

# Assessing the Toxicological Risk on Biscuits Consumers with Regard to Product Information and their Public Health Concern in the Douala Urban City Area of Cameroon

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## Abstract

**Introduction:** a descriptive transversal and prospective study was carry out on biscuits been marketed (over 5 years) within the Douala urban city area so as to elucidate the potential toxicological risks from biscuits consumers (cookies) with regard to product information.

**Material and method:** A4 white sheets, Disposable gloves, a data analyzing tool (Microsoft Excel 2010), ruler and pens, temporal analysing space (Laboratory), desk and table, spray sheet, questionnaire, plastic bags to easy transportation, rubber trays, hand lens and data collection sheets.

A pilot survey was carryout, followed by data collection of 40 biscuits that had been highly commercialized for over five years within the city markets in the Douala urban city area. A randomized sampling method was employed to purchase 40 biscuit samples from the 02 major markets of Douala urban area; 'marche centrale' and 'marche Mboppi'. In the laboratory space arrange for the purpose of the study, the various components of each of the biscuits were identified.

**Results:** From our finding, 3 group of biscuits were indentified; dry simple biscuits (52%), sandwich biscuits (43%) and waffle biscuits (5%). 29 basic different food additives principally made of; colorants; E110(13%), conservators; E223(25%) emulsifiers E471(21%), antioxidant E322(67%) and pH regulators E500(71%) were identify as the most used form of additives. 12(41%) of the food additives indentified had proven toxic potential to its consumers; E223, E471, E110 and E102 been the most recurrent respectively. As per the origin of these biscuits, 3 major countries top the list; 16 biscuits (40%) of which 11(69%), 7 biscuits (18%) of which 05(71%), 4 biscuits (10%) of which 3(75%) had potential health risk were from Cameroon, Nigeria and India respectively.

**Conclusion:** The high demand for biscuits as food is becoming a preliminary public health risks. Cameroon therefore is in need to implement strategic measures on food security policies.

**Keywords:** Biscuit; Cookies; Food additive; Health risk; Consumers; Toxicological risk; Public health

## Introduction

Classifications have always been the bases of Sciences and technology but, unfortunately articles based on natural products, tend to form overlapping groups, and biscuits are no exception to the problem. It is therefore useful to characterized biscuits from their external and internal appearance as these helps in deciding likely, recipe and means for forming and baking [1].

The consumption of cookies or biscuits can be coin as far back as the 14<sup>th</sup> century. The original word came into being through a French chronicler; Jean de Joinville (1224-1317) and adviser of Saint-Louis (Louis IX of France 1214 - 1270), who spoke about these bread that were roll and cooked twice called "besquis". A term derived from Latin word "bis" which means "twice" and *coquere, coctus* (to cook), hence mean; "twice cooked" [2]. The origins of biscuits and cakes could also be trace as far back as ten thousand years as food for Egyptian pharaohs, the Greeks and the Romans when pulps made from cereal became cake and could be conserved. These were the first food likely to be preserved [3].

The military also played a great role in advancing the types and approaches of cookies conservation considering the fact that biscuits were basically developed to meet and satisfy the needs for the solders and the marines, who were to have a food of long conservation and compactness so as to enable them keep up with their assignment far from home. This was something very common to the Rome's, the bakers; bake their bread twice in order to provide long lasting biscuits

as food to the legions. A similar situation could be witness in France by Antoine-Augustin Parmentier (1737-1813) a French pharmacist of the military and an agronomist and hygienist who contributed in given biscuits shapes and enhancing it favour [4]. However, the technique on the preparation of biscuits and cake was ameliorate during the middle Ages that saw the replacement of ashes cooking with ovens [5]. The development of advanced techniques of production, the improvement of conservation recipes used as food additives these ameliorations are proposing an incredible diversity of choice to the consumers. This diversity has led to high demand for Cookies as sandwich for breakfast, long distance traveler's food choice and surviving food choice were normal food is absent [2].

It is nowadays regarded as an international trade food and these high demand therefore exposes cookies to production of contraband

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products, the poor employment of additive and the abusive misrepresentation of product information that may present health risks; such was the case notice in 2008 by the service of consumption and the veterinary department of economy and health of Geneva with the use of melamine a synthetic and toxic chemical substance that increase the number of nitrogen atoms and thus distort and increase the apparent content of analyzed proteins, in biscuits imported from Thailand contain 9.2 mg/kg of melamine i.e. almost four times superior the authorized standard (WHO and the European union (EU) set a TDI of 0.2 mg per kg of body weight). Melamine which should not be confused with melanin is very toxic and chronic exposure may cause cancer, reproductive damage kidney stones, irritant; to the eye, skin and respiratory tract. This product has a  $LD_{50}$  of 3 g per kg bodyweight [6]. A similar finding conducted by the Association of Veterinary Laboratory diagnosticians related the developing of Kidney stone as a result of Melamine combining with cyanuric acid in the kidney, which eventually don't dissolve easily thereby resulting in potential for chronic toxicity [7].

Considering the necessity to implement system of risk analysis to enable the control of food and ensure appropriate food safety to prevent toxicity and exposure risk from the consumers which may be from microbiological origin or related to the presence of chemical substances from the environment in the food. Countries of the European Community, Japan, the United States, Canada and others etc. These systems of analysis and employing food safety measures in country where they do exist has as principal objective to allow citizens to understand food risks and permit them to recognizes it socially acceptable level, which help in reducing any health hazard that may arise, thereby increasing vigilance on the consumers part [8]. However, in comparison with the absence of active food control safety in our market in Cameroon, one can notice a population left to its own challenges but surviving by the grace of nature. A population that; consume what they do not know, what no one ensures its safety in the market and a population gradually becoming a public health bondage to the public health system if nothing is done on the norms and safety to protect the consumers right in Cameroon. Nevertheless, the passive improvement on bakery and confectionary product by the Cameroon league of Consumers, could further be used if improved upon as a preventive strategy against food risks and its toxicological related complications which may occur such as with heavy biscuits consumers, more especially those who use it as a good supplementary food for energy malnourished children and adults more specifically the population. In this case the population is that of the city of Douala the economic capital and representative image for Cameroon.

