International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Volume 3 Number 9 (2014) pp. 300-310**
http://www.ijcmas.com

Original Research Article

The Characteristics of a food system: The Case of Lebol a "local butter" produced in Ngaoundéré 3rd – Cameroon

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A B S T R A C T

The production of L*ébol* and its various stakeholders constitute the food system of the Ngaoundéré 3rd subdivision. However, all these components are not really identified. The objective of this study is therefore to determine the structure of the "*Lebol*-related system" and to sort out its characteristics. To achieve our aim, we first listed out all the *Lebol* processing techniques in order to propose a standard process, after that, we were able to identify the stakeholders and the material they use. Finally we worked out the characteristics of a finished product. Result shows that 93.4% of stakeholders are women against 6.6% of men. Most stakeholders are aged from 25 to 84 years old and the average age is 46. The majority of producers 60% are from the *Peul* tribe, whereas only 1% is *Mboums*. The average quantity of milk transformed is 4 litres per day. D*ang* and *Maïborno Ngodi* are villages which host 8.3% of producers each. Two processing types were observed: the "hot type" followed by fermentation and the "cold type" without fermentation. Physical and chemical analyses of the two products resulting from the two processing types have proven that heat treatment and fermentation do not influence the quality of fatty acids of *Lebol* since the acid indices collected from the products of the two processing types are almost the same. As regards to uses, 95% of users were in favour of a substitution of margarine by *Lebol*, 5% were against that substitution. People use *Lebol* for socio-cultural and economic reasons. This sector of the market should therefore be developed.

K e y w o r d s

Dairy product, Lebol, Food system, Ngaoundere, Cameroon

Introduction

The observation of technical system is based on operational grids, ideas and methods. This analysis starts with the observation of technical practices that is of "somebody who is doing something". The concept "practice" embodies the notion of "know-how and process". *Lebol* is a local butter obtained from dehydration of milk cream. Its production mobilizes people and families who have got traditional know-how, all of

which makes a technical system or an elementary technical unit. In fact, a technical system is a complete structure based on interrelations between three elements: man, tool and material. The technical system has operational, relational and cultural functions (Ferré and Muchnik, 1986). The interrelations between the elements involved in the production of *Lebol* are not identified, neither is the typology of its production processes. To solve this, we have conducted a research entitled: "Description of food technical systems: the case of *Lebol* a local butter produces in the Ngaoundéré 3rd".

Furthermore, Administratively, Cameroon has ten (10) regions, the Adamawa region is one of them, it is the first cattle rearing region (Edima *et al.*, 2014). His head-town Ngaoundere has five divisions namely, Djerem, Faro and Deo, Mbere, Mayo Banyo and Vina. The latter is the largest with eight Subdivisions, and Ngaoundéré 3rd is one of them. The tribal groups found in this subdivision are diverse, with agriculture, cattle breeding, trade and handicraft as main activities. In this Subdivision, the dairy products found on the market are referred to *kossam* which is generic term meaning milk in *Peul* language (Libouga *et al*., 2001). According to the processing type, the specific terms used are as follows: *Biraadam* for the raw, fresh, non-fermented, unskimmed milk; *Kindirmu* for thick milk, this is ordinary milk, heated and coagulated; *Penndiidam* for fermented milk made from skimmed *Biraadam*, heated and fermented; *Dakéré* for a mixture of fermented milk and *cassava semolina*; Yoghurt: there are two types of yoghurt, the manufactured yoghurt and the semi-manufactured one; they are marketed under the label *Kossam*; the taste and consistency (generally thick) make them different from *Kindirmu* or *Penndiidam* which are produced with traditional methods, due to different starter; and *Lebol* à local butter which is the topic of the present research study (Libouga *et al*., 2001).

Materials and Methods

Study area

The description of this food technical system cannot be done without careful analysis of the geographical features. Dang is the Headquarter of the subdivision. It stretches over 725 Km^2 with a population of about 18.250 inhabitants. The active population is estimated at 8.300 with 4.525 farmers (MINADER, 2012). The families which were surveyed are located in the following villages: Dang, Malang, Bini, Manwi, Malo-Goni, Maïborno Ngodi, Wouro-Soua, Ngodi Mafalgaou, Beka Nganmokone, Beka Tinguering, Malo-Mbifal, Tchabbal Naboun, Tchabbal Margol, Saltaka, Tchabbal Djalingo, Tchabbal Mounguel, Tchabbal Baouro, Madjéré I, Madjéré II and Nganbougou Tchabbal.

