after the pH meter had been calibrated with standard buffer solutions of pH 4.00, 7.00 and 10.00 respectively (Butler, 1997; Christian, 2003). Percentage moisture and insolubles (water and alcohol) were determined by gravimetric methods (Paquot, 1979; SON, 1984; Butler, 1997), while unsaponified fatty mater (UFM) was determined by the extraction and gravimetric methods (Paqout, 1979; SON, 1984, Butler, 1997). The percentage total fatty mater (TFM), Rosin TFM, Free Fatty Acids (FFA), Free Alkali, Chloride and Glycerol were all determined by the titrimetric method (SON, 1984; Woollatt, 1985; Butler, 1997). Each of these parameters was determined from the ten (10) tablets obtained from each sample and results subjected to statistical treatment. The microbiological analysis used particular techniques for each type of anti-septic solution or soap, so as to concentrate, detect and quantify microorganisms (Serufo, 2009)

III. Results And Discussion

Results of analyses carried on samples of soap collected from Bokkos B/ Ladi and Pankshin are recorded in tables 1, 2 and 3 respectively. They are rendered in average of 10 determinations for each sample product.

Table 1: Average Result Of Quality Parameters For Products From Bokkos Market

Name of product	QUALITY PARAMETERS												
	Declared weight (g)	Actual weight (g)	%T.F.M	% Rosin TFM	%FFA (as Oleic)	% Free Alkali (as Na_2O)	%Chloride (as NaCl)	% Glycerol	% Moisture	% UFM	% H_2O Insoluble	%Alcohol Insoluble	pH
New Savana Beauty Soap	75.00	73.04	81.74	2.84	1.34	-	0.57	0.60	6.20	0.37	2.52	2.82	6.44
Lux Suave with milk and moisturizers	80.00	82.04	69.88	2.48	-	0.05	0.71	5.52	9.44	0.50	2.50	3.38	8.65
Imperial Leather classic	75.00	72.46	76.80	2.66	-	0.10	1.10	1.74	9.26	0.40	0.58	3.20	8.84
Royal Princess	90.00	80.70	70.11	3.67	-	0.06	1.77	5.88	12.52	0.58	1.50	5.00	8.66
Premier Toilet Soap	75.00	72.05	76.02	2.75	-	0.04	0.51	2.41	12.60	0.30	0.44	1.50	8.75
Lux Soap for Normal skin with Vit. E	80.00	81.10	74.88	2.88	0.88	-	0.48	5.18	7.50	0.28	1.39	3.74	6.64
Joy Beauty Soap	80.00	77.50	77.57	2.68	-	0.10	0.77	1.62	8.50	0.70	0.88	4.45	8.83
New Palm Olive Naturals	90.00	83.80	79.28	2.39	0.59	-	0.64	2.72	6.43	0.88	1.76	3.51	0.74
Nasco Beauty Soap	90.00	89.66	74.11	2.66	-	0.08	0.87	5.38	12.50	0.70	1.25	2.42	8.38
Nasco Nova Soap	90.00	90.08	67.28	3.84	-	1.11	0.99	4.94	10.11	1.10	5.94	3.33	9.52
Average Results	-	-	74.77	2.89	0.94	0.22	0.84	3.60	9.51	0.58	1.88	3.34	8.19
Standard Deviation	-	-	4.53	0.48	0.38	0.39	0.38	1.97	2.44	0.27	1.59	0.98	1.12
SON Standard	-	-	≥77.00	≤3.00	≤0.30	≤0.05	≤0.75	≤8.00	-	≤0.50	≤0.50	≤2.00	6.50-8.50

TFM - Total fatty matter
FFA - Free fatty acids
UFM - Unsaponified fatty matter
SON - Standard Organization of Nigeria