### **Biscuits/cookies**

Biscuits are a baked product, usually made from wheat flour together with fat, sugar and salts as. They are made in a variety of shapes and sizes and may contain dried fruits, nuts and food colors. They are a dry product, usually with a golden brown colour and a crisp texture. The major raw ingredients used for the preparation of biscuits are: 44% flour, 23% sugar and 3% milk, 11% fat and 4% eggs giving an average chemical composition of 6% protein (that could be falsified by incorporating melamine), 28% fats 57% carbohydrate and 1% fibers for an average energy contain of approximately 510 Kcal/100 g [9]. The sugar level is on a dry basis and it is assumed that liquid sugar has 67% solids, invert syrups 80% solids, malt extract 80% solids, glucose syrups 80% solids. The fat values on pure fat, so margarines and butter are only 85%. The water level is the total added water. This is principally as liquid water but may be as fresh milk (87% water), butter and margarine (15%

water), fresh eggs (75%), syrups (20%), liquid sugar (33%) etc. Biscuits have a fairly long shelf life of several months when stored in proper conditions. Their characteristic rolled out shape with a thickness of 4-5 mm gives them the possibility to be cut out using different shaped cutters. Biscuits are baked in a hot oven of 200-250°C for a period of 5-20 minutes depending on the size and thickness of the biscuits [9].

### **Types of biscuits**

No official classifications of biscuits do exist, as a result of the large variety of the productions and the use of multiplicity recipes. Trying to classify biscuits could only be possible from the point of view of their consistency of the paste used for baking the Cookies, Hard or semi-hard pastes giving rise to the type of sweetened and salted dry biscuits: snacks, sanded, small butter, etc. Its a manufacture without eggs which accounts for approximately 60% of the biscuit. The soft pastes: which are mostly used in industrial baking are biscuit with very high content of eggs and oils [10].

For better understanding of the study, the biscuits were classified into 3 major groups, based mainly on the finish product:

**Dry simple biscuits and hard sweet biscuit:** Around the world one can find endless varieties of biscuits, cookies and crackers, which differ in terms of taste and shape, decoration and other unique features that individual bakers add to their products to differentiate them and set them apart in their own market [11,12].

**Sandwich biscuits:** The extensible nature of British type semi-sweet dough, make it suitable for containing in a dough sandwich, a filling of fruit. The process is quite difficult to perfect and it is important that very little fruit is allowed to break through top and bottom dough layer, otherwise it dries too much in the oven and a tough leathery product is produced after baking. There are at least three different forming systems for introducing the fruit between two layers of dough, but the most successful way is to have two sheet each with two pairs of subsequent gauge rolls, to give dough sheet of about 8 mm thick. A carpet of fruit is evenly over the lower sheet the top sheet is then laid onto the fruit, and reduction to the final sandwich thickness should be achieved with one further pair of gauging rolls. If more than one-gauge roll used after compressing the fruit and the dough together, there is an increased chance of fruit breaking through the dough causing poor biscuit quality. It is almost essential that small currants are used, as larger fruit will be broken in the gauging. The ratio of fruit to dough also has a great effect on the backed biscuit thickness. Thus, it is important to keep the spread of fruit even, prior to making the sandwich [11].

**Waffle biscuits:** Products in this group are distinguished from others in that they are made from a dough that lacks extensibility and elasticity. Wheat flour or some other farinaceous material is the major ingredient, but the quantities of fat and sugar solution present in the dough create a plasticity and cohesiveness of the dough with minimal formation of gluten network. The structure of the baked biscuit consists of a mixture of protein, starch and sugar glass (super cooled molten sugar). There is no continuous protein matrix and the fat is present in the form of large globules or of larger interconnected masses between the starch protein masses. The texture is typically relatively coarse as there is much coalescence of the gas bubbles that form during the baking.

Thus, the features of the dough of this group result in biscuits which tend to become larger in width and length as they bake, rather than shrink as for crackers and semi-sweet types. Control of this increase in size or spread is the biggest single processing problem [11].

## Food additive

The use of food additives in food manufacturing has been a public health issue for many years Saltmarsh et al. 2013. A report issued by the European Food Safety Authority (EFSA) in 2010 showed that 25% of people surveyed were «very worried» about food additives and a further 41% were «fairly worried» [13]. Because food additives have become essential in the food industry, the European Economic Community (EEC) in 1988 introduced the regulation of labelling and numbering of food additives, such as food colourings, flavours, taste enhancers and preservatives, to promote a free and fair market of safe food products within the European Community [14].

According to WHO/FAO food additives are classified as follows;

*There are substances that are added to food to maintain or improve the safety, freshness, taste, texture or appearance of food. Examples of such additives are; salts, sugar, or sulfur dioxide etc.*

Whereas, The European Union (EU) legal definition of a food additive is as follows:

*Any substance not normally consumed as a food in itself and not normally used as a characteristic ingredient of food, whether or not it has nutritive value, the intentional addition of which to food for a technological purpose in the manufacture, processing, preparation, treatment, packaging, transport or storage of such food results, or may be reasonably expected to result, in it or its by-products becoming directly or indirectly a component of such food».*

The advancement in technology and food processing techniques have help in the development of several different food additives, the making of food on a large scale needs a more secure guarantee that processed food remain safe and in good condition during its journey from the factories to the warehouse and shops and to the final consumers. Wealth Health organization (WHO) stipulate clearly that the use of food additive should not be misled to the consumers but to clearly define it technological function it is destined to do; such as preserve the nutritional quality of the food or enhance the stability of the food. There are several thousand food additives used, all of which are designed to do a specific job in making food safer or more appalling. WHO, together with Food and Agricultural Organization (FAO), have groups food additives into 3 broad categories based on their function.

**Flavouring agents:** which are incorporate in food to enhance their aroma or taste, there make up the greatest number of additives used in food.

**Enzyme preparations:** These additives might not end up in the final product. There are boosters of biochemical reactions as they help in breaking down long chain molecules into smaller ones. There are the most abundant in baked products such as biscuits. In order words there improve dough and increase yields.

