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Evaluation of microbiological quality of raw milk, sour milk and artisanal yoghurt from Ouagadougou, Burkina Faso

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The present study was undertaken to investigate the microbiological quality of milk and artisanal dairy products sold in Ouagadougou markets. Forty-five (45) samples of milk and dairy products including raw milk, sour milk and yoghurt were collected and analyzed for aerobic mesophilic bacteria (AMB), total coliforms (TC), thermotolerant coliforms (TTC), *Staphylococcus aureus (S. aureus)*, lactic acid bacteria (LAB) and yeasts and moulds (YM). The coliforms bacteria were then purified and identified by using API 20E system. The mean values of TC, TTC, *S. aureus* LAB and YM in the raw milk were 8.95, 6.43, 6.21, 4.83, 8.01 and 4.78 log cfu mL^{-1} respectively, In sour milk they were 10.44, 5.62, 4.12, 6.98, 7.38 and 3.75 log cfu mL^{-1} respectively, while in yoghurt samples the mean values of TC, TTC, *S. aureus* LAB and YM were 9.98, 5.77, 5.50, 6.12, 9.78 and 4.86 log cfu mL^{-1} respectively. The dominant coliforms isolated from raw milk, sour milk and yoghurt samples were found to be *Escherichia coli*, *Klebsiella pneumonia* and *Enterobacter cloacae*. *Citrobacter* spp was not found in any of the analyzed samples. The wide range of the samples analyzed did not comply with the standards quality. Thus it is necessary to set up an awareness program including capacity building of all the actors working in the sector of milk and dairy products.

Key words: Raw milk, sour milk, yoghurt, microbiological quality, Ouagadougou.

INTRODUCTION

Milk and dairy products are important components of a healthy diet. However, they can present a health hazard due to the possible contamination with pathogenic bacteria when there are consumed unpasteurized or expose to environment, (Angulo et al., 2009). More than 200 known diseases are transmitted through food contaminated by pathogenic bacteria, fungi, viruses, and parasites (Oliver et al., 2005). The prevalence of food

borne pathogens in milk is influenced by numerous factors such as farm size, number of animals on the farm, hygiene, farm management practices, variation in sampling and types of samples evaluated, differences in detection methodologies used, geographical location, and season (Oliver et al., 2005). In Burkina Faso, livestock production increase results in the diversification of supply especially in the dairy sector (Hamadou et al., 2004). There is an important demand of milk and dairy products although the dairy potential is particularly important with 250 million liters of milk per year of bovine origin mainly (Hamadou and Sanon, 2005; Corniaux, 2013). A significant part of production sold to people is found in the informal sector without any control. Milk and its derivatives are sold in dubious circumstances in the local markets. The actors of this form of marketing of the products are often both producers and sellers and the sale of milk is a cultural activity. It is practiced generally by the Fulani ethnic group whose main activity is farming. Raw milk is processed at home, and thereafter left for spontaneous fermentation or transported to the market in calabashes. Other dairy products such as dégué, yoghurt, gappal, tchobal are also sold (Hamadou and Sanon, 2005; Hama et al., 2009). Sour milk is mostly packaged in recycled bottles and sold by street food vendors resulting from the fermentation of unpasteurized raw milk (Bagré et al., 2014). Several studies reported the presence of enterobacteria, *Salmonella,* yeast and *Staphylococcus aureus* in the raw milks and sour milk sold in Burkina Faso markets and their consumption can seriously affect the health of consumers (Barro et al., 2002; Savadogo et al., 2004; Bagré et al., 2014; Sissao et al., 2015). These studies showed that *Escherichia coli* and *Salmonella* strains isolated from raw milk and sour milk consumed in Ouagadougou and Ziniaré were resistant to antibiotics. All of the isolates were resistant to amoxicillin-clavulanic acid, 90% of the isolates were resistant to erythromycin and 75 to 78.26% to amoxicillin (Bagré et al., 2014).