Field survey

The interview guides enable us to search information for identification of the producer, supply and storage of milk, processing method, preservation of *Lebol*, the main use of *Lebol* and the problems faced by producers. According to the marketing study, the questionnaire focus on the identification of the consumer, reasons for using *Lebol*, preferences of consumers concerning *Lebol*, availability of *Lebol*, reasons hindering the use of margarine, collecting data on the consumption of butter to see if it can be substituted, substitution of margarine by *Lebol*, butter consumption constraints, why should margarine be preferred. To collect data, we hired a field guide who was also our interpreter. It was essential to watch producers at work in order to better understand the conditions of work; their milk transformation techniques and the

material used. The structural interrelations of a food processing system composed of person, milk and material were hence displayed.

Physicochemical Analyses of samples

Acid Index

To determine the acid index, we used the phenolphthalein test as described in 1979 by UICPA. We weigh 1g of *Lebol* in a glass cup, added 10 ml of ethanol/diethyl oxide mixture (1/1, V /V) and 3 phenolphthalein droplets. The obtained solution was titrated with a solution of KOH 0.5 N till a pink colouring was reached and the volume V_1 of KOH was noted down. By putting 10 ml of ethanol/diethyl oxide mixture and 3 droplets of phenolphthalein in a beaker one obtains the blank sample of this solution. Titrating was done with KOH 0.5 N till a pink colouring was obtained, volume V_0 was noted down. The experiment was repeated thrice. The Acid index was obtained from the follow equation:

$I_A = 56.1 \times N \times (V_0 \tilde{} V_1) / m$; with:

V_0: volume of the titrated solution of KOH used for the blank trial; V_1: volume of titrated solution of KOH used for the sampling; N: normality of the solution of KOH; m: mass in grams for trial taking; 56.1: KOH molar volume.

saponification Index

The saponification index was determined by phenolphthalein test described in 1979 by UICPA. 25 ml of 0.5 alcoholic KOH and 3 glass beads were introduced in an Erlenmeyer containing 2 g of *Lebol*. The Erlenmeyer was adapted to a burette used as a reflux cooler and slightly boiling in a 75°C "bain –marie" for 45 minutes by stirring gently. After ebullition, the burettes were withdrawn and two drops of phenolphthalein were immediately poured in the solution of HCl 0.5N. The titrating was done in a solution until a pink colouring was reached. The V_1 of HCl volume was noted down. The blank sample was carried according to the same process. On 25 ml of 0.5 N alcoholic KOH, the titrating was done with HCl 0.5 N and volume – V_0 was noted down. The experiment was carried out thrice. The formula used for weighing the saponification index was:

$I_S = 56.1 \times N (V_0 - V_1) / m$ with,

56.1: molecular mass of KOH; N: normality of the HCL solution; m: mass in g of the trial taking; V_0: volume of HCl used for the blank trial; V_1: volume of HCl used for the trial taking.

Iodine index

The iodine index was determined according to the reagent of Wijs described in 1979 by par UICPA. 15 ml of CCl_4 were put in a 250 ml erlenmeyer containing 0.20 g of *Lebol*. The *Lebol* was dissolved by quick shaking. Then 25ml of Wijs reagent (ICl) were added in the Erlenmeyer which was thereafter shaken, sealed and placed in the dark for one hour. After staying in the darkness, 150 ml of distilled water and 20 ml of KI (100 g/ l of water) were added in the Erlenmeyer. The solution obtained was titrated with the sodium thiosulfate in the presence of freshly produced starch (dispersion à 1 g / 100 ml of water) till complete discolouring was reached. The volume V_1 of the thiosulfate solution was noted down. The blank trial was carried out under the same conditions but the *Lebol* was replaced by the same quantity of water and the volume V_0 of the

thiosulfate solution was noted down. Three trials were carried out.