**Other additives:** are used for a variety of reasons, such as preservation, colouring and sweetening. They are added when food is prepared, packaged, transported or stored and they eventually become a component of the food, example is; preservatives to help control contaminant, colorants to replace or improve on the colour lost during preparation, non – sugar sweeteners.

Preceding the approval of new food additives, intensive risk assessment usually based on animal studies, are undertaken and food additives already in use periodically re-evaluated. While a small amount of uncertainty on food additives' potential harmfulness on

humans cannot be ruled out, food safety experts generally agree on the reliability on this approach [15]. It is therefore necessary for food manufacturers to make sure that the type and amount of a particular additive is suitable to use and does not exceed the acceptable safety limits specially for those people, who by nature of their diet, may consume high amounts of a particular food product such as children.

## Toxicological risk for biscuits consumption

Current research also suggests that consumers are worried and would like to be better informed about the potential health risks of food additive use and consumption [16]. However, many nutritionists still hold on to the claim that food additives are an essential element in the spread of snaking culture as well as the commercial success of so-called junk foods, which are often held responsible, at least in part, in the increased prevalence of non-communicable diseases [12].

WHO in cooperation with FAO are all responsible for assessing the risk on human health that might arise from food additives. The assessment of these risks is conducted by an Independent, international Expert scientific group – the Joint FAO/WHO expert Committee on food additive (JECFA).

However, despite the efforts put in place by the FAO/WHO and calling on each member country like Cameroon to adhere with its define policy on additives, more strategies are still needed to ensure an active follow up. The present of sugar a major ingredient in most biscuits give it characteristic sweat treats, these biscuits carry a hidden health risk that means they are more salty that other salt related food such as popcorn. As a result, they are fueling a toxic daily salt overdose particularly in children who by their nature consume it in excess, eating too much salt over a lifetime as additive from biscuits are prime exposure to public health risk predisposing factors like; raise in blood pressure, increase in the risk of stroke and an undefined cause of early deaths each year [13]. The Consensus Action of Salts and Health argues that many peoples are been exposed to salts consumption without knowing by eating processed foods, such as biscuits. There further put forward that many children are eating as many as 46 packets of 25 g biscuits every year, putting them at a greater risk of developing hypertension in adulthood.

Moreover, another preoccupying additive in biscuit production is Fats. food Manufacturers often go in for this hydrogenated oil (man-made trans-fats) or as trans-unsaturated fatty acids because of the great potential to increase the shelf life and keep the flavor of their product stable though these fats are perceive to have considerably potentials to raise cholesterol levels in the body a major factor that causes several cardiovascular diseases; a leading cause of death in the western world. Yet with all this health risk and recommendation put in place by JECFA, many manufacturers still bias the laws and market products with no clear information on the additive used, some manufacturers go a long way in representing food additives with their chemical names making worse the situation of misinformation by consumers. However, with a clear understanding of the Acceptable Daily Intake (ADI) as a starting point for determining whether food additives are safe or present harmful effects. These are the preliminaries to better apprehend food additives toxicity health related effects. A knit respect of the TRVs (toxicity reference values) for all food products and additives as define by the JECFA as an intergovernmental standards set by FAO and WHO and the Agency for Toxic Substances and Disease Registry (ATSDR) by appropriate intuitional bodies like; Canadian food inspection Agency, Food and Drug Administration at the international level and Agency

des Normes et de la Qualité (ANOR) and the Cameroon League of Consumers (CLC) in Cameroon, are key actors in safeguarding of food and preventing exposure to toxicant that may produce acute to chronic health effect to biscuit consumer. The TRVs is a toxicological index that, when compared with exposure (ADI), is used to qualify or quantify a human health risk [15,13].

## Method

### Materials

A4 white sheets, Disposable gloves, a data analyzing tool (Microsoft Excel 2010), ruler and pens, questionnaire, temporal analysing space (Laboratory), desk and table, spray sheet, plastic bags to easy transportation, rubber trays, hand lens and data collection sheets highlighting the key indicator for analysis.

### A pilot survey on biscuits sources

A cross sectional small-scale preliminary study (100 participants) on retailers within the Douala city area was conducted using a questionnaire designed in English and French to assess their main source of purchase. The questions used were closed/opened-end questions on two categories: demographic related questions like: gender, nationality, age. And retailer experiences on biscuits products like: how long have you being doing the business? (Less than 12 months, less than 3 years, 5 years or more), where is your major source of purchase of biscuits products within Douala? How long have you been purchasing from this site your earlier mention? (Less than 12 months, less than 3 years, 5 years or more), which are the highly demanding biscuits by customs? Can you name 10 of the most demanding biscuits requested by your customers? How would you rank the site you mention above in term of satisfying your purchase order? (Very good, poor, average).

## Sampling

### Study site

The region to conduct the study was obtained by a simple randomize sampling using the balloting method; the entire 10 regions in Cameroon, were listed on small pieces of papers and a neutral person was sorted randomly to cast the ballot. When the region of study was known, the major purchasing site mention by different retailers involve in a pilot survey markets were identified within the urban city area.

### Study design

A descriptive cross-sectional design was use in this study to assess the toxicological risk on biscuits consumers with regard to product information and their public health concern of Biscuits been commercialized for over 5 years in the Douala urban city area of Cameroon.

### Study population

The study population included biscuits that have been commercialized by wholesales provision shops in Douala for over 5 years with high demand and base on the major purchasing site mention by different retailers involve in a pilot survey within the Douala city area to help affirm the types and biscuits seniority within the market. All the owners or salesmen of whole sales involved in the sales of Biscuits were ask a common question on their frequency in the manipulation of the various biscuits and their knowledgeable experiences on the sales rate of biscuits during the 4 months period of the study.

## Selection criteria

### Inclusion criteria

- All major wholesale shops involved in the sales of biscuits.
- All shops with five or more years of existences within the same sphere of activity of importing and selling biscuits.
- All biscuits which have been commercialized for five years or more with product information in English or French.