Table 2: Average Result Of Quality Parameters For Products From B/Ladi Market

Name of product	QUALITY PARAMETERS												
	Declared weight (g)	Actual weight (g)	%T.F.M	% Rosin TFM	%FFA (as Oleic)	% Free Alkali (as Na_2O)	%Chloride (as NaCl)	% Glycerol	% Moisture	% UFM	% H_2O Insoluble	%Alcohol Insoluble	pH
New Savana Beauty Soap	75.00	72.57	83.27	3.33	1.28	-	0.58	0.47	6.60	0.36	2.90	3.00	6.56
Lux Suave with milk and moisturizers	80.00	82.13	72.99	2.67	-	0.03	0.60	5.46	9.49	0.42	2.50	3.48	8.48
Imperial Leather classic	75.00	72.45	76.65	2.76	-	0.08	1.07	1.86	9.66	0.46	0.59	2.88	8.64
Royal Princess	90.00	80.71	69.02	3.66	-	0.05	1.88	5.94	12.82	0.73	1.42	4.90	8.56
Premier Toilet Soap	75.00	72.15	75.50	2.84	-	0.05	0.55	2.35	12.52	0.26	0.50	1.48	8.54
Lux Soap for Normal skin with Vit. E	80.00	80.06	76.02	2.72	0.65	-	0.52	5.49	7.30	0.29	1.48	3.90	0.52
Joy Beauty Soap	80.00	77.57	77.93	2.58	-	0.08	0.76	1.57	8.53	0.63	1.00	4.46	8.73
New Palm Olive Naturals	90.00	83.83	81.97	2.99	0.68	-	0.63	2.61	6.50	1.00	2.00	3.50	6.66
Nasco Beauty Soap	90.00	89.51	72.10	2.86	-	0.07	0.99	5.31	12.59	0.74	2.25	3.05	8.64
Nasco Nova Soap	90.00	90.35	66.59	4.43	-	1.11	1.11	4.96	10.23	1.22	6.54	3.23	9.48
Average Results	-	-	75.20	3.08	0.87	0.21	0.87	3.80	9.62	0.61	2.12	3.39	8.08
Standard Deviation	-	-	5.25	0.58	0.36	0.40	0.42	2.26	2.43	0.32	1.75	0.94	1.07
SON Standard	-	-	≥77.00	≤3.00	≤0.30	≤0.05	≤0.75	≤8.00	-	≤0.50	≤0.50	≤2.00	6.50-8.50

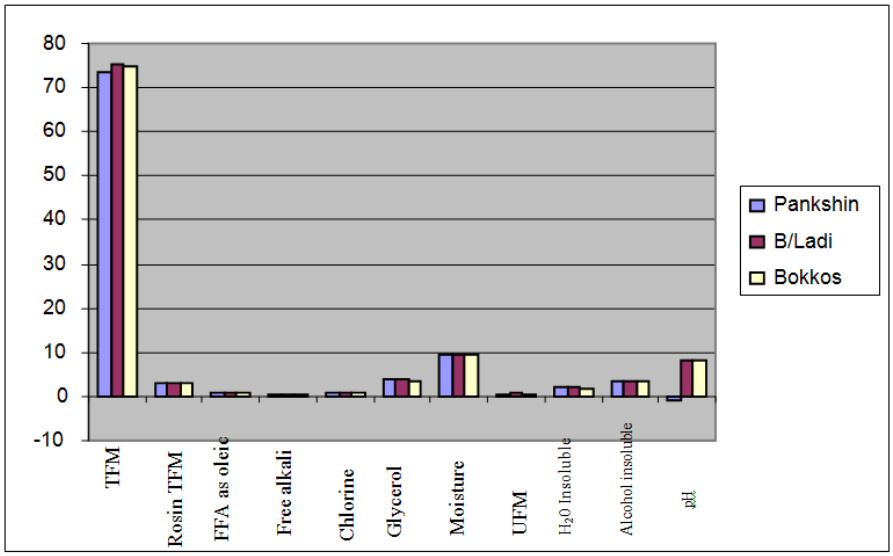
TFM - Total fatty matter
FFA - Free fatty acids
UFM - Unsaponified fatty matter
SON - Standards Organization of Nigeria

