Socio-economic study of Toukoudi millet technology in Niger, Africa

Original Research Article

Abstract

Background: The study was carried out at the level of the municipalities of intervention of the REDSAACC (Research and Development Project for Food Security and Adaptation to Climate Change) project in the Zinder region.

Materials and Methods: The data was collected on a restructured questionnaire including socio-cultural, technological and economic questions.. The study took place in the form of an interview based on a questionnaire and observation of the actors at work. Results: Majority of the Toukoudi producers were female and carrying out this activity from the age of at least 15 years. as compared to 0.6% of unmarried , 58.7% of women in this profession were married without a co-wife, 35.2% are married with a co-wife, 1.7% are divorced, 3,9% are widows.. 83.87% of producers were illiterate, 9.68% completed primary school and 6.45% completed secondary school. The targeted producers use millet in 100% of cases. According to them, millet produces white Toukoudi which is highly appreciated by consumers. The technical production parameters at Maradi, Dosso and Tillabéri differ from those of Tahoua and Zinder in terms of shelf life, average grinding cost and average cost of ingredients. The analysis of variance carried out on the shelf life gives a probability $p = 0.025 < 0.05$. Conclusion: Thus from the above findings we can conclude that, there is a significant difference at the 5% threshold between the technologies from the point of view of shelf life. The best conservation technology is that of Tahoua and Zinder because Toukoudi lasts on average 7.58 ± 0.54 weeks, almost double that of the others. The production of toukoudi is an activity which provides on average a profit of around 240 FCFA/Kg. We note at the end of this survey that all regions according to the producers have the same number of people during cleaning and washing. On the other hand, they agree on the fact that the washing time depends on the state of purity of the millet. According to the producers, cleaning times (90.32%), washing, grinding, packaging and storage vary depending on the quantity of Toukoudi produced.

All consumers surveyed believe that the cleanliness of the producer influences the consumption of Toukoudi. According to 67.74% of respondents, Toukoudi is often eaten when it is hot. The product is not always available (93.33%). Most consumers do not find it full time (80.65%).

Keywords: Toukoundi, Nutrition, Processing, Transformers, profitability, profit.

1. Introduction

Worldwide, malnutrition is directly or indirectly responsible for more than 60% of the 10.9 million annual deaths of children under five years old and the number of children who are stunted is approximately 226 million (1). In Africa, malnutrition continues to be one of the leading causes of

child mortality and especially affects the poorest countries (2). This is the case in the countries of the Sahel strip (Burkina Faso, Mali, and Niger) where it is becoming more and more common place due in particular to food insecurity and the poverty in which the popular masses live. This situation of vulnerability forces them to apply inappropriate dietary practices. In Niger,Africa nutrition is one of the pillars of economic development. The absence of adequate prevention measures for malnutrition has enormous consequences. An annual drop of 7.1% in Gross Domestic Product (GDP) in Niger (3). Low productivity in all productive sectors and high cost of care and treatment of acute malnutrition in health structures and at the community level.

Complementary foods are, in most cases, prepared from local foodstuffs, notably starchy products such as cassava and millet which do not undergo any prior enzymatic treatment and are used alone in the preparation of local porridges apart from their high sugar content (4; 5). Millet, in fermented form, constitutes the commodity most frequently used in the preparation of local porridges in Niger (6). When the mother prepares porridge for her child, she is faced with a dilemma: add less dough or flour, or increase the quantity of dry matter (7). Thus, the starch in the porridge must undergo technological treatments leading to increased fluidity.