### Exclusion criteria

- Shops and bakeries that import for retails.
- Biscuits with less than five years of existence.
- Shops with salesman with less than five years of experiences in the biscuit business.
- Biscuits with product information in a different language other than French or English.
- New biscuits entering the Cameroonian market during prior to start of the study.
- Supermarkets or retail shops that retail biscuits.

## Sample size

The sample size for this cross- sectional study was well define as it considers only biscuits which had existed for five years or more within the Cameroonian market and are still witnessing a high demand as a result of their increase desire for consumption. Considering the vast availability of biscuits products in the Cameroonian market and with focus on their seniority of 05 years or more in the market and their high demand, as result of some many reoccurrences of products, a sample size by convenient of 40 was chosen. These were then collected from the 02 markets revealed by the pilot study.

## Study area setting

The study was carried out in Cameroon and was conducted in; one region (Douala city urban area): Mboppi market and the Marche Centrale of Douala.

## Background on study area

Cameroon is a country in central Africa usually known as “Africa inminiature”, it has more than 200 different linguistic groups with French and English been the official languages. According to the World Bank estimate of 2013; Cameroon has a population of over 22.534.532 with a total surface are of 475,442 km<sup>2</sup>. Cameroon has a typically equatorial climate of raining season (April-October) and dry season (November- march).

The littoral region is divided into four major department which are; sanaga maritime, Nkam, Mounjo and Wouri. Douala is the head quarter of the Department of Wouri and the capital of the littoral region. It is also the commercial and economical capital of Cameroon with a population of over 2,446,945. This makes Douala the busiest city in Cameroon. It is in this town that the presence of Cameroon only active and busiest seaport; The Douala Autonomy port. The presence of the Douala international airport and it characterized geographic location been open to the Atlantic sea makes Douala a true inflow terminal for imported products of which Biscuits are an inclusive part of it. The inflow terminal of imported products makes Douala to possess one of the largest markets in Central Africa which are the ‘MBOPPPPI’ market and the ‘MARCHE CENTRALE’ market of Douala.

## Study procedure

The investigators began by seeking an ethical approval from the Institutional Research Committee for Human Health (IRCHH-UD) of the University of Douala, followed by an administrative authorization from the Divisional officer (D.O) of the department of Wouri, in whose jurisdiction the work was to be conducted.

## Data collection procedure

The tool used for data collection was a data collection sheets highlighting the key indicator for subsequent analysis, which in this case were the product information. These were then entered into a design Microsoft Excel 2010 analyzing sheet for subsequent analysis.

## Technique for data collection

**Procedure for data collection:** With the orientation from the pilot survey involving residential retailers of biscuits within strategic areas that make up the city of Douala, the investigators proceed by identifying these sites of purchase. For each shop, an introduction was made and the D.O authorization was presented, and Consent was requested to partake in the study. Furthermore, on request by the investigators, proof or evidences for 05 years functioning was verified based on the appropriate documents like; purchase invoice or any other document presented by the salesman. The request on the most commonly demanded biscuits were key question. Upon getting all this

information's, the investigators proceed to purchase, some quantities from the main site of purchase as identified by some biscuits retailers; Marché central and Marché Mboppi of Douala. The biscuits purchased were then transported to a laboratory sit arranged temporally for the purpose of the study.

The product information's as define by the various manufacturers on their products were identified and filled in the data collection sheet designed for the study. This information was then entered into a designed Microsoft Excel 2010 analyzing sheet for analysis.

## Results

### Biscuits contents

After scrutinizing all the products (biscuits) purchased from the two-major market; marche centale and Mboppi market. By doing a product by product verification with the use of the naked eyes and when possible the use of a hand lens, to read out all the ingredients as mention on the product by the manufacturers. A total presentation of the results was made showings the:

Name of the biscuits,

Additives/ingredients,

Origin (country)

This was then presented on the Table 1.

Biscuits / cookies	WF	F	SG	Mik	slt	Additive	Other ingredient	Biscuit type	Origin
All sport orange	p	p	p	p	p	E123, E223, E322, E330, E500, E503		BW	CMR
Butter bread	p	p	p	p	p	E322, E471, E500, E503	Invert syrup	BD	NGA
Butter cookies	p	p	p	p	p	E322, E500i, E503ii	Glucose syrup, artificial flavour	BD	CMR
Bomeo	p	p	p	p	p	E322, E500i, E503ii	Glucose syrup, flavour, corn starch	BS	TUR
Chic chic	p	p	p	p	p	E223, E322, E500, E503	Flavour banana taste	BS	NGA
Choco tom	p	p	p	p	p	E322, E330, E450i, E500i, E503ii	Invert syrup, flavours, cocoa powder, Corn flour	BS	TUN
Choco mandel	p	p	p	p	p	E322, E500, E503	Flavours, colours and cocoa powder	BD	CMR
Custard creams	p	p	p	p	p	E110, E102, E322, E471, E500, E503	Flavour(ethylvanile), caramel	BS	NGA
Cream delight	p	p	p	p	p	E110, E124, E133, E150d, E223, E322, E422, E450i	Artificial flavours (chocolat and vanille)	BS	IND
Delys	p	p	p	p	p	E102, E110, E122, E133, E322, E471, E481, E500ii, E503ii	Artificial flavours, cacao powdeer, invert syrup	BD	CMR
Elisa Vita biscuits	p	p	p	p	p	E500ii, E503ii	Invert syrup	BD	CMR
Gingin honey	p	p	p	p	p	E322, E500ii, E503i	Honey and ginger flavours, ginger powder	BD	NGA
Happy face	p	p	p	p	p	E223, E322, E500i, E503ii	Cacao flavour, kernel cream	BS	TUR
Kreams gold	p	p	p	p	p	E110, E223, E322, E471, E481i, E500ii, E503ii	Invert syrup, artificial milk and orange flavour	BS	CMR
Malt milk	p	p	p	p	p	E322, E471, E500ii, E503ii	Malt and milk flavour, invert syrup	BD	NGA
Milk choc	p	p	p	p	p	E223, E500, E503	Flavour, cacao powder	BS	CMR
Naya fraise	p	p	p	p	p	E102, E110, E124, E127, E322, E471, E481, E500, E503	Artificail flavour, invert syrup, glucose liquide, Corn flour, Liquid glucose	BS	CMR
Naya choco	p	p	p	p	p	E102, E105a, E133, E322, E471, E481, E500, E503	Artificial and natural flavour, invert syrup, glucose liquid, corn flour, cacao powder	BD	CMR
Naya coco	p	p	p	p	p	E102, E124, E322, E471, E481, E500, E503	Artificial flavour, invert syrup, glucose, Corn flour	BD	CMR
Nice	p	p	p	p	p	E319, E450, E500ii, E503ii	Glucose syrup, invert syrup, flavour (ethylvanilla)	BD	IND
Noreos	p	p	p	p	p	E102, E110, E124, E150, E322, E471, E500ii, E503II	Corn starch, cacao powder	BS	NGA