The objective of this study is to assess the hygienic quality of commercially available dairy products in Ouagadougou markets and to identify the eventual coliforms and *Staphylococcus* found.

MATERIALS AND METHODS

Sampling

The collection of the samples took place from October 2013 to May 2014 at five markets in Ouagadougou, Burkina Faso. Raw milk, sour milk and yoghourt sold in five markets of Ouagadougou (codified market A, market B, market C, market D and market E) were concerned by the sampling. Three (03) samples of each product were collected by market. A total of forty five samples were collected in sterile bottles and transported to the laboratory in cold chain under temperature 4°C and analyzed within 24 h of sampling.

Physico-chemical analysis

The physico-chemical analysis was measured according to standard methods. pH values of the samples were measured with an electronic pH meter by homogenizing 10 mL of product and 10 mL of distilled water, (CONSORT P901, Belgium). Total titratable acidity (TA) was measured by titrating 10 mL of sample against N/9 sodium hydroxide (NaOH) solution using phenolphthalein as indicator and dry matter (DM) content was measured using standard procedure (AOAC, 2005).

Microbiological analysis

For preparation of stock solutions, there were tenfold dilutions and inoculation on agar plates. For all the determinations, 10 g of the samples were homogenized in a stomacher with 90 mL of sterile peptoned buffered water. Tenfold serial dilution was prepared and spread-plated for microorganisms count. 1 mL of suitable diluted was used for spreading except *S. aureus* enumeration. Aerobic mesophilic bacteria (AMB) were enumerated on pour plates of Plate Count Agar (Liofilchem, Italy) incubated at 30°C for 72 h (ISO 4833, 2003).

Yeasts and moulds were counted by cultivation on Sabouraud-Chloramphenicol Agar (Liofilchem, Italy) after incubation at 25°C for 4 to 5 days according to ISO 7954 (1988) standard. Lactic acid bacteria (LAB) were counted by cultivation on De Man, Rogosa and Sharpe Agar (Merck, Germany) incubated anaerobically in an anaerobic jar at 37°C, for 3 days according to ISO 15214 (1998) standard.

S. aureus counts were determined by spreading 0.1 mL of a suitable diluted sample onto the surface of Baird-Parker agar (Liofilchem, Italy) containing Egg Yolk Tellurite Emulsion. The inoculated plates were incubated at 37°C for 48 h. For confirmation, one vial of coagulase test (Liofilchem, Italy) was aseptically reconstituted with 4 mL of physiological solution. Presumed colonies were purified and transferred in tubes containing 5 mL of brain-heart infusion and incubated for 6 h at 37°C. 0.5 mL of culture broth were then mixed with 0.5 mL of coagulase test and incubated at 37°C for 6 h in order to observe coagulation (positive result). For negative result after 6 h, the tube was incubated overnight for a new observation (French Standard EN ISO 6888-2, 2003). Coliforms were enumerated on Violet Red Bile Agar (VRBA) (Liofichem, Italy), incubated at 37°C (TC) or 44°C (TTC) for 24 h according to International standard ISO 4832 (2006)..

Identification of coliforms bacteria and determination of pathogenic germs prevalence

For identification of coliforms, the colonies on VRBA were picked were obtained. A total of 181 coliforms bacteria were isolated. The isolates were first characterized based on colony and cell

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Table 1. Physico-chemical and microbiological (log cfu.mL^{-1} ± SE) characteristics of raw milk.