Malnutrition is a public health problem because the national rate is above 10% in Niger (6). The most affected regions in order are Maradi, Zinder and Tillabéri. Taking into account on one hand, the structural and multifactorial nature of malnutrition in Niger and on the other hand that several children of its members are victims, the REDSAACC project has adopted an intervention strategy in the humanitarian field which gives pride of place to the improvement of nutritional practices. The project also has, through component 5, a directory of nutritional and health practices in its areas of intervention. Component 5 has in its activities 1entitled “Training women on food processing standards”. This activity, once carried out, must scale up the technologies developed after a socio-economic analysis of the latter. It is within this framework that this article falls, economically and socially evaluating the Toukoudi technology developed by component 5 of the REDSAACC project in the regions of Zinder, Maradi, Tahoua, Dosso and Tillabéri in Niger.

2. STUDY AREA

The geographical framework of this study consists of five (5) regions of Niger which constitute the intervention regions of the REDSAACC project. These are the regions of Maradi, Dosso, Tahoua, Tillabéri and Zinder. The study was carried out in the Communes of Djirataou, Guidan Roumdji, Koré Mairoua, Doguéraoua, Malbaza, Hamdallaye, Liboré, Albarkaram and Droum because they are considered Communes (municipality) having followed the demonstration on the technology.

3. MATERIAL

3.1. Survey Material

Questionnaires including socio-cultural, technological and economic questions were sent to producers, sellers and consumers involved in the Toukoudi production chain.

3.2. Plant material

The millet used does not depend on the variety. It is purchased at local markets without distinction of variety. Baobab fruits (monkey bread) are also part of the ingredients.

3.3. Other ingredients

Powdered milk, dates, spices, roasted peanuts were also used.

3.4. Toukoudi production equipment

The equipment used in the production of Toukoudi is : basins, baskets, a polyethylene bag, trays, plastic buckets, pots, a pallet, a hearth, a mill.

4. METHODOLOGY:

4.1. Field investigation

The survey took the form of an interview based on a questionnaire and observation of the processors working.

It comprised three main phases, namely:

- an exploratory phase;
- a data collection phase;
- a data analysis phase

4.2. Exploratory phase

The exploratory phase includes the identification of different areas where Toukoudi was tested. The choice of survey communes as well as the size of the population to be surveyed are based on a pre-survey at the team level of component 5. This pre-survey revealed that there is no statistical data on production of toukoudi in Niger. However, the nutrition department heads of the various centers visited were interested in our research.

4.3. Data collection phase

4.3.1. Consumer survey

Twenty (20) people were interviewed in each municipality, i.e. 180 people in total for the nine (9) municipalities surveyed.

. The survey was carried out in the immediate vicinity of the production sites and especially in the markets. The questionnaire addressed to consumers provided an idea of the frequency of consumption, consumer preferences and possible reasons for consumption.

4.3.2. Survey on Toukoudi preparation technologies

This survey aims to understand the different stages of the toukoudi production process, the different varieties of raw materials used and to identify risky practices linked to this production. It consisted of sending a questionnaire to Toukoudi producers.

4.3.3. Statistical analyzes of data

The data collected was cleaned and formatted using Word software. Excel software was used to perform the calculations. SPSS 17 software was used to analyze the survey data using ANOVA, Turkey's two-by-two comparison test and the non-parametric Kruskall Wallis test. The significance level retained is 5%.

5. RESULTS

Socio-economic and demographic characteristics of producers

Distribution of producers according to sex and age

Figures 1 and 2 respectively show the results of the distribution of producers and respondents according to sex and age. Fig. 1 shows the distribution of sex of the respondents. It shows that that all the Toukoudi producers are female. They begin to carry out this activity from the age of at least 15. In the five regions surveyed, the age groups are as follows: 3.23% are aged between 15 and 25; 58.06% between 26 and 35 years old and 38.71% are over 35 years old.

