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Microbiological Quality of Traditional and Commercial Weaning Foods in Jimma Town, Southwestern Ethiopia

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Abstract
Weaning food is normally a semi-solid food that is used in addition to breast milk and not only to replace it and are mostly prepared in the form of thin porridges or gruels. The aim of the present study was to evaluate the Microbiological quality of traditional and commercial weaning foods in Jimma town, southwestern Ethiopia. Food samples of the boiled milk, atimit and cerifam were tested for the presence of microorganisms. The food samples were tested for the presence of *aerobic mesophilic bacteria, Enterobacteriaceae, staphylococcus, coliform*, yeast and mold. The total count of Aerobic mesophilic bacteria on boiled milk, cerifam and atmit is 2.9×10^4, 2.3×10^4 and 1.3×10^4 respectively. While total count of Enterobacteriaceae from food samples of boiled milk, cerifam and atmit were 2.7×10^4, 1.1×10^4 and 5.1×10^3 respectively. Also the total count of Staphylococcus from food samples of boiled milk, cerifam and atmit were 9.3×10^3, 7.8×10^3 and 8.7×10^3 respectively. Similarly the total count of Coliforms from food samples of boiled milk, cerifam and atmit were 6.3×10^3 1.5×10^3, and $<1\times10^3$ respectively and the total count of yeast and mold from food samples of boiled milk, cerifam and atmit were 3.2×10^2, 1.6×10^2 0.5×10^2, and 2.5×10^2, 0.5×10^2, 0.5×10^2 respectively. From the analysis of our study boiled milk and cerifam was contaminated but Atmit was relatively saved.
Keywords: weaning food, cerifam ,atmit, boiled milk, *aerobic mesophilic bacteria, Enterobacteriaceae, staphylococcus, coliform*, yeast and mold

1. INTRODUCTION

Microbial contamination leading to infections and poor nutrient associated with weaning foods may contribute significantly to deaths of 13 million infants and children aged less than five years worldwide each year (Motarjemi *et al.,* 1993). After respiratory infections, diarrhoeal diseases are the commonest illness and have the greatest negative impact on the growth of infants and young children (Tetteh *et al.,* 2004). The causes of diarrhoeal diseases have traditionally been ascribed to water supply and sanitation (Rowland *et al.,* 1978).

To prevent such diseases, governments and non-governmental organizations have focused their efforts on and sometimes limited to improving water supply and sanitation and promoting and protecting breastfeeding with less emphasis on food safety(. This issue is increasingly becoming important in national and international debates about agriculture, nutrition, and health. Food safety is not a luxury of the rich but a right of all people (WHO, 2003).

Educational programmes based on the hazard-analysis-critical-control-point approach, taking into consideration also sociocultural factors, should be integrated into all national infant-feeding or food and nutrition programmes (Blais *et al.,* 2005). Food-borne infections can have dangerous and long-term effects, especially on nutritional status. Formula-fed infants usually require formula for their first year but they are introduced to other kinds of foods once they reach six months of age.

Based on literature, weaning foods prepared under unhygienic conditions are frequently heavily contaminated with pathogens and may, thus, be a major factor in causing diarrhoeal diseases and associated malnutrition. In particular, traditional gruels used in The Gambia for supplementing breastmilk were found to be heavily contaminated with potentially pathogenic micro-organisms, and such supplements are important factors in weaning-related diarrhoea (Iroegbu *et al*., 2000). Therefore, it appears that current efforts are not sufficient to prevent diarrhoeal diseases; thus, education of mothers in food-safety principles, particularly weaning foods, must also receive high priority (Motarjemi *et al.,* 1993). In jimma town isolation and characterization of microorganisms from weaning food of any type was not identified yet. But identifying it is must for growth of healthy children. Therefore the aim of the current study were to evaluate the quality of different traditional and commercial weaning food samples in terms of microbial load and to identify more perishable weaning food sample.

2. Materials and methods

2.1. Study area and Study period

The study was conducted in Jimma University, post graduate research laboratory.

2.2. Sample collection

A total of 3 samples from commercial weaning foods such as cerifam and traditional weaning food atmit and boiled milk was collected in sterile glass bottles using aseptic technique from super markets and Jimma

specialized and teaching hospital in Jimma town respectively. All the samples were freshly or immediately brought to the laboratory and microbial analyses were conducted in one to two hours of collection.