Table 3: Average Results Of Quality Parameters For Product From Pankshin Market

Name of product	QUALITY PARAMETERS												
	Declared weight (g)	Actual weight (g)	%T.F.M	% Rosin TFM	%FFA (as Oleic)	% Free Alkali (as Na_2O)	%Chloride (as NaCl)	% Glycerol	% Moisture	% UFM	% H_2O Insoluble	%Alcohol Insoluble	pH
New Savana Beauty Soap	75.00	73.21	81.68	2.98	1.33	-	0.66	0.49	6.55	0.29	2.06	2.93	6.38
Lux Suave with milk and moisturizers	80.00	82.17	69.98	2.74	-	0.04	0.58	6.02	9.38	0.40	2.19	3.33	8.46
Imperial Leather classic	75.00	72.46	78.00	2.68	-	0.08	0.98	1.96	9.67	0.41	0.72	2.92	8.74
Royal Princess	90.00	80.88	68.88	3.11	-	0.07	1.48	5.88	12.80	0.66	1.38	4.88	8.54
Premier Toilet Soap	75.00	72.46	75.49	2.69	-	0.06	0.64	2.09	12.50	0.30	0.60	1.46	8.55
Lux Soap for Normal skin with Vit. E	80.00	81.13	77.00	2.84	0.58	-	0.60	5.48	7.31	0.27	1.50	3.72	6.72
Joy Beauty Soap	80.00	77.68	82.01	2.70	-	0.10	0.72	1.66	8.60	0.80	1.44	4.40	8.84
New Palm Olive Naturals	90.00	85.40	72.16	2.76	0.70	-	0.60	2.63	6.55	0.78	2.16	3.52	6.71
Nasco Beauty Soap	90.00	90.11	66.74	2.59	-	0.08	0.97	5.44	12.11	0.75	1.55	3.35	8.63
Nasco Nova Soap	90.00	90.00	64.88	2.66	-	1.00	0.98	5.20	9.86	1.10	7.40	5.30	9.34
Average Results	-	-	73.68	2.78	0.87	0.20	0.82	3.69	9.53	0.58	2.10	3.58	8.09
Standard Deviation	-	-	6.06	0.16	0.40	0.35	0.29	2.10	2.35	0.28	1.94	1.09	1.06
SON Standard	-	-	≥77.00	≤3.00	≤0.30	≤0.05	≤0.75	≤8.00	-	≤0.50	≤0.50	≤2.00	6.50-8.50

TFM - Total fatty matter
FFA - Free fatty acids
UFM - Unsaponified fatty matter
SON - Standards Organization of Nigeria

BAR CHART OF AVERAGE CHEMICAL QUALITY IN DIFFERENT MARKETS



The results were subjected to statistical treatments such as the mean, standard deviation and F-Ratio. The F-Ratio was used to establish whether the means of the parameters determined for each product in the different markets were significantly different (Ekpenyong, 2001; Harry and Steve, 2002; Christian, 2003). For all the products determined from the three markets, the calculated F-ratios were far less than the tabulated F-ratio of 4.10. This is to say that the means of the product parameters determined from the three markets are not significantly different. It also implies that there is no difference in the precision of the methods but the standard deviations are from random errors alone and do not depend on the samples (Christian, 2003).

These standard deviations must have come from weather differences effectiveness of storage facilities as well as technical and man-made errors during batch-wise production. Also the average of each parameter, with respect to the various samples, was calculated as well as their respective standard deviations so as to have an idea of the range of the quality of a toilet soap randomly picked in the open market.