Nutro	p	p	p	p	p	E162, E322, E330, E500ii	Cow milk lait, dextrose, artificial flavour, vanilline	BS	UAE
O'choco	p	p	p	p	p	E150d, E223, E334, E472e, E500ii, E503ii	Artificial chocolate flavour, caramel	BD	CMR
Parle G glucose	p	p	p	p	p	E223, E322, E471, E481ii, E500ii, E503ii	Invert syrup	BD	CMR
Petit beurre	p	p	p	p	p	E322, E500ii, E503ii	Invert syrup, glucose, malt extrait	BD	IRN
Prince chocolat	p	p	p	p	p	E322, E385, E500, E503	Invert syrup, coton seeds, corn starch, artificial flavour (vanille)	BD	PAK
Riko chocolat	p	p	p	p	p	E223, E322, E500, E503	Cocoa powder flavour	BW	CMR
Sangokou	p	p	p	p	p	E322, E500ii, E503ii	Glucose syrup, invert syrup, corn starch, cocoa powder	BS	CMR
Sablito	p	p	p	p	p	E322, E330, E336, E500ii, E503ii	Natural flavour (vanille), flavour cocoa, kernel paste	BS	TUN
Shibobo	p	p	p	p	p	E110, E223, E322, E500ii, E503ii	Flavour, cream, invert syrup (fructose)	BS	Saf
Start	p	p	p	p	p	E330, E500ii, E503ii	Vanille flavour, gluten	BD	TUN
Super cao	p	p	p	p	p	E322, E500, E503	Malt, flavour, cocoa powder	BD	CMR
Tasty	p	p	p	p	p	E127, E223, E296, E322, E471, E500ii, E503ii	sugar solution	BS	IND
Tiger krundi	p	p	p	p	p	E223, E322, E481i, E500ii, E503ii	Vitamin A and D, cocoa powder, artificial vanille flavour	BS	IND
Tungo	p	p	p	p	p	E322, E330, E500ii, E503ii	Vanille flavour, invert syrup	BD	TUN
Yale digestive plus	p	p	p	p	p	E322, E500ii, E503ii	Vanille flavour	BD	NGA
Biscuits fourres	p	p	p	p	p	E322, E503	Glucose syrup, black cocoa powder	BS	BEL
Briens	p	p	p	p	p	E322, E500ii	Invert syrup, artificial milk and honey flavour, vanille flavour	BD	TUR
O'lait	p	p	p	p	p	E223, E322, E500ii, E503ii	Invert syrup, corn starch	BD	CMR
Klas mosaic	p	p	p	p	p	E150d, E322	Cocoa powder, corn starch, albumine and flavour	BD	TUR

**Note :** WF = Wheat Flour; F= Fats;Sg = Sugar; Mlk= Milk; Slt = salt; P = Present; DC : Dry Cookies/Biscuits ; BS : Sandwich Biscuits ; BW : Wafer Biscuits; CMR : Cameroun ; BEL : Belgique ; EAU : Emirats Arabes Unies ; IND : Inde ; IRN : Iran NGA : Nigeria ; TUN : Tunisie ; TUR : Turquie ; PAK : Pakistan ; ZAF : Afrique de Sud

**Table 1:** Biscuits contents.

The 40 biscuits chosen for the study were group into their types to better view and apprehend the most common biscuits that are highly consumed by Cameroonian and that had stood the test of time of still been actively present in Douala- Cameroon since their demand is still high. As shown in Figure 1. Table 2 was used to present some of the commonly consume biscuits in terms of toxicity potential, in proportion to their names and product information (Figure 2).

To further elaborate on the content of the 40 biscuits more especially on their potential toxicity a table of E- numbers with document evidences of causing harm was established. From the 40 biscuits; a global sum of 184 food additives was identified from all of the products, of which 53 were identifying to possess potentially toxic effect or high probability of causing hypersensitive reaction. This was then summarized as follows; from the 184 identified, they could be sum up into 23 main food additives of which; 10 were colorant, 02 as preservatives, 05 as antioxidant and acid regulators, 04 thickeners and 02 pH regulators as how with Table 2 and Figure 3. In addition, since all of the food's ingredient labels lack the information about the amounts of food additives besides the obvious use of more than one additive in most of the products, the frequency and percentages of reoccurrence of the various food additives were presented Table 2 and Figure 4.

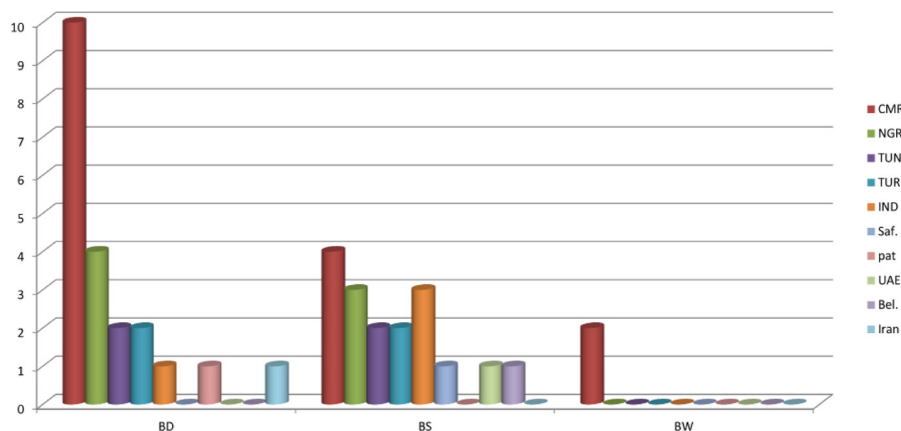
### Pilot study

Analysis of the data collected from 100 participants involved in the preliminary survey study, it demographically revealed that all the participants were male and, among them 88% age range from 20-35 years, 11% 36-40 years and 2% 41 years plus. 89% were foreigner