Characteristics	Standard values*	Markets					Mean
		A	B	C	D	E	
pH	6.6-6.8	6.34±0.09^{a}	6.14±0.13^{a}	6.31±0.04^{a}	6.27±0.00^{a}	6.39±0.27^{a}	6.29±0.05
TA (°D)	15-17	26.25±5.75^{b}	69.50±13.00^{a}	23.50±7.50^{b}	30.25±0.00^{b}	21.50±5.00^{b}	33.84±5.86
DM (%)	12.8	8.89±2.07^{a}	8.16±4.01^{a}	7.34±3.62^{a}	5.54±0.00^{a}	7.58±4.59^{a}	7.32±1.07
AMB	<5.48	8.20±0.92^{b}	8.17±0.55^{b}	9.57±0.01^{a}	7.64±0.00^{b}	5.83±0.69^{b}	8.95±0.43
TC	<3	6.08±1.57^{b}	7.00±0.26^{a}	5.57±0.12^{b}	0.00±0.00^{b}	4.46±0.58^{b}	6.43±0.84
TTC	<2	5.93±1.62^{ab}	6.80±0.41^{a}	5.20±0.76^{ab}	0.00±0.00^{b}	4.41±1.57^{ab}	6.20±0.82
YM	<3.3	5.41±0.34^{a}	4.48±0.81^{ab}	2.74±0.03^{b}	4.23±0.00^{b}	3.87±2.09^{b}	4.83±0.46
LAB	nd	7.45±0.00^{a}	7.64±0.66^{a}	8.58±2.00^{a}	7.43±0.00^{a}	5.15±1.89^{a}	8.00±0.60
S. aureus	<2	4.17±0.70^{bc}	3.28±0.61^{c}	5.26±0.27^{a}	5.15±0.00^{ab}	3.43±1.04^{c}	4.78±0.39

AMB: aerobic mesophilic bacteria, TC:total coliforms, TTC : thermotolerant coliforms *S. aureus: Staphylococcus aureus* LAB : lactic acid bacteria YM: yeasts and moulds. The same letter (a, b, c) in the same column indicated no statistical difference (p≥0.05). Results are expressed as the mean of three independent determinations with the standard error (SE). cfu refers to Colony Forming Unit. *FAO (1978).

morphology (Parkouda et al., 2010), Gram staining, catalase test, 3-hydroxy-butanone production (VP test), acids mixt fermentation (RM test), oxidase test. Gram reaction was carried out by the KOH (3%) method (Gregersen, 1978), catalase was determined by adding to a colony on a glass slide a drop of H_2O_2 solution (30%). Oxidase reaction was carried out by using oxidase disc. VP reaction and RM reaction was carried out on the Clark and Lubs broth (Clark and Lubs, 1915; Sevastianos, 1977). The analytical profile index (API) tests kits were used for identification of presume coliforms (*E. coli; Enterobacter* spp*, Citobacter* spp and *Klebsiella* spp). The API test kits used were API 20 E Kit, which were prepared and performed according to the manufacture manual bioMerieux (system for the identification of *Enterobacteriaceae*). Apiweb STAND ALONEV.1.1.0 software (Biomérieux) was used for isolates identification.

Statistical analysis

Each sample was analyzed in triplicate. Microbial counts were converted to log cfu mL^{-1}. All the results were subjected to Analysis of variance (ANOVA) using SPSS (version 20). Means, standard error of means and the least significant difference between the means were determined ($p < 0.05$).

RESULTS AND DISCUSSION

The present study investigated the microbiological and physico-chemical quality of artisanal milk products (raw milks, sour milks and yoghurts) sold in Ouagadougou. The results from the raw milks are presented in Table 1. The pH values of raw milk from the 5 markets varied from 6.14 to 6.39. The mean value (6.29) is lower than FAO standard and the pH value (6.60) reported by Akabanda et al. (2010). This low pH prevents the growth of most spoilage and pathogenic organisms (Varga, 2007). The titratable acidity (TA) values ranged from 21.50°D to 69.50°D corresponding to 33.84±5.86°D as mean value. This value is higher than FAO standard and those reported by Varga (2007) where the milk titratable acidity varied from 18.1°D to 21.0°D.

The dry matter contents in raw milk samples varied from 5.54 to 8.89% with a mean value of 7.32±1.07%. The mean value was lower than those recommended by FAO (1978) which is 128 g L^{-1} (12.8%).