2.3 Sample preparation

A 10 ml of each of weaning foods were separately measured and mixed to 90ml diluent (0.15% peptone water). Then the food sample was homogenized in diluent for one minute using vortex mixer. From this homogenized sample 1ml of the sample was transferred to the first test tube containing 9 ml diluent by pipette to make serial dilution of the homogenize sample until 10^{-2} dilution factor .All this process were repeated for each food samples (Garbutt, 1997). From each dilutions 0.1 ml of suspension was spreaded on various types of solid media for microbial count, the count were taken from plate contain microbial load between 30 and 300 colony.

2.4. Enumeration

2. 4.1. Aerobic mesophilic counts (AMC)

From appropriated dilutions, 0.1 ml aliquots were spread plated in duplicates on pre-solidified surfaces of plate count agar (PCA) plates and incubated at 30-33°C for 24 -48 hours, finally, colonies were counted from countable plates.

2.4.2. Counts of Enterobacteriaceae

From the appropriate serial dilution 0.1 ml aliquots was seed in duplicate on pre-solidified surfaces of macConkey agar and incubated at 30-32 °C for 18-24 hours after which pink to read –purple colonies counted as member of a family of Enterobacteraceae.

2.4. 3. Counts of coliforms

From the appropriate serial dilutions 0.1 ml aliquots was seed in duplication pre-solidified surfaces of violet Red Bile Agar (VRBA) and incubated at 30-32°C for 18-24 hours to count colonies of coliform that is purplish red colonies surrounded by reddish zone of precipitated bile were counted as coliforms.

2. 4. 4. Counts of staphylococci

From appropriate serial dilution 0.1ml aliquots was seed in duplicate on solidified surfaces of Mannitol Salt Agar (MSA) plates, the plates were incubated at 30-32°C for 24 -36 hours yellow colonies on media were counted as staphylococci

2. 4.5. Colony characterization

After enumeration of aerobic mesophilic bacteria, characterize for colony morphology, and, biochemical test, like Gram reaction, catalase test, KOH test and the general morphology or form of the colony and the shape of the edge or margin were determined by looking down at the top of the colony. The nature of the colony elevation is apparent when viewed from the side as the plate is held at eye level. Based on form (punetiform, circular, Filamentous, irregular, Rhizoid and spindle), elevation (Flat, Raised, convex, pulvinate and umbonate and margin (entire, undulate Lobate, Erose, Filamentous, curled) and pigmentation, (pale, yellow, white, red, purple etc)

2.4.6 Some Biochemical tests

2.4.6.1 KOH-test (test on lipopolysaccharide)

One or two drops of 3% KOH solution was placed on a clean microscopic slide. A colony was aseptically picked from the surface of Plate count agar using an inculcating loop and stirred in the KOH solution for 10 s to 2 min. The inoculating loop was raised slowly from the mass, when the KOH solution become viscous, the thread of slime followed the loop for 0.5 to 2 cm or more in gram-negative bacteria. When there will no slime, but a watery suspension that do not follow the loop, the reaction were considered negative and the isolate was considered as Gram positive bacteria. (Gregerson, 1978).

2.4.6.2 Catalase test

A young colony was flooded with a 3% solution of hydrogen peroxide (H_2O_2). The formations of bubbles indicate the presence of an enzyme Catalase.

2. 4.7 YEAST AND MOLDS COUNTS

From appropriate dilutions, 0.1 ml aliquot was spread-plated on pre-solidified surfaces of Potato Dextrose agar supplemented with 0.1g Chloramphenicol and incubated at 25-28 ^{o}C for 5-7 days (Spencer *et al*., 2007). Smooth (non-hairy) colonies without extension at periphery (margin) were counted as yeasts. Hairy colonies with extension at periphery were counted as molds.

3. Result and Discussion

3.1 Microbial loads in tested food sample

All weaning food items considered in this study were boiled foods except cerifam. Most people believe that commercial and traditional weaning foods as safe and use for their infants. But our study was showed that boiled milk, atmit and cerifam are highly loaded by microbial population including aerobic mesophlic count, coliforms, enterobacteriacae, Staphylococcus as well as yeast and mold (Table 1). as Ikeh *et al.* (2001) have been reported