residing in Cameroon and 11% were Cameroonian doing the retailing business. Concerning their business experiences, 84% had been doing the business for 5 years or more, 12% less than 3 years and 4% one year or less. On the questions on purchasing sites, 63% responded Marche Mboppi, 35% as Marché Central, 1% Marché Nkoloulou and 1% Marché Ndokoti. With regard to the most demanding, 58% participant could be identified with dry biscuits, 37% for sandwich biscuits types and 5% for wafers/others. This could be seen as shown in Table 2 and Figure 5.

### Discussions

In the past century, we have all witnessed a marked increase in the number of food additives being added to food products. Today, more than 3,000 substances are approved for use as food additives by national and international food regulatory bodies. From the data collected during the study, 5 major ingredients were found to be the backbone of all the biscuits we collected, this was as documented by several confectionary theories. These ingredients were also as define by the WHO/FAO content of biscuits; wheat flour, fats, salts, sugar and milk. Since it is first of its kind to conduct such study in Cameroon, the information we got from the dealers during the data collection phase was all we had to work on. The highest source of biscuits were biscuits made in Cameroon 16 (40%) and as external sources (imported) into the market were as such; Nigeria 7 (18%) topping the list, followed by Indian 4 (10%), Tunisia 4 (10%) and Turkey 4 (10%). Concerning the products types, 52% were dry biscuits (cream crackers); 43% as sandwich biscuits and 5% as wafer biscuits, from this it was clear that the majority of biscuits consumers go in for dry biscuits as earlier revealed during the pilot study.



CMR= Cameroon; NGR=Nigeria; TUN= Tunisia; TUR= Turkey; IND= India; Saf= South Africa; PAT= Pakistan; UAE= United Arab Emirates; Bel= Belgium; Iran= Iran  
BD= Dry biscuits; BS= Sandwich Biscuits; BW= Wafers Biscuits

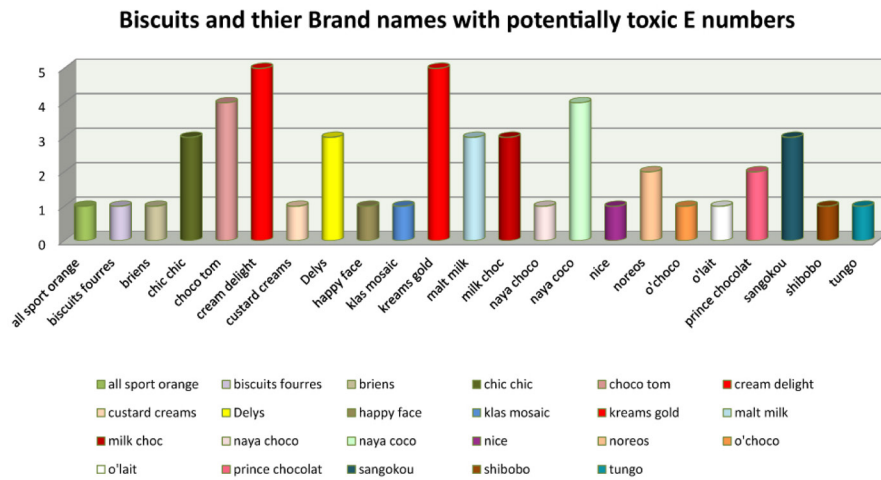
Figure 1: Biscuits types been commercialized in the DUCA with potential toxic food additives effects and their sources.

E NUMBERS	102	110	122	123	124	127	133	223	385	450	471	Sum
all sport orange	0	0	0	0	0	0	0	1	0	0	0	1
biscuits fourres	0	0	0	0	0	0	0	1	0	0	0	1
briens	0	0	0	0	0	0	0	0	0	1	0	1
chic chic	1	1	0	0	0	0	0	0	0	0	1	3
choco tom	0	1	0	0	1	0	1	0	0	1	0	4
cream delight	1	1	1	0	0	0	1	0	0	0	1	5
custard creams	0	0	0	0	0	0	0	1	0	0	0	1
Delys	0	1	0	0	0	0	0	1	0	0	1	3
happy face	0	0	0	0	0	0	0	0	0	0	1	1
klas mosaic	0	0	0	0	0	0	0	1	0	0	0	1
kreams gold	1	1	0	0	1	1	0	0	0	0	1	5
malt milk	1	0	0	0	0	0	1	0	0	0	1	3
milk choc	1	0	0	0	1	0	0	0	0	0	1	3
naya choco	0	0	0	0	0	0	0	0	0	1	0	1
naya coco	1	1	0	0	1	0	0	0	0	0	1	4
nice	0	0	0	0	0	0	0	1	0	0	0	1
noreos	0	0	0	0	0	0	0	1	0	0	1	2
o'choco	0	0	0	0	0	0	0	0	1	0	0	1
o'lait	0	0	0	0	0	0	0	1	0	0	0	1
prince chocolat	0	1	0	0	0	0	0	1	0	0	0	2
sangokou	0	0	0	0	0	1	0	1	0	0	1	3
shibobo	0	0	0	0	0	0	0	1	0	0	0	1
tungo	0	0	0	0	0	0	0	1	0	0	0	1
most used toxic E numb	6	7	1	0	4	2	3	12	1	3	10	

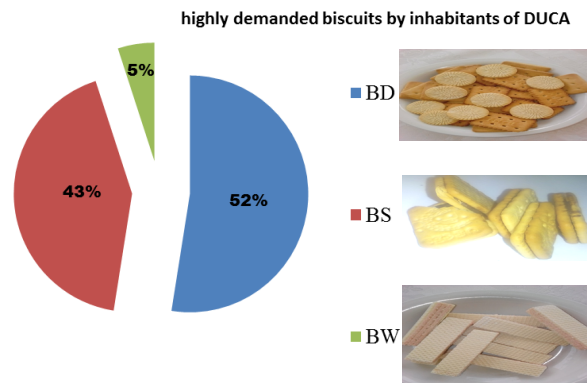
Table 2: Toxicity potential of biscuits.