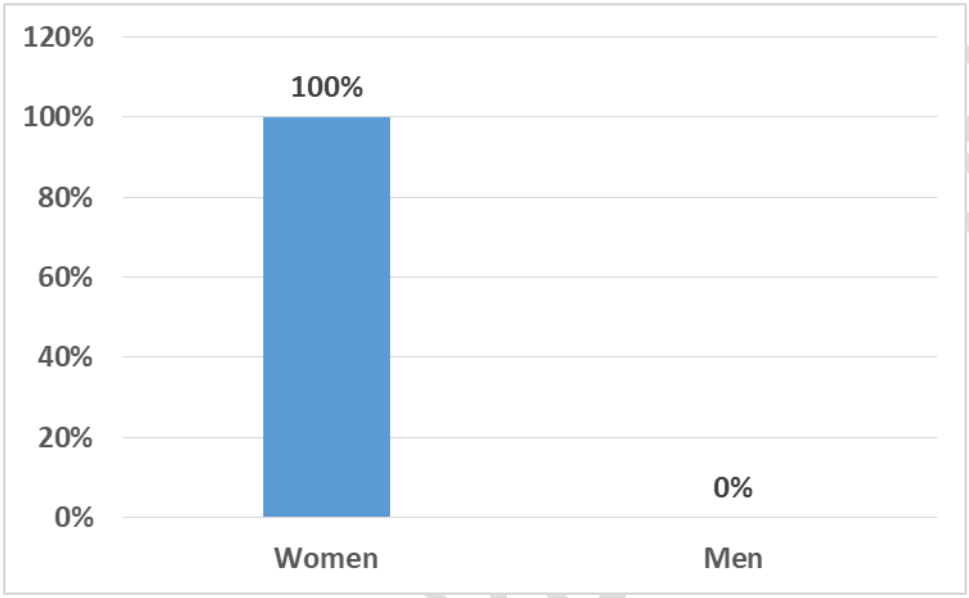

Figure 1: Sex of respondents (

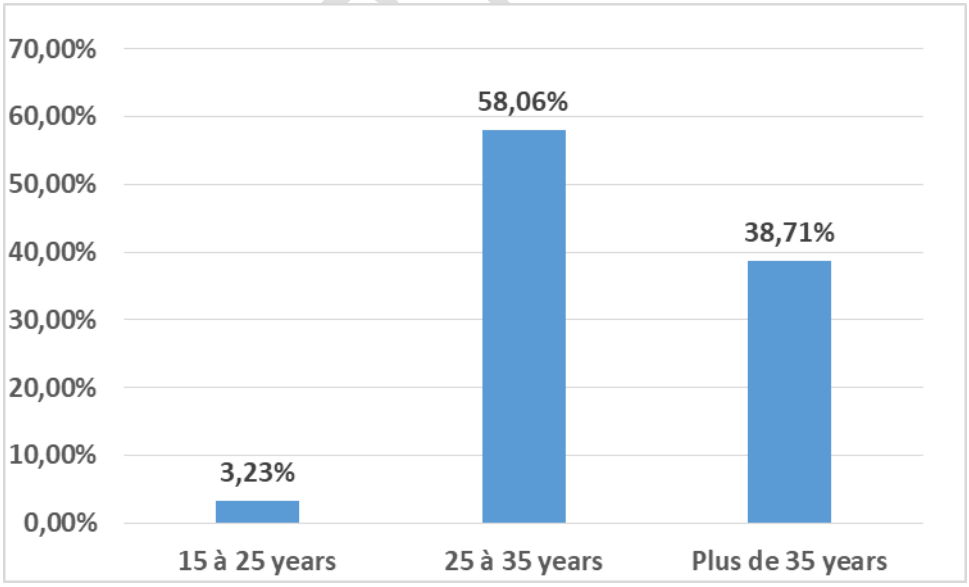

Figure 2: Age of respondents

5.1. Distribution of producers according to social status and level of education

Figures 3 and 4 respectively show the results of the distribution of the producers surveyed according to social status and level of education. Regarding social status, Fig. 3 shows that 58.7% of women in this

profession are married without a co-wife, 35.2% are married with a co-wife, 1.7% are divorced, 3,9% are widows compared to only 0.6% unmarried. The study of the level of education shows that 83.87% of producers are uneducated or illiterate; 9.68% completed primary school and 6.45% completed secondary school.