Determining the exact titrating of a thiosulfate solution

Due to its instability, the exact titrating of a thiosulfate solution had to be determined with the iodine dosage before its use. To determine it, potassium iodide was mixed with potassium iodate in a sulphuric conditioning. 10 ml of potassium iodide water solution at 10% (P/V), 15 ml of potassium iodate solution at 2% (P/V) and 10 ml of an N/50 solution of sulphuric acid were put in a beaker. The presence of the released iodine marked the colouring turn brown. The hyposulfite was then poured in the glass cup until a light yellow straw-colouring was reached. A few droplets of starch were put in the obtained solution and continued titrating was done by pouring hyposulfite drops one after the other till complete discolouring was reached. Volume V_1 was noted down. The titrating of hyposulfite was: **N: N_1V_1/V.** The iodine index was calculated using the equation:

$$I_I = 12.69 \times T (V_0 - V_1) / m$$

V_0: volume of thiosulfate solution 0.1N used for the blank trial; V_1: volume of the thiosulfate solution used for the sampling; T: exact titrating of the thiosulfate solution; m: mass in g of the trial taking.

Results and Discussion

Identification of stakeholders

The gender and the age

The results show that 93.39% of *Lebol* producers are women and 6.6% are men (Figure 1). These results reflect the culture of the people of northern Cameroon, which reserves domestic activities for women. We found that 6.6 % of men are either widowed (two of them) and perpetuated the activities of their wife or are unmarried (six of them) and perpetuates the activities of their mother.

The youngest producer was 25 years old and the oldest 84. The modal class was (43-48) with the largest staff of producers. We can conclude that the majority of producers were still physically active. Even if There still older people (79-84) who perpetuated the activity of their deceased wives to meet their needs.

The ethnic group

Originally, the study area was populated by the *peul*, *Dii*, and *Mboum* ethnic group, but the production of *Lebol* was part of the *peul* culture and tradition, it was transmitted by parents to children from generation to generation. This can explain why 60% of the producers were *peul* (Figure 2).

There are also many producers who belong to the *Toupouri* ethnic group (17%) despite the fact that originally they are from the far north region. likewise, some producers were from the *Bamiléké* and *Bamoun* tribes' which are from the West Region of Cameroon. This can be explained by the influence of the environment, cross-cultural contacts and the adaptation of tribes. The *Mbororos* are poorly represented here because they are nomadic people; we met only 4 *Mbororos* during our field trips.

The level of tuition

Results show that 45% of producers are not educated, 45% have managed a primary school level, and 01 % went to secondary school. These results confirm those of Edima *et al.*, (2012) which founded that the majority of people involved in the dairy sector in Cameroon are illiterate.

Origin and quantities of milk

It has already been said that there are two main types of milk supply systems for producers. 95.9% buy their milk directly from milk supplier and 4.1% transformed the milk of their exploitation. During deliveries, quantities differ from one producer to another depending on their objective. Figure 3 shows milk quantities at the moment milk is delivered. We can see that, the majority of producers, 62% use less than 4 litres of milk to produce *Lébol*. There is only 2% which uses more than 14 litres. This can be due to financial and production constraints as observed by Edima *et al*. (2013). In fact, many people produce milk to feed their family, only the surplus can be sold.

Material involve in the production of *Lebol*

The producers mainly use Plastic bottles of 1.5 litres and small drums having contained mineral water or refined oil (91.8%); calabashes represent 8.3 % .The use of plastic containers is the result of recycling of packaging mineral water, cooking oil and hydrocarbon products. However, this container can be source of chemical contamination of milk due the exchange and the transfer of chemical into the milk, and also a biological contamination due to the structure of the container which cannot be easily cleaned and disinfected.

According to the transportation of milk, from the farm to the transformation area, 77.27% of the producer goes on foot to collect milk from shepherds, only 22.73% of them use motorbikes. This mode of transport compromises the hygienic quality of milk which is transported at the ambient temperature (Edima *et al.*, 2012).

Consumers' opinions about the use of *Lebol* as common butter

We have visited 161 households which are used to *Lebol* and margarine. 78.3% of them use only *Lebol* whereas 21.7 % use either *Lebol* or margarine. Many of them use *Lebol* for socio-cultural reasons (Figure 4). 50.57% use it for eating/cooking; 28.22% as cosmetic, for this group, the *Lebol* improves the hydration, the touch and the appearance of the skin. 21.21% use it for health problems, for massage, because according to them, it improves blood circulation and reduces arthritis pain. It has also been noticed that the *Peuls* and the *Mbororos* apply it on the nipple of the breast before breastfeeding the baby.