Concerning the aerobic mesophilic bacteria of raw milk from the 5 markets, the values varied from 5.83 log cfu mL^{-1} (market E) to 9.57 log cfu mL^{-1} (market C) corresponding to 8.95 log cfu mL^{-1} as mean value. This value is higher than FAO standard (5.48 log cfu mL^{-1}). Torkar et al. (2008) and Aaku et al. (2004) reported 4.51 log cfu mL^{-1} and 6.74 log cfu mL^{-1} as total number of micro-organisms in raw milk, respectively, which is lower than in our experiment (8.95 log cfu mL^{-1} as mean value). According to the Regulatives EU (Regulation 853, 2004) the rolling geometric average of total number of micro-organisms should not exceed 5 log cfu mL^{-1} of raw cow's milk from primary production.

Total coliforms counts ranged from 0.00 (market D) to 7 log cfu mL^{-1} (market B) corresponding to 6.43 log cfu mL^{-1} mean value. The number of thermotolerant coliforms varied from 0.00 (D) to 6.80 log cfu mL^{-1} (B) corresponding to 6.20 log cfu mL^{-1} as mean value. Kas et al. (2013) reported 2.7 log cfu mL^{-1} as thermotolerant coliforms concentration in milk, which is lower than our mean value. Moreover it is important to note that no coliform (both total and thermotolerant) was detected in D market samples. In this market standards are respected (<3 log cfu mL^{-1}).

The incidence of coliforms in raw milk has received considerable attention, partly due to their association with contamination of fecal origin and the consequent risk of more pathogenic fecal organisms being present, partly because of the spoilage their growth in milk at ambient temperatures can produce. Coliform counts regularly in excess of 2 log are considered as evidence of

Table 2. Physico-chemical and microbiological quality (log cfu mL^{-1} ± SE) of sour milk by market.

Characteristics	Standard values	Market					Mean
		A	B	C	D	E	
pH	≤ 4.5^{+}	5.47±0.60^{a}	4.37±0.43^{a}	4.36±0.59^{a}	4.50±0.55^{a}	4.17±0.58^{a}	4.57±0.24
TA (°D)	≤ 30*	82.69±9.00^{a}	115.88±29.70a	29.56±5.83^{a}	84.13±32.17^{a}	92.69±40.62^{a}	80.99±12.59^{b}
DM (%)	nd	4.98±0.79^{a}	6.55±2.27^{a}	6.22±0.65^{a}	6.71±0.39^{a}	7.84±1.93^{a}	6.46±0.60
AMB	≥7*	11.00±1.21^{a}	8.23±0.08^{a}	6.91±0.67^{a}	7.57±0.12^{a}	10.55±0.76^{a}	10.44±0.36
TC	<2$^{\lambda}$	0.00±0.00^{b}	5.11±1.20^{a}	6.07±0.31^{a}	5.90±5.90^{a}	1.68±0.54^{a}	5.63±0.59
TTC	<1	0.00±0.00^{a}	4.44±1.09^{a}	3.75±0.89^{a}	1.28±1.28^{a}	0.40±0.25^{a}	4.11±0.40
YM	nd	7.23±1.08^{a}	6.56±0.74^{a}	6.08±0.85^{a}	7.23±0.56^{a}	6.69±0.38^{a}	6.98±0.32
LAB	≥7*	7.08±1.43^{b}	7.84±0.32^{a}	6.57±0.48^{b}	7.14±0.09^{b}	7.36±0.30^{ab}	7.38±0.35
S. aureus	<2$^{\lambda}$	1.15±0.32^{a}	1.40±0.39^{a}	3.43±0.46^{a}	4.39±0.47^{a}	2.04±0.16^{a}	3.75±0.29

AMB: aerobic mesophilic bacteria, TC: total coliforms, TTC : thermotolerant coliforms *S. aureus: Staphylococcus aureus* LAB : lactic acid bacteria YM: yeasts and moulds. The same letter (a, b, c) in the same column indicated no statistical difference (p≥0.05). Results are expressed as the mean of three independent determinations with the standard error (SE). cfu refers to Colony Forming Unit. +FAO (1978), *Codex Standard for Fermented Milk (243-2003), $^{\lambda}$ ANZFA (2000).

unsatisfactory production hygiene (Directive 92/46/EEC). Sporadic high coliform counts may also be a consequence of unrecognised coliform mastitis, mostly caused by *E. coli* (Torkar et al., 2008).