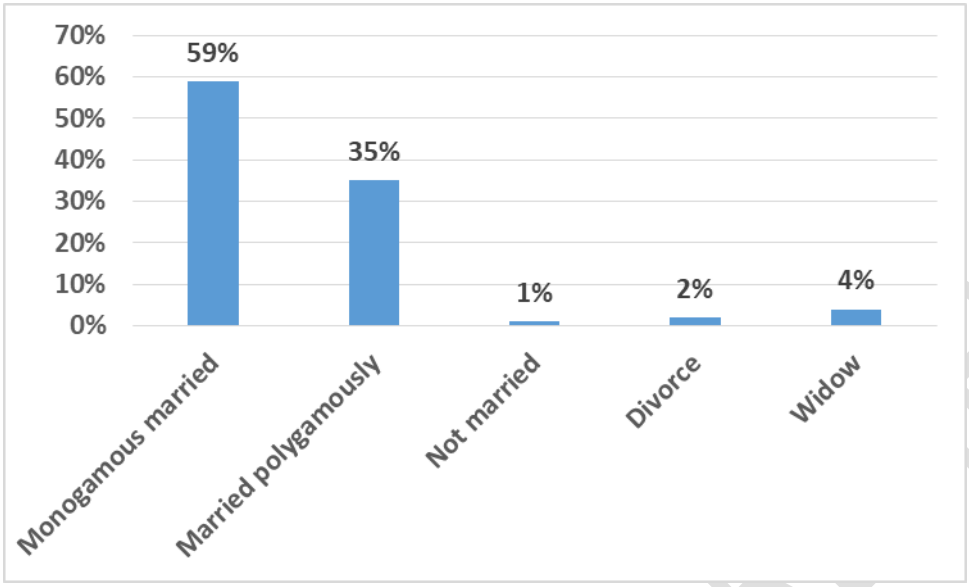

Figure 1: Marital status of the rspondents

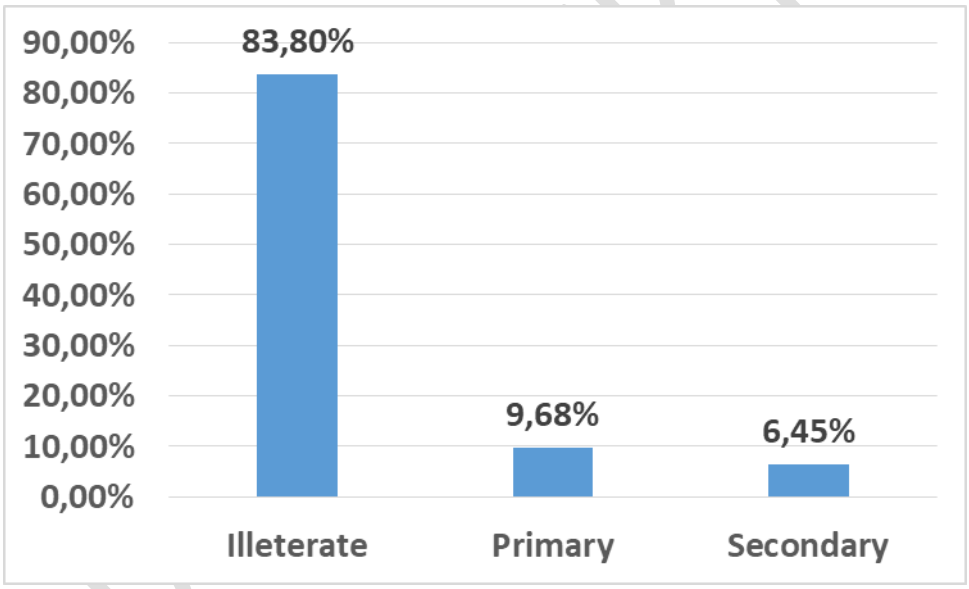

Figure 4: Educational status of the respondents

5.2. Distribution of producers according to the source of technology acquisition

Figure 5 below shows that the majority of producers surveyed have acquired Toukoudi production technology from the REDSAACC project (55.16%) as compared to others (44,84%) i.e. Family (especially mothers).