According to the preference of *Lebol* than margarine, people like *Lebol* because they assume that it is something locally produced which does not contain any chemical agents. It is also a natural product with a special flavour which is instilled to the other foods. In terms of the availability of the product, the *Lebol* can be scarce at times; especially in the dry season since it is a period when the production of milk is lower (Edima *et al*., 2014). There are however other complaints such as the presence of sand and cow hair in the *Lebol*.

For the common use of margarine, some people use it because they do not always find *Lebol* in sufficient quantities in the market. It is therefore a way of making with what they find; Margarine is more available in the market. However, some natives are scared of using margarine since they do not always know whether the product they see is genuine. Though, 95 % are in favour of replacing margarine by *Lebol,* while 5% needed both products.

Identification *of Lebol food system*

Operational Function: The survey has clearly shown the operational function of the food system. In fact, from the milk tapped directly from the cow to the *Lebol* (processed food), there is a complex process. There are two traditional processing methods: a heating technique (97.5%) and a cooling technique less used (2.5%). Figure 5 illustrates those techniques.

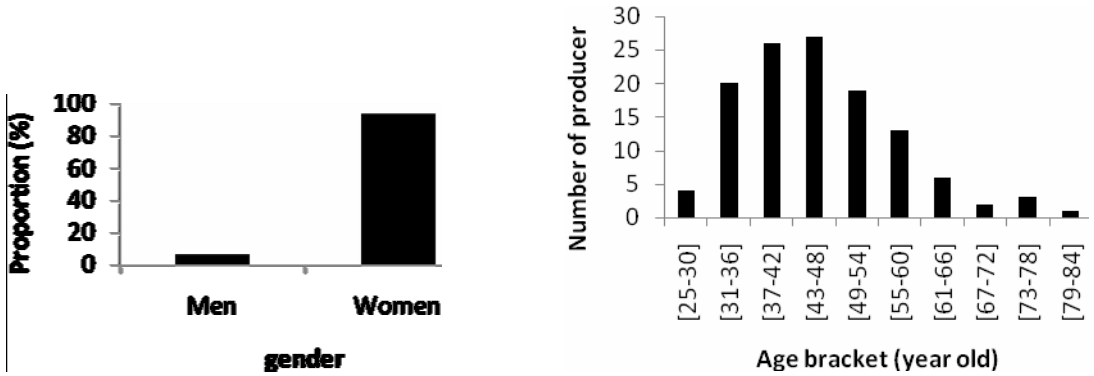

Figure.1 The gender (a) and the age (b) of the producer

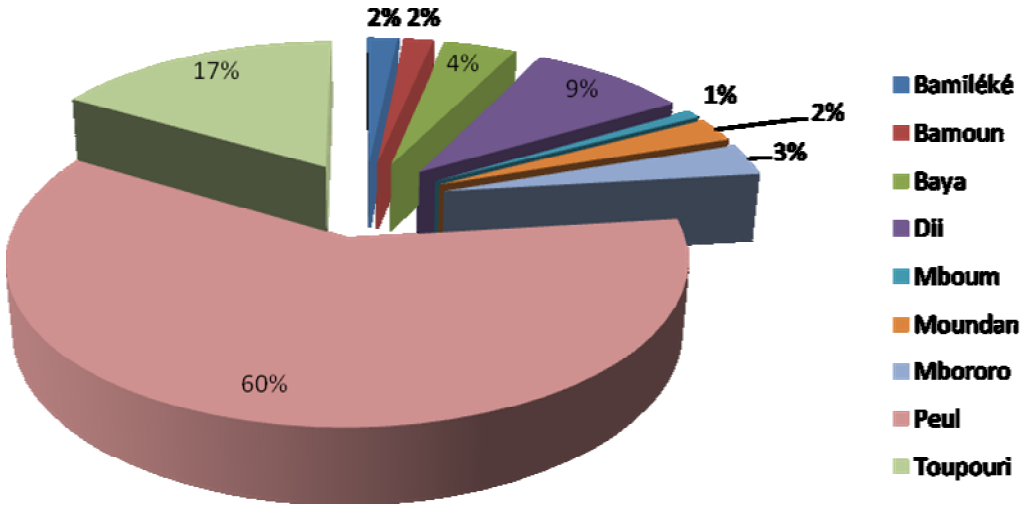

Figure.2 Ethnic representation of *Lebol* producers

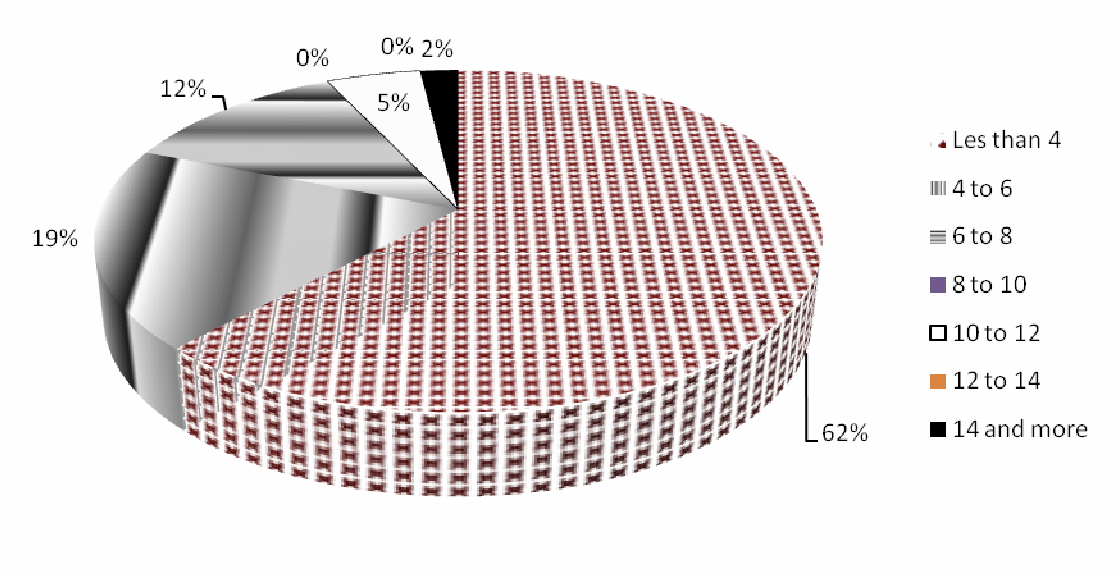

Figure.3 Quantity of milk used

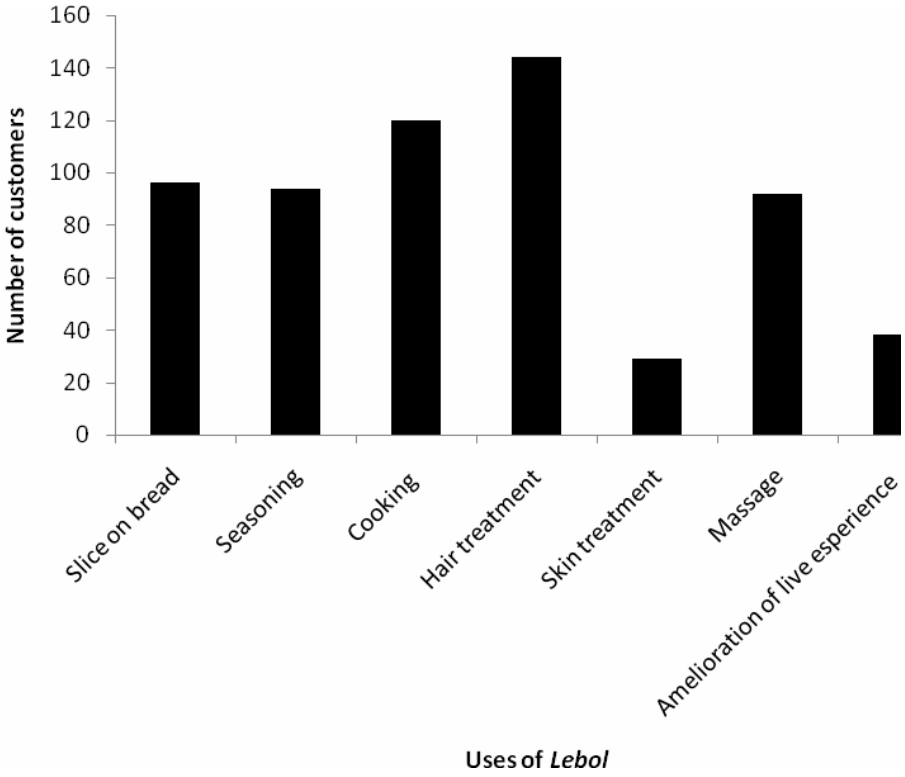

Figure.4 The uses of *Lebol*

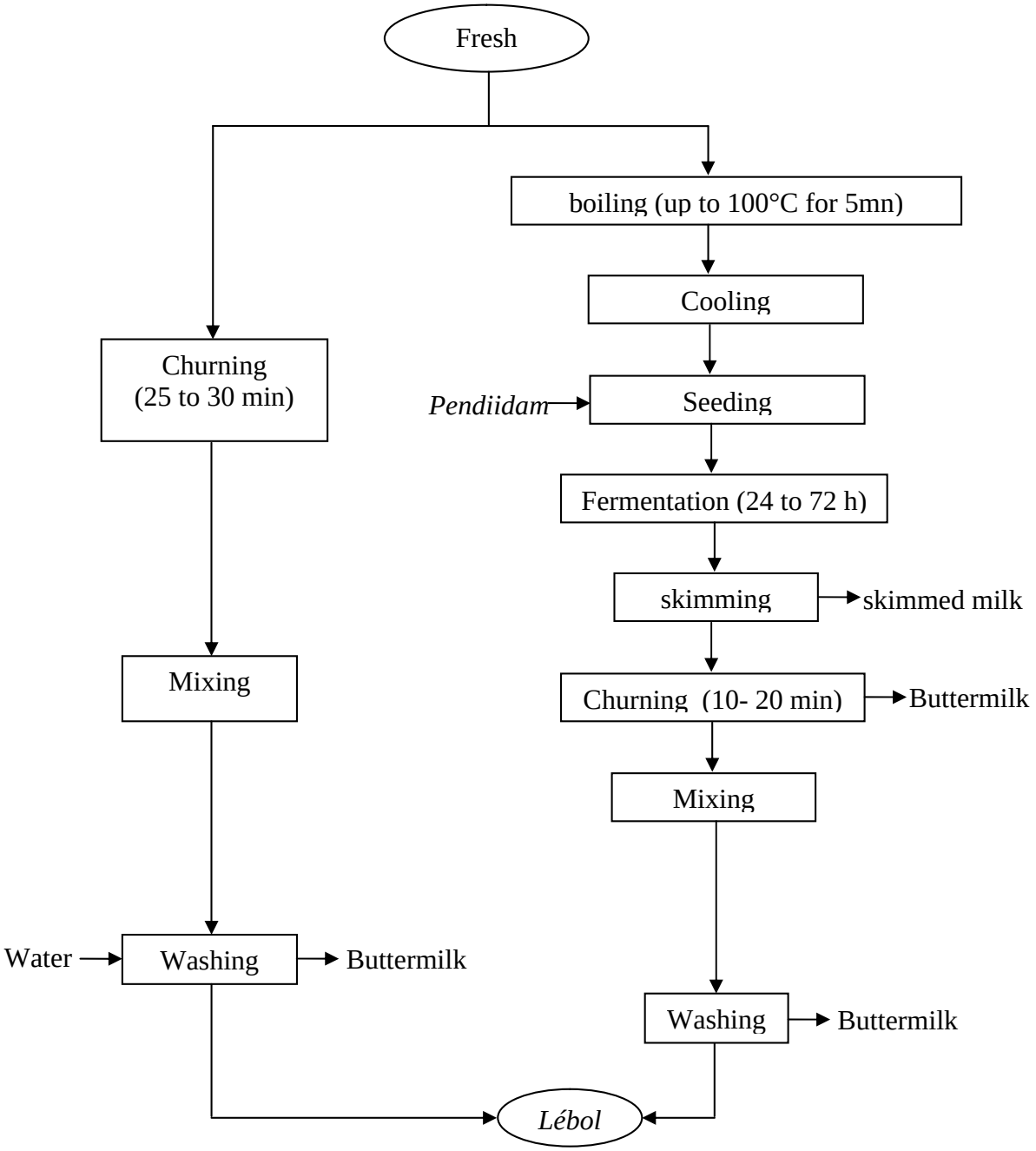

Figure.5 *Lebol* producing diagram

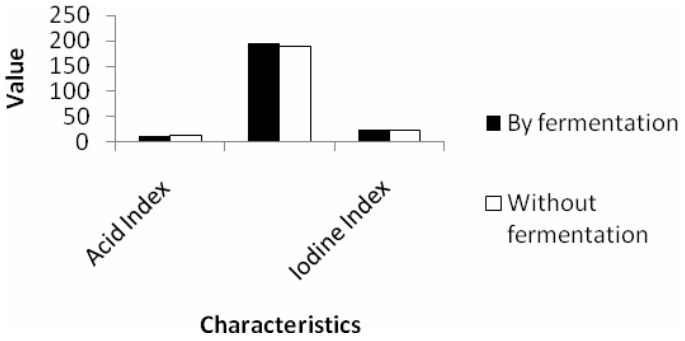

Figure.6 Influence of treatment on *lebol* characteristics

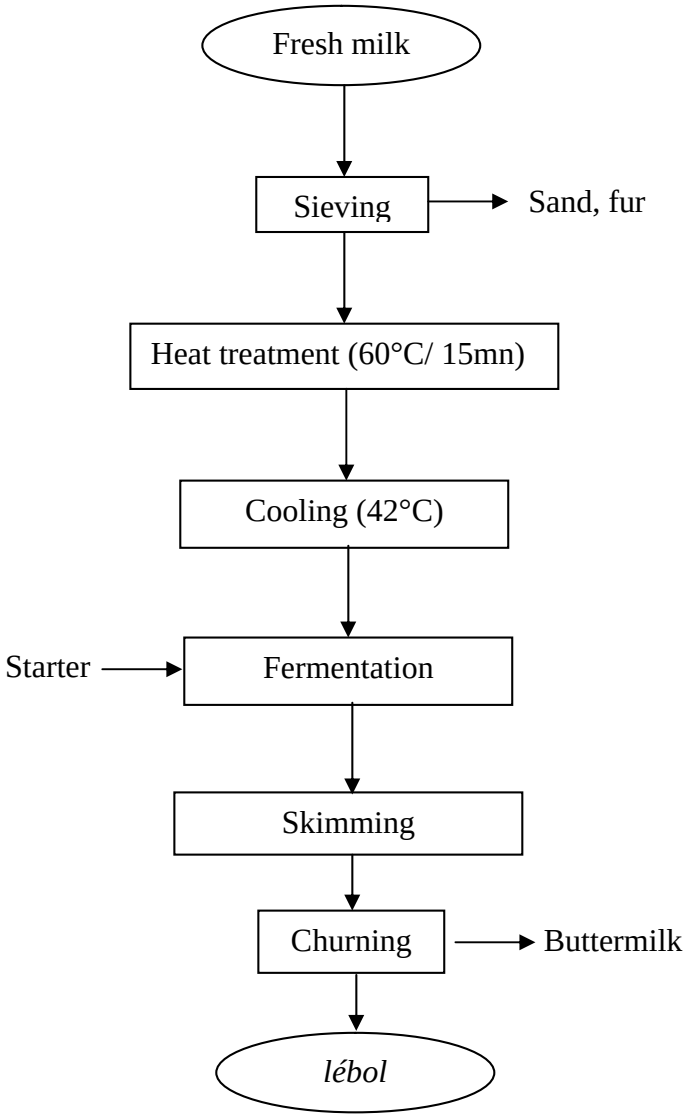

Figure.7 Proposed method of producing *Lebol*

Relational Function: there is also a relational function. Person are brought in contact, person are also in contact with their environment, products, and markets. One of the main peculiarities of the activity is that the same stakeholder can intervene at the start (supplying producers with fresh milk) and at the end (consuming or selling *Lebol*) of a production process. Producers hence work as service providers. Upstream, men mainly intervene in milking and exceptionally in carrying the milk. Women then take over till the finished product. Downstream, the *Lebol* generally serves family purposes. If there is a surplus, it can therefore be sold.