The concentration of yeasts and moulds in milk samples ranged from 2.74 to 5.41 log cfu mL^{-1}.The mean number of yeasts and moulds found in raw milk samples of this study (4.83 log cfu mL^{-1}) is higher than the mean yeast count (2.64 log cfu mL^{-1}) in raw milk from farms located in different areas of Sardinia (Fadda et al., 2004). It is also worth noting that two out of five market (C and E) samples examined had viable yeast counts lower than 4 log cfu mL^{-1}, a level required by Codex Alimentarius (Codex, 2004). In that case, it is documented that yeasts occur in raw milk at insignificant numbers probably due to competitive utilization of the growth substrates by psychrotrophic bacteria of milk or owing to inhibition by metabolites excreted by bacteria (Viljoen, 2001).

LAB counts ranged between 5.15 log cfu mL^{-1} (market E) and 8.58 log cfu mL^{-1} (market C). The mean value (8.00 log cfu mL^{-1}) is lower than those obtained by Akabanda et al. (2010) in Fulani raw milk from northern Ghana (4.69 log cfu mL^{-1}).

The concentration of *S. aureus* in raw milk varied from 3.28 log cfu mL^{-1} (market B) to 5.26 log cfu mL^{-1} (market C) and the mean value was 4.78 log cfu mL^{-1}. No sample contained a concentration of *S. aureus* lower than 2 log cfu mL^{-1}, a limit required by FAO (1978). The presence of those bacteria in milk indicated the contamination from various sources, such as animal, human, environment, utensils and others (Mubarack et al., 2010; Tankoano, 2014). The high numbers of the microorganisms indicated that milk is contaminated by external microorganisms as well as internal microorganisms. This might be due to the fact that milk is a good nutritive medium for the growth of microorganisms, especially with poor sanitary procedures and lack of the cooling facilities (Mubarack et al., 2010). *S. aureus* has been linked to gastroenteritis by producing enterotoxins, boils, skin infections, pneumonia, deep abscesses and meningitis in debilitated persons *(*Okpalugo et al*.,* 2008*).*

The physico-chemical and microbiological quality of sour milk and yoghurt collected from Ouagadougou markets are shown in Tables 2 and 3, respectively. The results showed that the physic-chemical and microbiological quality of sour milk and yoghurt varied according the markets.

The pH of sour milk ranged between 4.17 (market E) and 5.57 (market A) corresponding to 4.57 as mean value; the pH for yoghurt samples varied from 3.98 (C) to 4.80 (B) corresponding to 4.33 as mean value. Similar values (3.84 to 4.48) were reported by Omafuvbe and Enyioha (2011) for yoghurt. According to Codex Alimentarius (2004), the pH of fermented milks and yoghourt should not exceed 4.5.

The titratable acidity of sour milk varied from 29.56°D to 115.88°D leading to 80.99°D as mean value while the titratable acidity for yoghurt ranged from 96.83 to 191.50 corresponding to 93.08 as mean value. These mean values were above minimum admitted limit 30°D and 60°D by Codex alimentarius (2004) respectively for fermented milks and yoghourt. Our results were similar to those reported by Kantinan et al. (2012) and Tidjani (2013).

The total bacterial count in sour milk varied from 6.91 to 11.00 log cfu mL^{-1}; the mean concentration (10.44±0.36 log cfu mL^{-1}) was higher than those obtained by Kantinan et al. (2012). In yoghurt samples, the total bacterial ranged between 7.64 and 10.69 log cfu mL^{-1} with a mean value of 9.98±0.58 log cfu mL^{-1}. According to Samet-Bali

Table 3. Physico-chemical and microbiological (log cfu mL^{-1} ±SE) quality of yoghurt by market.