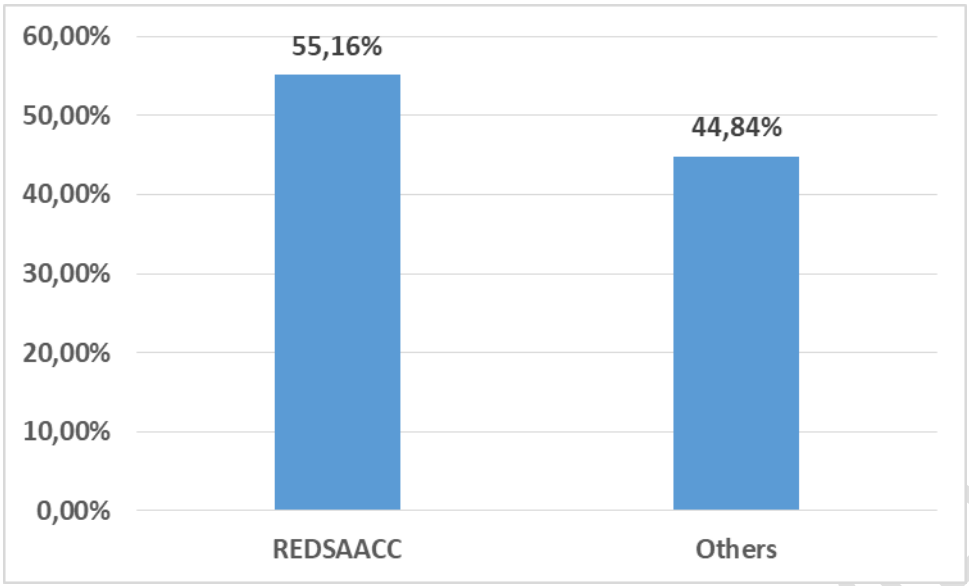

Figure 5: Source of acquisition of Toukoudi technology

5.3. Characterization of traditional Toukoudi manufacturing technologies according to producers

5.3.1. Raw materials

The targeted producers use millet in 100% of cases. According to them, millet produces white Toukoudi which is highly appreciated by consumers. So according to the producers, millet is the only cereal used for the production of real (original) Toukoudi.

5.3.2. Technical parameters of technology

According to the data each region presents a specific technology. To this end, we tried to see what differentiates the technologies of one region to another region ?. The results of these parameters are presented in Table 1 below:

Table 1: Comparison of technological parameters

Distinctive settings	**Regions**					
	MARADI	**DOSSO**	**TAHOUA**	**TILLABERI**	**ZINDER**	**P-value**
Duration of preparation of raw materials and ingredients (h)	12,11 ± 0,11^{a}	11,80 ± 0,32^{a}	12,00 ± 0,00^{a}	12,11 ± 0,11^{a}	11,80 ± 0,32^{a}	0,241
Duration of the operation (h)	11,55 ± 0,29^{a}	11,90 ± 0,10^{a}	11,83 ± 0,11^{a}	11,90 ± 0,10^{a}	11,83 ± 0,11^{a}	0,213
Packing method	Sachet blanc	Sachet blanc	Cop avec couvercle	Sachet blanc	Cop avec couvercle	-
Shelf life (weeks)	3,94 ± 0,17^{a}	3,75 ± 0,15^{a}	7,58 ± 0,54^{b}	3,75 ± 0,15^{a}	7,58 ± 0,54^{b}	0,025
Average grinding cost/Kg (FCFA)	175,00 ± 0,0^{a}	170,00±5,00^{a}	197,92 ± 2,08^{b}	170,00±5,00^{a}	197,92 ± 2,08^{b}	0,000
Average cost of ingredients/Kg (FCFA)	342,67± 6,67^{a}	398,40 ± 1,60^{a}	637,00 ± 1,78^{b}	436,31 ± 1,60^{a}	641,37± 6,67^{b}	0,000

Mean values bearing the same letter on the same line are not significantly different at the 5% threshold.