that the prevalence of enteric bacterial pathogens, such as *Bacillus cereus*, *Staphylococcus aureus, Vibrio cholerae, Campylobacter jejuni*, *Salmonella,* and *Shigella,* found in weaning foods in many developing countries. In developing countries, up to 70% of diarrhoeal episodes are traced to pathogens transmitted from weaning food (Motarjemi *et al*., 1993). It has further been shown that weaning foods prepared under unhygienic conditions are frequently contaminated with enteric bacterial pathogens that are major aetiological agents of diarrhoeal diseases and associated malnutrition. One of the major enteric bacterial pathogens found frequently in weaning foods is Escherichia coli (Kaul *et al*., 1996). 43.7% of weaning food samples in an Egyptian village harboured *E. coli* (Afifi *et al*., 1998). In a related study in Zimbabwe, 16% of food samples also harboured *E. coli*. Most food items used for the composition of weaning foods, such as groundnuts, maize, and other oilseeds, are vulnerable crops to moulds, especially *Aspergillus parasiticus* and *A. flavu*s that produce aflatoxins (AFs) (Jimoh and Kolapo, 2008). These toxigenic fungi grow well. However, it is more serious in tropical countries of the world where humidity is high and the temperature is conducive for the growth and production of AFs. AFs are potent carcinogens, mutagens, teratogens, and immunosuppressants. In addition to being potent carcinogens, AFs may contribute to early growth faltering of the child (Turner *et al.,* 2003), and strong associations have been reported around the weaning stage in Beninese infants (Gong *et al*., 2004). A study in Beninese children reported that secretory IgA in saliva may be reduced by dietary levels of AF. The immune status of Ghanaian adults has been reportedly affected by exposure to AFs (Jiang *et al.,* 2005). The result were also show that From isolated colonies 78.2% of them were gram positive and the remaining 21.8 of them were gram negative by KOH test and From isolated colonies 95.3 % of them were catalase positive.according to the result three of food samples dominated by spoilage microorganisms of both bacterial and fungal species . in addition there was high count of microbs found in boiled milk , next in cerifam and least count in atimit weaning food sample . this was due to poor handling ,cooking and storage of stake holders. This result were in line with (WHO, 2002) which is Water sources, consisting mainly of rivers, boreholes, and fountains, used by rural communities for domestic and drinking purposes, are usually faecally-contaminated and devoid of treatment. Faecally-contaminated water, an important vehicle for transmitting pathogenic microorganisms, may account for a high degree of morbidity and mortality. Although traditional weaning foods in East Africa are known to be of low nutritive value *Guiro et al.* (1987) and are characterized by low protein, low energy density, and high bulk density.

Table 1: Counts of microorganisms

N_o	Microorganismes	Food sample		
		Boiled milk(CFU/ml)	atmit(CFU/ml)	Cerifam (CFU/ml)
1	Aerobic mesophilic bacteria.	2.9×10^4	1.3×10^4	2.3×10^4
2	Enterobacteriaceae	2.7×10^4	5.1×10^3	1.1×10^4
3	Staphylococcus	9.3×10^3	8.7×10^3	7.8×10^3
4	Coliform	6.3×10^3	$<1\times10^3$	1.5×10^3
5	yeast	3.2×10^2	0.5×10^2	1.6×10^2
6	mold	2.5×10^2	0.5×10^2	0.5×10^2
Mean		**$7.22x10^4$**	**$1.5x10^2$**	**$9.85x10^3$**

3.2. Colony morphology of the isolated microorganisms from food sample

White and yellow colors were dominant in the AMC colonies. The shapes of most colonies were irregular, their margins were undulated and their elevations were convex (Figure 1). Light yellow and few pink colors were dominated in the Enterobacteriaceae colonies. The shape most colonies were irregular, their margins were undulated Figure 2. The colonies of staphylococcus were yellow in color, their shapes were circular, their margins were entire and their elevation were pulvinate (Figure 3). The colonies of coliform were pink in color, their shape was circular and their elevations were pulvinate (Figure 4). The colonies of yeast and mold were white color and greenish color with mycelium ramification respectively (Figure 5).