From the results, one can say, categorically, that in the open market the quality of a toilet soap is 75.20 ± 5.25, 3.08 ± 0.58, 0.94 ± 0.38, 0.22 ± 0.40, 0.87 ± 0.42, 0.61 ± 0.32, 3.80 ± 2.26, 5.68 ± 3.03, 9.63 ± 2.44 and 8.19 ± 1.12 for %TFM, % Rosin TFM, %FFA (as oleic acid), % Free Alkali (as Na_2O), % Chloride (as NaCl), % UFM, % Glycerol, % Total insoluble % Moisture and pH respectively. This implies that most of the toilet soap samples found in the market is alkaline when compared to the National Standard for alkalinity (≤0.05) to protect the skin. High alkalinity in soap could pre-expose the skin to various diseases because of the saponification of the fats and oils on the skin during bathing, producing a soluble organic salt which will be washed away by the bathe water.

However, because good toilet soap should contain little or no free alkali (Woollatt, 1985; SON, 1992), the need for a good manufacturing practice to achieve this is imperative. This could be done by producing a super fatted product, in which the actual amount of sodium or potassium hydroxide that would have been added could be discounted by 5-10% of the total fat/ oil and alkali to be used or addition of super fatting agents. Addition of humectants to the soap such as glycerol, propylene glycol, honey etc. could reduce the effect of the high alkali levels on the skin. It could also be reduced to an appreciable level with inorganic polyprotic acids such as phosphoric acid, which could also serve as preservative in the product. All these are intended to increase mildness in use (Woollatt, 1985).

Although about 50% of the products have good % TFM, which is a very important parameter in soap, quite a few of them have very low % TFM compared to the SON standard. It is important that toilet soaps have their % TFM within the SON specification so that it can be friendly to all types of skin. Products with high % TFM but low % UFM indicate premium products with probably little or no super fatting agents, especially when the product has no free alkali. Conversely those with free alkali and low % TFM as well as high % UFM must have been produced with either low-purity fat/ oil or super fatted with super fatting agents like jelly, lanoline, stearin or coconut oil (Woollatt, 1985). This will make the products user-friendly as it will be mild on the skin.

Salt as sodium chloride is mainly used to grain soap. No work has so far been reported of the health effect of high NaCl content in soap. However, high NaCl content in soap helps to enhance the soap's hardness.

The high glycerol content in some of the products, compared to the National Standards, indicates that these products were probably produced via the kettle method. It is also evident that all the products, except Premier have % insoluble above the SON standard. This shows that either the products are super fatted with

some form of fats and waxes (like bees wax) that are insoluble in alcohols or are filled with some soap fillers such as kaolin, talc, sodium silicate or other electrolytes (Woollatt, 1985).

All the soap samples analyzed for microbial (bacterial and fungal) content showed negative results. This could probably been due to good preservatives used in their production or alkali content which could not provide suitable environment for their growth. Also, the absence of microbes in the samples may be attributed to the low moisture content in the soap samples as may be seen in the result where none of the samples has up to 13% moisture content compared to that in liquid soaps which could have up to 70% moisture that can be favourable fluid that can enhance microbial growth in the absence of a potent preservative or where its concentration is inadequate. This agrees with recent works (Serufo, 2009; Joselany et al, 2011; Rama et al, 2011.)

Generally, however, the products are friendly and safe to use as most of them either have high % Glycerol, % UFM and /or % Rosin TFM, compared to the National Standards, shows that these parameters helps in making the product mild for use. However, Nasco Nova has an unprecedented high alkalinity which ought to have been corrected or made as super fatted product before being sent to the markets.

IV. Conclusion

Considering the sensitivity of the skin and the prevalence of skin and skin-related diseases, the need to keep close quality surveillance on all skin preparations such as toilet soap and cosmetics is imperative. Government and non-governmental regulatory bodies having the interest and duty to maintain standards in our manufacturing industries should be empowered with capable manpower, infrastructure, good incentives and legislation to carry on their duties and responsibilities effectively. Also, the need to review the standards regularly by such government regulatory bodies as Standard Organization of Nigeria (SON) and National Agency for Food and Drug Administration and Control (NAFDAC) is important. This should also be in consultation with all stakeholders for the benefit of the National economy and the populace.

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