Table 1. shows that the technical parameters of the production technology of Maradi, Dosso and Tillabéri differs from those of Tahoua and Zinder in terms of shelf life, average grinding cost and average ingredient cost. The analysis of variance carried out on the shelf life gives a probability p = 0.025 < 0.05. We can therefore say that there is a significant difference at the 5% threshold between the technologies from the point of view of shelf life. In addition, the two-by-two comparison test shows us that there is not a significant difference between the technology of Maradi and that of Dosso on the one hand and that of Maradi and Tillabéri on the other hand.

The difference is therefore observed between the regions of Tahoua and that of Zinder. The non-normality and non-homogeneity of the variances show that the median duration of preparation of ingredients and that of operations is not significantly different at the 5% threshold from one region to another. Unlike Tahoua and Zinder, the producers of Maradi, Dosso and Tillabéri package the Toukoudi is in white bags. The analysis of variance carried out on the average grinding costs and the average ingredient costs gives a probability p = 0.000 < 0.05. Which therefore allows us to say that there is a significant difference at the 5% threshold between regions from the point of view of average grinding cost and average cost of ingredients. Likewise, the two-by-two comparison test carried out shows us that there is no significant difference between the regions of Maradi, Dosso and Tillaberi. The difference lies with the regions of Tahoua and Zinder. The best conservation technology is that of Tahoua and Zinder because toukoudi lasts on average 7.58 ± 0.54 weeks, almost double that of the others.

5.3.3. Production yield, cost and sales profit per kilogram of Toukoudi

The average yield, cost and profit of production in the three Communes are presented in the following table 2.

Table 2: Production yield, cost and sales profit per kilogram of toukoudi

Regions	Yield/Kg (Kg)	Cost/Kg (FCFA)	Profit/Kg (FCFA)
MARADI	4,310 ±0,139[a]	797,9±25,8[a]	261,4±16,1[a]
DOSSO	4,173 ±0,189[a]	788,8 ±30,5[a]	282,8±23,2[a]
TAHOUA	3,895±0,114[a]	771,3±19,0[a]	187,3±22,4[a]
TILLABERI	4,41±0,119[a]	789,9±23,8[a]	277,8±32,4[a]
ZINDER	3,89±0,115[a]	771,5±31,2[a]	185,3±14,4[a]
Average	4,1±0,088	784±14	239,6±14,3
P-value	0,140	0,741	0,012

Mean values bearing the same letter in the same column are not significantly different at the 5% threshold (p<0.05).

Table 2,reports the production of Toukoudi is an activity which provides on average a profit of around 240 FCFA/Kg. We note at the end of this survey that all regions according to the producers have the same number of people during cleaning and washing. On the other hand, they agreed on the

fact that the washing time depends on the state of purity of the millet. According to the producers, cleaning times (90.32%), washing, grinding, packaging and storage vary depending on the quantity of Toukoudi produced.

5.3.4. Consumer appreciation

100% of consumers surveyed believe that the cleanliness of the producer influences the consumption of Toukoudi. According to 67.74% of those surveyed, toukoudi is often eaten when it is hot. The product is not always available according to 93.33% of consumers surveyed. 80.65% of consumers say that we cannot find full-time toukoudi. According to 77.42% of consumers, a good quality toukoudi must be slightly acidic. 58.06% of consumers think that in addition to acidity it should be slightly sweet. 35.48% of respondents think that sugar can be added according to taste. 25.81% said that in addition to sugar, milk is necessary and 38.75% found that it would be ideal with ice cream.