Characteristics	Standard values	Market					Mean
		A	B	C	D	E	
pH	≤ 4.5^{+}	4.67±0.70^{a}	4.80±0.18^{a}	3.98±0.03^{a}	4.22±0.25^{a}	4.04±0.14^{a}	4.33±0.15
TA (°D)	≥60*	96.83±8.35^{c}	158.83±19.22^{ab}	191.50±11.25^{a}	172.10±9.65^{a}	117.67±26.24^{bc}	148.93±10.72
DM (%)	nd	19.54±7.11^{a}	26.40±1.98^{a}	24.09±5.24^{a}	31.87±5.23^{a}	27.43±6.94^{a}	26.24±2.41
AMB	≥7*	8.36±0.45^{a}	8.30±0.19^{a}	7.64±0.94^{a}	8.08±1.60^{a}	10.69±0.95^{a}	9.98±0.58
TC	<2$^{\wedge}$	4.25±0.22^{b}	2.11±0.76^{b}	6.47±0.53^{a}	4.92±1.34^{b}	0.00±0.00^{b}	5.777±0.6
TTC	<1	4.00±0.16^{b}	0.00±0.00^{b}	6.20±0.66^{a}	4.83±1.30^{b}	0.00±0.00^{b}	5.50±0.6
YM	nd	5.81±0.55^{a}	5.62±0.58^{a}	4.11±0.30^{a}	5.36±0.29^{a}	6.76±1.35^{a}	6.12±0.29
LAB	≥7*	8.17±0.53^{a}	7.07±0.61^{a}	7.44±0.91^{a}	8.25±1.02^{a}	10.50±0.98^{a}	9.78±0.42
S. aureus	<2$^{\wedge}$	3.63±0.21^{a}	2.36±0.56^{a}	1.72±0.73^{a}	5.45±0.79^{a}	1.38±0.20^{a}	4.86±0.42

AMB: aerobic mesophilic bacteria, TC: total coliforms, TTC : thermotolerant coliforms *S. aureus: Staphylococcus aureus* LAB : lactic acid bacteria YM: yeasts and moulds. The same letter (a, b, c) in the same column indicated no statistical difference (p≥0.05). Results are expressed as the mean of three independent determinations with the standard error (SE). cfu refers to Colony Forming Unit. +FAO (1978), *Codex Standard for Fermented Milk (243-2003), $^{\wedge}$ ANZFA (2000).

et al. (2012), the dominance of mesophilic bacteria may be explained by the fact that the ambient temperature at which the natural fermentation of the samples took place is favorable for the proliferation of mesophilic bacteria.

LAB counts ranged from 6.57 to 7.84 log cfu mL^{-1} in the sour milk samples with a mean value of 7.38 log cfu.mL^{-1} and from 7.07 log cfu.mL^{-1} to 10.50 log cfu mL^{-1} in yoghurt samples with a mean value: 9.78 log cfu mL^{-1}. These data showed that LAB are the dominating microorganisms in sour milk and in yoghurt. Our results are similar to those reported by Akabanda et al. *(*2010) in Ghana which was 4.00 to 9.00 log cfu mL^{-1} and Nyambane et al. *(*2014) in Kenya which was 7.26 to 8.08 log cfu mL^{-1} in traditionally fermented milk products.

Yeasts and moulds counts in sour milk samples varied from 6.08 log cfu mL^{-1} with a mean value of 6.98 log cfu mL^{-1}. Abdalla and Ahmed (2010) reported on 4.17 to 5.70 log cfu mL^{-1} of the concentration of yeast and mold in Sudanese fermented dairy product, which is lower than in our results.