Cultural Function: in addition to the operational and relational importance, *Lebol* also plays a cultural role. Much behaviour is hardly shaped by the social groups from which people stem or belong. The scale of values which characterize a given group shall influence the particular ways they conceive their activities and their specific organizational methods. The Producers of *Lebol*, and especially, the stakeholders of the whole sector shall display behaviours strongly inspired by the cultural dimensions, and which shall determine specific operating schemes. One of the decisive elements going along with that dimension is the gender factor: it is mainly a women's activity. In the North of Cameroon, there is a clear-cut separation of women's activities and men's activities in the production work. The current organization of the society is the strict separation of tasks according to genders: men are in charge of commercial activities whereas women are involved in feeding. Although *Lebol* is a profit making endeavour, it has also remained a feeding activity whose main role is to supply the family with food and this is a woman's task. The know-how continues to be transmitted from mother to daughter although its feeding role tends to evolve. The food processing technique of *Lebol*, the case of Ngaoundéré 3rd has been scrutinized; we should now determine its physicochemical characteristics.

Physico-chemical Analysis

Acid Index

The acid index of the sample from the "hot process" (11.63) is not significantly different of that of the "cold process" (11.53) (Figure 6). These indices tell us about the presence of free fatty acids in *Lebol.* So whatever the processing system, the *Lebol* contains the same proportions of free fatty acids.

Saponification Index

The saponification index of the sample from the "hot process" (196.16) is higher than the saponification index of the cold one (190.27) (figure 6). The saponification index gives us information about fatty acids which can help to make soap and about the length of carbon chains of these fatty acids. Hence our samples have almost the same quantities of saponifying fatty acids. Moreover, there are made-up of short chains of carbons.

Iodine Index

The iodine index of the sample from the "hot process" (25.91) is higher than that of the cold one (23.95). This index shows that the fatty acids are not saturated. The sample from the "hot process" is lightly composed of more fatty acids which are not saturated than that of the "cold" one. Indeed, the first one has fixed more iodine than the second one.

Proposal of a typical method adapted to the socio cultural context.

In order to improve the methods observed and give more satisfaction to users, the

following process was conceived according to the work context of producer and their lifestyle.

The *Lebol* related food system of the subdivision of Ngaoundéré 3rd has been described. The mains results show that: 93.4% of producers are women, most of them are aged 25 to 84 years old; *Peuls* are the greatest producers (60%); the average quantity of milk used is about 4 litres. We had identify two types of processing methods; a "hot" one followed by fermentation and a "cold" one without fermentation, but the processing method of production does not influence the physicochemical analyses of products. People mainly use *Lebol* for sociocultural and economic reasons. 95% of users are for the substitution of margarine by *Lebol* whereas 5% are against. The typical processing method adapted to the sociocultural context shall lead to the amelioration of the production capacity and of the quality of the finished products.

References

Edima, H.C., Awono, E.T., Ndjouenkeu, R. (2013). An Analysis of the Milk Quality in Cameroon. A Study in Adamawa Region. *JSRR,* 2(1): 337–346.

Edima, H.C., Tofaing, J.T., Ngoune, L.T., Ndjouenkeu, R. (2012). Assessment of antibiotic residues in cow milk produced in ngaoundere. *IJBPAS.* 1(11): 1530–1538.

Edima, H.C., Awono, E.T., Etoa, F.X. (2014). Dairy farm breeding practices and milk production in the Soudano Guinean and Sudano Sahelian zones of Cameroon. *JSRR,* 3(12): 1656–1664.

Libouga, D.G., Jiwoua Ngounou, C.N., Kouebou, C.P. (2001). Etude du lait de zébu (*Bos indicus*) obtenu à Ngaoundéré (Adamaoua, Nord Cameroun). Revue de l'académie des sciences du Cameroun. Vol. 1 N°1. French.

Minader. (2012). Ministère de l'Agriculture et du Développement Rural, Cameroun.

Ferré T., Muchnik J. (1986). Le nététou au Sénégal, Systèmes Techniques et innovation pages 263 à 291. Montpellier.

UICPA (Union Internationale de Chimie Pure et Appliquée), (1979). Méthode d'analyse des matières grasses; sixième édition 640 p.