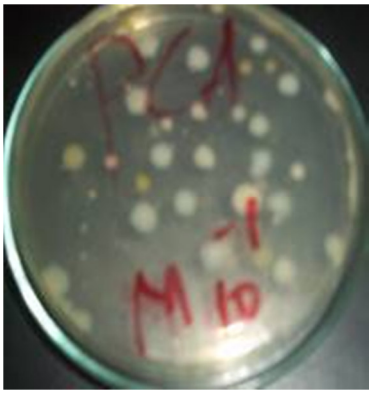

Figure 1: Colonies of aerobic mesophilic bacteria on plate count agar

Figure 2: Colonies of enterobacteriaceae on MacConkey agar

Figure 3: Colonies of staphylococcus on Manitol Salt agar

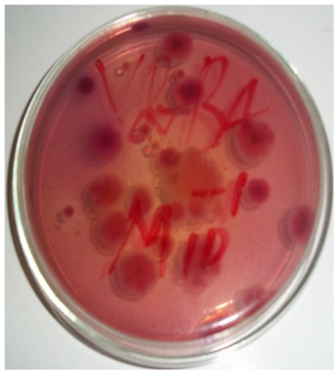

Figure 4: Colonies of coliforms on Violet Red Bile Agar

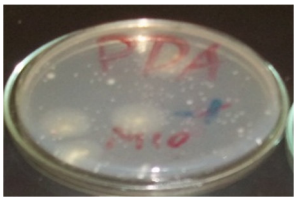

Figure 5: Colonies of yeast and mold on Potato Dextrose Agar

4. Conclusion and recommendations

From the analysis of our study the boiled milk was highly contaminated but Atmit was relatively saved that had been taken from Jimma specialized teaching hospital. In addition to that cerifam from supper market also contaminated. .Food samples such as boiled milk and cerifam were highly risked for consumption. So, the people those use traditional and commercial weaning food should take awareness for the hazardness of these weaning food. Health workers and nutritionists can educate rural mothers about the importance of adequate weaning foods and practices, infant health, host defense system, homescale drying, processing, and so on. Eventually, awareness creation of mothers in weaning food hygiene and continues supervision of supermarkets by stake holders specially sanitarians to improve the quality of weaning food that sell in different supermarkets in Jimma town.

5. REFERENCES

Afifi, Z.E, Nasser, S.S, Shalaby, S, Atlam, S.A. (1998). Contamination of weaning foods: organisms, channels and sequelae. J Trop Pediatr 44: 335-337.

Ikeh, E.I, Okwudili, P.E, Odumodu, C.U. (2001). Microorganisms associated with locally available infant weaning foods in Jos and Environs, Nigeria. Nig J Paediatr 28: 7.

Blais, B.W., Leggate, J, Bosley, J. and Martinez-Perez, A. (2005). Detection of Escherichia coli 0157 in foods by a novel polymyxin-based enzyme-linked immunosorbent assay.J Food Prot 68: 233-238.

Gong , Y. Hounsa, A, Egal ,S., Turner, P.C., Sutcliffe. A.C. and Hall, A.J. (2004). Postweaning exposure to aflatoxin results in impaired child growth: a longitudinal study in Benin, West Africa. Environ Health

Perspect 112:1334-1338.

Guiro, A.T., Sail, M.G., Kane, O., Diarra, D. (1987): Protein-caloric malnutrition in Senegalese children. Effects of rehabilitation with a pearl weaning food. Nutr Rep Int: 36: 1071- 9.Senegal.

Iroegbu, C.U., Ene-Obong, H.N., Uwaegbuta, A.C and Amazigo, U.V (2000). Bacteriological quality of weaning food and drinking water given to children of market women in Nigeria: implications for control of diarrhoea. J Health Popul Nutr;18: 157-162.

Jiang, Y., Jolly, P.E., Ellis, W.O., Wang, J.S. And Phillips, T.D. (2005). Aflatoxin B1 albumin adduct levels and cellular immune status in Ghanaians. Int Immunol

Jimoh ,K.O. And Kolapo, A.L. (2008). Mycoflora and aflatoxin production in market samples of some selected Nigerian foodstuffs. Res J Microbiol 3: 169-174.

Motarjemi, Y, Kaferstein , F, Moy, G, Quevedo, F. (1993). Contaminated weaning food: a major risk factor for diarrhea and associated malnutrition. Bull World Health Organ; 71: 79-92.

Rowland, M.G., Barrel, R.A. and Whitehead, R.G. (1978). Bacterial contamination in traditional Gambian weaning foods. Lancet. 136-138.

Spencer, k., John, F.T. and Spencer, A.L. (2007). Food Microbiology Protocols, Homana Press, Totowa, New Jersey, Indian.

Tetteh ,I.K., Frempong, E.and Awuah, E. (2004). An analysis of the environmental health impact of the Barekesse Dam in Kumasi, Ghana. J Environ Manage; 72: 189-194.

Turner, P.C, Moore, S.E., Hall, A.J., Prentice, A.M.Wild, C.P. (2003). Modification of immune function through exposure to dietary aflatoxin in Gambian children. Environ Health Perspect 111: 217-220.

World Health Organization, (2003). UN Food and Trade Standards Commission opens meeting to adopt new standards for foods and revise others, Rome. (http://www.who.int/media centre/news/ releases/2003/pr53/en/, accessed on 10 January, 2012).

World Health Organization. Water for development: a practical advocacy guide for World Water Day 2002. (http://www.worldwaterday.org/advocacy/M index.html, accessed on 5th January, 2012).