The concentration of yeasts and moulds in yoghurt samples ranged from 4.11 log cfu mL^{-1} to 6.76 log cfu mL^{-1} corresponding to 5.10±0.24 log cfu mL^{-1} as mean concentration. These values were higher than 2 log cfu mL^{-1} the limit recommended by Egyptian standards (2005) for yoghurt. Contamination due to yeast is still one of the major limiting factors for shelf life and commercial value of yoghurt. Moulds and yeasts growing in yoghurt and sour milk utilize some of the acid and produce a corresponding decrease of the acidity, which may favorable for the growth of putrefactive bacteria (Oyeleke, 2009).

S. aureus counts in sour milk varied from 1.15 to 4.39 log cfu mL^{-1} corresponding to a mean concentration of 3.75 log cfu mL^{-1}, which is higher than those reported by Abdalla and Ahmed (2010). Staphylococcal count in yoghurt ranged between 1.38 and 5.45 log cfu mL^{-1} with a mean concentration of 4.86 log cfu mL^{-1}. This value is higher than standard (< 2 log cfu mL^{-1}) and those obtained by Bonfoh et al. (2002) result which was 4.5 log cfu mL^{-1}.

A total of 182 coliforms isolates were regrouped according to morphological, physiological and biochemical characteristics and 41 isolates were identified.

The study indicates (Table 4) that the dominant coliforms associated with the dairy products were *Klebsiella* spp, *Enterobacter* spp, and *E. coli*. Here, no *Citrobacter* was identified in isolates. Other bacteria such as *Brucella, Serratia* spp*, Pantoea* spp*, Pasteurella* spp were also observed among the isolated stocks. The presence of those bacteria in dairy products indicated the contamination from human or by animals. The presence of coliforms in dairy products is not acceptable by safe food consumption standards. These organisms are highly pathogenic and may cause serious diseases for human. The frequency of *E. coli* was similar to those obtained by Bagré et al. (2014) (38% for raw milk and 44% for sour milk). The presence of *Serratia* and *Brucella* indicated the presence of mastitis in the cow milk (Bonfoh et al., 2002). The identification of these germs thus justifies the need for a follow-up of the animals, the screening of the pathogenic bacteria in the dairy products as well as the evaluation of their resistance to antibiotics usually used in Burkina Faso.

Conclusion

The results of the present work provide an overview on

Table 4. Frequency percentages of some coliforms isolated from milk, sour milk and yoghurt collected from local markets at Ouagadougou (Burkina Faso).

Isolates	Raw milk	Sour milk	Yoghurt	Total
E. coli	(5/15) 33.33	(2/15) 13.33	(1/15) 6.67	(8/45) 17.78
Klebsiella spp	(15/15) 100	(5/15) 33.33	(4/15) 26.66	(24/45) 53.33
Klebsiella pneumoniae	(10/15) 66.67	(3/15) 20.00	(4/15) 26.68	(17/45) 33.78
Enterobacter spp	(13/15) 86.66	(3/15) 20.00	(2/15) 13.33	(18/45) 40.00
Enterobacter cloacae	(10/15) 66.67	(1/15) 6.67	(2/15) 13.33	(13/45) 28.89

the microbiological quality of raw milk, sour milk and artisanal yoghurt sold in Ouagadougou markets. Raw milk, sour milk and yoghurt samples collected from the five markets were found to contain total coliforms, thermotolerant coliforms, *S. aureus*, lactic acid bacteria and yeasts and moulds at concentrations varying according to the markets as well as the microorganisms. Most of the samples examined were contaminated with microbes at the levels exceeding regulatory limits thus making these products inappropriate for human consumption. This study revealed that artisanal milks and dairy products from Ouagadougou markets including the raw milk, sour milk and yoghourt represents a risk for consumers and also for public health. The hygienic quality of commercial milk and dairy products must be improved considerably. Further studies should be undertaken to determine the source of the spoilage organisms. Therefore, it is necessary to set up an awareness program including capacity building of all the actors working in the sector of milk and dairy products.

Conflict of interests

The authors have not declared any conflict of interests.

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