With no other literature study to verify why this high request of dry biscuits consumption, we put forward the reason; that the cheap nature of the biscuits could be the prime reason why some many consumers go in for it. From a report by Lakshmi et al., on bakery and confectionary products, dry biscuits have a very high contain of sugar, salt and carbohydrate. The high-level sugar and salt in these types of biscuits makes them the most dangerous form of biscuits especially to their consumers and serve as potential sources of eminent health problems. They exist a high chance for hearth related problem with this biscuits consumption especially to the vulnerable population whom are children who are the highest consumers of these biscuits products as a result of it cheap nature

and readily availability in the market and their child promotional form of marketing labels. We could affirm this claim when referencing the price of the other biscuits identified in the study; wafer and sandwich biscuits though there a source of other potential harm to the health of their consumers, like source of Juvenile diabetes and other predisposing factors leading to hypertension, their consumption rate was relatively lower as compared to dry biscuits, when looking at the various purchasing price and retail cost, one can easily affirm why dry biscuits were the most accessible and available in the market, more reason why they are sure future public health problem if no measures are taken to control the safety of these products that are filling the Cameroonian markets.

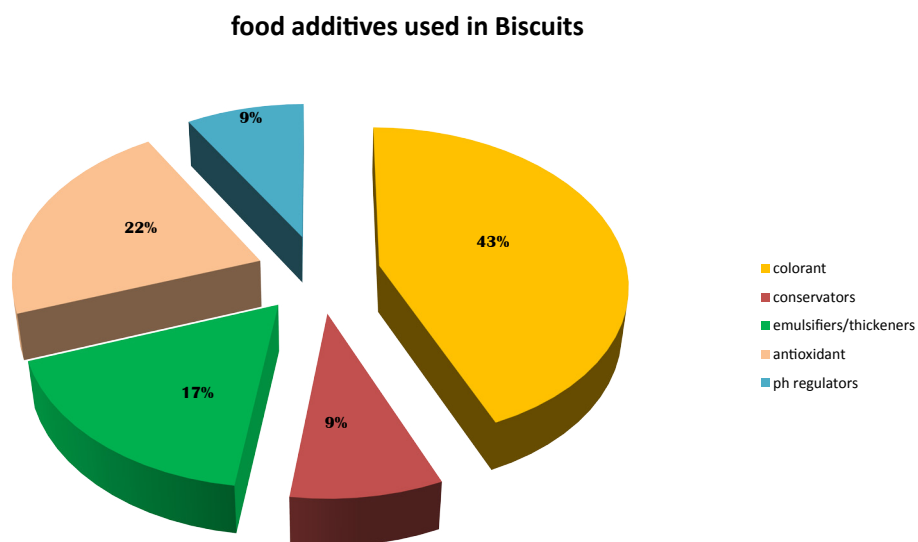


**Figure 2:** Biscuits with the highest potential toxic e number been commercialize in DUCA.



BD= Dry biscuits; BS= Sandwich Biscuits; BW= Wafers Biscuits

**Figure 3:** Biscuits with the highest consumption in DUCA.



**Figure 4:** Common additives used in the various biscuits.





BD= Dry biscuits; BS= Sandwich Biscuits; BW= Wafers Biscuits

Source: TEKUH's Image

**Figure 5:** Pictorial view of biscuits used in the study, BD, BS and BW.

It was also revealed that the biscuits with the highest potential of toxic food additives commercialized in the Douala Urban City Area (DUCA) are were; the sandwich biscuits, they recorded the highest used of potential harmful documented E-numbers; E102, E124, E127, E223, E450 this was followed by dry biscuits; E102, E122, E133, E385, E471 and lastly the wafer biscuits types; E223, E123. This was another evidence that norms and food safety measures were really absent on biscuits been commercialised in the Cameroonian market. Whereas institution like ANOR and LCC do exist in Cameroon to fight for consumers and protect them from any harm related to food or confectionary products within the Cameroonian market. Moreover, the negligent on the part of policy makers and institution in charge of norms and standards show up for the laxities on their part in actively implementing the WHO/FAO joint initiatives on the use of food additives, packaging and product information. Moreover, the poor product information writes up on most of the products collected for the study is still another evidences as to the fact that the manufacturers left to define their roles and the consumers are bound to abide by the rules, as the manufacturers keep defining and exercising their sale and purchase rights. Despite this food security dilemma on biscuits products commercialized in the DUCA, no practical institution is they to actually protect and reassure the practical implementation and fellow ups of confectionary standard polices on products like biscuits in the Cameroonian market. Concerning Nigeria as a highest source of imported biscuits in the Cameroonian market and since no literature could explain their commercial tires. We put forth the reason that it should be as a result of Nigeria being a neighbouring country to Cameroon and the cheap purchasing factor offered by Nigeria as one of Africa industrialised country are the main factors as to why the majorities of biscuits products are from Nigeria rather than other countries. However, these also show up for the good business tires that exist between Cameroon and Nigeria.

The highest use of colourants 43% as the major food additives used in the 40 biscuits sample; E102, E110 and E124 was similar to with a report presented by EFSA on the important role colourant play in the production of food product [11,17].