6. DISCUSSION

In the present study we was found that, all Toukoudi producers were female (figure 1). These results are the same as those found by Michel ELENGA and al., 2009 during his study on the evaluation and improvement of the nutritional quality of fermented corn pastes and porridges in Congo. We also found that female producers begin to carry out this activity when they were of at the age of 15 (figure 2), which is also reported by Bokossa yaou and al., 2013).

As far as social status is concerned the present study shows that 58.7% of women practicing this profession are married without a co-wife, 35.2% are married with a co-wife, 1.7% are divorced, 3.9% are widows compared to only 0.6% of unmarried (figure 3), our results statistics are close to those found by Tamang J.P and al., 2013on fermented cereal-based products. In present study, 83.87% of producers were illiterate; 9.68% had completed primary school and 6.45% completed secondary school. Same type of results were also shown by N'goma M'foundou RS, 2001in India.

According to Louembé D and al., 2004 in its study on the food supplement for infants in black tip, we highlighted from our results that the surveyed producers acquired the Toukoudi production technology from the project (REDSAACC project) (55.16%) or others (44.84%).

The technical parameters of Toukoudi production technology differ depending on the region (locality) in particular on the average cost of grinding and the average cost of ingredients. The analysis of variance carried out on the shelf life gives a probability $p = 0.025 < 0.05$. So there is a significant difference at the 5% threshold between the technologies from the point of view of shelf life. These results corroborate with those found by Kayodé A.P.P and al., 2012in Congo. This showed, through the two-by-two comparison test, that there was no significant difference between certain regions.

The production of Toukoudi is an activity which provides on average a profit of around 240 FCFA/Kg (Table 2), these results are close to those found by Kabak B. and Dobson A.D.W. 2011. during his study on fermented sorghum in Congo, a very similar cereal millet. According to our results, all the surveyed consumers believes that the cleanliness of the producer influences the consumption of Toukoudi and that 67.74% of respondents say that Toukoudi is often consumed when it is hot. These

two results are not very different from Georgala A. 2013. According to our study, the product is not always available (93.33%) which shows that the activity is practiced occasionally and these results are close to those found by Georgala A. 2013. Most consumers do not find it full time (80.65%). A good quality Toukoudi should be slightly acidic (77.42%) and slightly sweet (58.06%). Sugar may be added depending on taste (35.48%), milk (25.81%), or ice (38.75%). However, the majority of consumers do not use milk (74.19%) or ice cream (48.39%). These results are close to those found respectively by Ben Omar N and al., 2008, Cornu A and al., Tamang J.P and al., 2013.

7. CONCLUSION

The results showed that Toukoudi is appreciated by consumers because of its cooling functions, especially in hot periods. It is a slightly acidic and slightly sweet product. Toukoudi production is a profitable activity for producers. There is a significant difference at the 5% threshold between regions in terms of shelf life.

In addition, the two-by-two comparison test showed us that there is not a significant difference between the technology in Maradi and Dosso on the one hand and in Maradi and Tillabéri on the other hand. The difference is therefore observed between the regions of Tahoua and that of Zinder. Also, there is no significant difference at the 5% threshold between regions in terms of average grinding cost and average ingredient cost. Likewise, the two-by-two comparison test carried out shows us that there is no significant difference between the regions of Maradi, Dosso and Tillaberi. The difference lies with the regions of Tahoua and Zinder. The best conservation technology is that of Tahoua and Zinder because Toukoudi lasts on average 7.58 ± 0.54 weeks, almost double that of the others.