Though biscuits had stood the test of time in several continent and country as alternative form of food; breakfast and snacks, their toxicity cannot easily be established. For this study, however, we established the potential toxicity of the products based on the information we got from the labels, though most of the labels did not meet up with standard regulation 2.2.2(5) (ii) and regulation 3.2.1 of Food Safety and Standards (Food Product Standards and Food Additive) Regulation of 2011. From the 40 sample size biscuits, a global total of 183 food additives were present, of which 24 biscuits inclusive had a well identified hazard food additive to the health of their consumers these was as a result of evident present of potentially harmful E- numbers. We could record an average of approximately 5 additives per biscuit and approximately 2 potentially unhealthy additives per biscuits, making a ratio of 1:3 these values were common to that published by a work done by students at the university IBN TAFALL, in the faculty of biotechnology in 2011 on the harm which could occurred from the used of food additives. They recorded that in an average of 517 biscuits samples, they had an average of 6 additives per biscuits and an average of 2 unhealthy additives per biscuits [18]. According to the re-evaluation report of the EFSA in 2016 on food colour, after reassessing of 41 different food colour, the maximum level of E104, E110, E124 ADI Level was lowered and the red E128 was removed completely from the European market. With such studies and results, there is deep need for more studies at a larger scale in Cameroon, to access the safety of additives in confectionary products like biscuits been commercialised in Cameroon. The remover of E 105a from the food codex and in the USA [19,20], were more evidence on the necessity to reinforce food safety policies though present in some biscuits collected from the market in DUCA. Lowering of the ADI of these colourants is another strong evidence of their toxicity as reported

by EFSA. With references to the EFSA reports, highlighting E 102 and 110 and other colourant as potential toxic colourant, from our findings we notice the use of; tartrazine (E102) 12%; sunset Yellow FCF (E110) 13%, ponceau4R (E124) 8% and brilliant blue FCF (E133) 6%; which are signs for weak food safety measures in Cameroon since their quantity and ADI were not define on the labelling.

However, the major health risk posse by these additives had been documented as; hypersensitivity reaction, growth retardation as with the E110 in an animal study [15]. Asthmatic attack and some with potential carcinogenic effects –E320 (BHA) as demonstrated by a study carried out by the IARC (international Agency for research on Cancer). A similar study conducted by a group of researchers at Southampton University Teaching Hospital also confirm on the hypersensitivity of these food additives as dangerous and hazardous to the health of the consumers [21]. In their research, to further illustrated the potential toxicity of food additives, they use as cocktail model ‘additive cocktail effect’ by combining preservatives; E210 and E213 with six other synthetic colorants; E102, E104, E110, E122, E124, E129) to better observe by simulation the harmful effect to the organism of the consumer [17,22]. Their result revealed that the potential to cause more harm to the biscuit consumer, was further increased by associating the food additive. From this we could see the necessity and the importance of implementing and using food safety polices. To complement the above work, a similar research work was also carried out in great Britain in 2005, after studying 4 food additive individually that is: E951 (aspartame), E621 Sodium glutamate) and 2 colorant; E104 and E133 showing their potential harmful effect on nerve cell, they then study their combining effects of E951 and E133, then E104 in a 3 years study, they revealed that the toxicity potentials of food additive increases when combine together, from their additives synergy, they found out that when E951/ E621 were combine with E133 or E104, it was found that there produces strong inhibitory effects on the growth of nervous cell [22], when : E133+E1621 the nervous toxicity level was increase by 4 time the initial harmful potential and when E104+E451, the toxicity level was 7 time potent to affect nerve cells in mouse. However, it should also be recall that in country like the USA, Canada, China, Europe etc were active food safety and security agency do exist, there have serve to unwrapped eminent food toxicity crises by helping in preventing future food crises and epidemics that could have arisen if their existence were not there. On the other hand, these agencies indirectly serve as budget lightener to the ministry of public health in every country where they exist, a situation that could be really apprehend through more research. In addition, JECFA and SCF after re-evaluating the safety of sunset yellow FCF (E110) as food additives and as nutrient sources added to food, they recommended and established an ADI of 0-2.5 mg/kg bw/day. This evidence was archived by reporting significant effects on the testis in rats exposed for 90 days to 250 and 1500 mg Sunset Yellow FCF/kg bw/day Mathur et al. They notice that; the Sunset Yellow FCF administered in these studies was obtained at the local market and that its specifications or purity were not defined as requested by FAO on food labelling. This scenario was very similar to our finding with no label identifying the purity of their colourants or other additives been employed in the biscuits manufacturing. The JECFA and SCF panel decided to reduce the ADI, by an extra uncertainty factor of 2.5, to 1 mg/kg bw/day and to make this value of the ADI temporary for 2 years. Within this period, clarification of the effects of Sunset Yellow FCF on the testis, sperm morphology and sperm mobility should be provided, based on a 28-day study performed according to the recently updated OECD test guideline.

Furthermore, it was revealed that the toxicity of biscuit found in DUCA, had a toxicity ratio of 1:2 with no define ADI by the manufacturers on their products. A prevalence rate of 28% chances of toxicity was recorded with biscuits having potentials to cause harm to it consumers. Also, the present of salt as major ingredient in these biscuits makes it as earlier mention another urgent area for research, since they present pre-disposing factors for the development of overweight, hypertension and other heart related problems as future public health problems. To better apprehend the urgent necessity for policy reinforcement on food safety and security and consumer protection, a larger scale study on the health effects related to biscuits consumption by Cameroonian is paramount. And the need to involve several sources of biscuits and the various exposure age groups associated to biscuits consumption in Cameroon will be an added advantage. The absences of substantial data on confectionary products and the shallow/unreliable product information knowledge to Cameroonian consumers on food additives on the various products been marketed in DUCA still remain a great dilemma for independent bodies like ANOR and CLC in Cameroon that need to ensure consumer safety and rights.

## Conclusion

The absent of reliable standard and measure to guard biscuits consumers of which children are the majority is still very lacking in Cameroon. This lacking can be shown by the high level of uncontrolled and proliferated food additives within the Cameroonian territory. The ministry of public health, the Cameroon league of consumer, ANOR and the ministry of commerce and all other policy makes directly or indirectly involve in policy making need to urgently draft strong polices and strategies to protect their population; starting with the population tutelage. The high demand for biscuits product by Cameroonian today if not control would be a catalyzing tool to increase the prevalence of existing public health problem like hypertension, heart related problems and respiratory crises.

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