REFERENCES

1. GAMBO Souleymane, “Knowledge, practices and eating habits of mothers of children aged 6 to 24 months”, Master’s Thesis, ISP, Niamey, Niger, 2012.
2. WHO, http://www.lefigaro.fr/flash-actu/2016/06/02/97001-20160602FILWWW00057-niger-le-taux-de-malnutrition-atteint-le-seuil-d-urgence-onu. php
3. INS-Niger, 2020; https://pnin-niger.org/web/toolkits/formation-info-nutrition/3.1%20Documents%20Syst%C3%A8me%20information/INS%20cadre%20analyse%20malnutrition/INS%20appel%2006_03_2020.pdf
4. Thomazic M. 2003. Characterization and sale of “poto-poto”. DESS dissertation, University of Montpellier II, 68p.
5. N’goma M’foundou RS. 2001. Study of the methods of use of complementary foods for infants and young children in the city of Pointe-Noire. End of engineering studies dissertation, I.D.R., Marien NGOUABI University, 56p.
6. Dr Hassoumi DJIBO, 2017; Eating practices of mothers in Niamey: between rule and reality, what future for children? 13p.
7. Treche. 2004. Fluid porridges, well-nourished babies. Information for agricultural development in ACP countries, No. 110

8. Michel ELENGA, Joachim MASSAMBA, Simon C. KOBAWILA*, Vheiye G. MAKOSSO and Thomas SILOU, Evaluation and improvement of the nutritional quality of fermented corn pastes and porridges in Congo, Int. J. Biol. Chem. Sci. 3(6): 1274-1285, December 2009 ISSN 1991-8631; 009 International Formulae Group. All rights reserved.Paper http://indexmedicus.afro.who.int 12p

9. Bokossa yaou i.1*, tchekessi c. K. C.2, banon j. Socio-economic study of the production of a traditional fermented dough "gowe" made from corn in benin j. Research. Sci. Univ. Lomé (togo), 2013, série a, 15(3): 347-358

10. PALLET D., 2011. Fermented cereal-based products: Akpan, Gowé, Kenkey, Kishk Sa'eedi. Cirad, Persyst- UMR Qualisud, Avenue Agropolis – 34398 Montpellier Cedex 5. The African Food Tradition Revisited by Research project.

11. Tamang J.P., Tamang N., Thapa S., Dewan S., Tamang B., Yonzan H., Kumar Rai A., Chattri R., Chakrabarty J. and Kharel N. 2012. Microorganisms and nutritional value of ethnic fermented foods and alcoholic beverages of north east India. Indian Journal of Traditional Knowledge, 11(1):7-25.

12. N'goma M'foundou RS. 2001. Study of the modalities of use of complementary foods in infants and young children in the city of Pointe-Noire. End of engineering studies dissertation, I.D.R., Marien NGOUABI University, 56p.

13. Louembé D, Kéléké S, Kobawila SC, Nzoussi JP. 2004. Variability and improvement of traditional technology for producing fermented corn paste in Congo. Tropicultura, 22(4): 211-218.

14. Kayodé A.P.P., Akogou F.U.G., Amoussa Hounkpatin W. And Hounhouigan D.J. 2012. Effects of processing processes on the nutritional value of sorghum-based supplement porridge formulations. Int. J. Biol. Chem. Sci., 6(5): 2192-2201.

15. Kabak B. and Dobson A.D.W. 2011. An introduction to the traditional fermented foods and beverages of Turkey. Critical Reviews in Food Science and Nutrition, 51(3): 248-260. DOI: 10.1080/10408390903569640

16. Georgala A. 2013. The nutritional value of two fermented milk/cereal foods named 'Greek Trahanas' and 'Turkish Tarhana': a review. Journal of Nutritional Disorders and Therapy, S11:002.

17. Ben Omar N., Abriouel H., Kéléké S., Valenzuela A.S., Martínez-Cañamero M., López R.L., Ortega E and Gálvez A. 2008. Bacteriocin-producing Lactobacillus strains isolated from poto-poto, a Congolese fermented maize product, and genetic fingerprinting of their plantaricin operons. International Journal of Food Microbiology, 127:18-25.

18. Cornu A, Trèche S, Massambba JP, Delpeuch F. 1993. Weaning food and nutritional interventions in Congo. Cahiers Santé, 3: 168-177.