

EFFECTS OF AQUEOUS AND ETHER EXTRACT OF *Moringa oleifera* SEED ON QUALITY OF WEST AFRICAN SOFT CHEESE

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ABSTRACT

The study assessed the effect of different levels of ether and aqueous extracts of *Moringa oleifera* (MO) seed on the nutritional quality and microbial stability of West African soft cheese. Using a completely randomized design, the cheese samples were treated independently with 3 levels (1%, 2%, and 3%) each of ether and aqueous extracts of MO seed. The results showed that 2% and 3% ether extract of the MO seed has the numerically least bacteria count ($p > 0.05$). The aqueous extract treated cheese has high moisture content than the ether extract. The 3% ether extract treated cheese had the highest protein and fat content but 2% aqueous treated cheese had the highest ash content. The sensory analysis revealed that the taste of cheese preserved with ether extracts was preferred to that of aqueous and the control. It was concluded that MO seed extract resulted in significant increase in the nutritive and improved microbial stability of cheese. The ether extract of the seed has the prospect of being used to improve the quality of West African soft cheese.

Key Words: Soft Cheese, Moringa seed Extract, Aqueous, Ether

INTRODUCTION

The contribution of cheese to human nutrition and well-being is age-long. Kashtanova (2010) reported that one third of the world's milk production is used for cheese manufacturing. Cheese is a rich source of essential nutrients - in particular, proteins, bioactive peptides, amino acids, fat, fatty acids, vitamins and minerals (Walther *et al* 2008).

Cheese is made in almost every country in the world with the existence of more than 2,000 varieties (O'Connor, 1993). The West African soft cheese (*wara*) is the popular cheese type in Nigeria, with a shelf life of 2-3 days when immersed in whey (Belewu, 2006). Various attempts have been made to increase its shelf life with preservatives (Aworh and Egunlety, 1985; Anon, 1995) Propionic acid at 0.8%, and sodium benzoate at 0.8% have been reported to effectively preserve *wara* for 8 days (Joseph and Akinyosoye, 1997). Belewu and Morakinyo (2009) as well as Badmos and Abdulsalam, (2012) reported that preservation of soft cheese with honey can improve the nutritional and sensory qualities and inhibit microbial spoilage. Ashaye *et al.* (2006) also studied some cheese preservative properties of *Aframomum*

danielli. Mahami et al., (2012) reported preliminary studies in which *Moringa oleifera* seed extract significantly improved the nutritive value of cottage cheese. The objectives of the study included the determination of cheese preservative potency of aqueous and ether extracts of *Moringa oleifera* seed, the effect of the preservative on nutrient value of West African soft cheese, and the optimal level of this preservative to inhibit the growth of spoilage micro-organisms.

MATERIALS AND METHOD

Preparation of *Moringa oleifera* seed extracts: The seeds used were obtained from the University of Ilorin Moringa Plantation, sorted, air dried for 24 hours and crushed. The aqueous extract was derived as the crushed material was vortexed to mix (Mahami et al, 2012). The ether extract was obtained by extracting the crushed MO seed with a soxhlet extractor, using petroleum ether (Ghandhi, 2012).

Preparation of Cheese: The cheese was prepared in the Dairy Science Laboratory of the University of Ilorin, similar to the method described by Belewu (2006), Ashaye et al (2006) and Badmos and Joseph (2012). Sodom apple leaves were obtained from the University of Ilorin premises, weighed and crushed with sterile mortar and pestle. It was sieved with a muslin clot. The juice obtained (3 ml thereof), fortified with varying levels of MO seed extract, was used to coagulate 100 ml of warm milk (50°C) in an aluminum cup, heated in a water bath, and the heating continued to 90°C.

Treatments: Seven varying levels of extract, added to the coagulant, and subsequently to the 100 ml milk represented the treatments. Each treatment was done in triplicates, as shown in Table 1.

Table 1. Treatments consisting of *Moringa oleifera* Extracts

Treatments	Extract Added	Percentage(%)
1	1ml MO seed ether extract	1
2	2ml MO seed ether extract	2
3	3ml MO seed ether extract	3
4	1ml MO seed aqueous extract	1
5	2ml MO seed aqueous extract	2
6	3ml MO seed aqueous extract	3
7	No Extract	Control Sample

Total Bacterial Count: One gm of the sample was weighed into a sterile McCartney bottle containing 9 ml of sterile distilled water, this was shaken thoroughly and carefully. A sterile insulin syringe was used to draw out 1ml of the

solution and put in another bottle containing 9 ml distilled water, the process was repeated to a serial dilution of 10^{-4} . One ml of the 10^{-4} dilution was put into each petri dish and sterile molten agar cooled at 45°C was poured into each petri dish and swirled to cover the plate and sample. The plates were allowed to solidify and incubated at 37°C for 24 hours. The colonies observed on the plates were counted and recorded. The morphologies of the observed colonies were also recorded (Fawole and Osho, 2004).

Proximate Analysis: The moisture, protein, fat, and ash contents of the samples were determined using the methods of AOAC (1990).

Sensory Evaluation: This involved the assessment by a taste panel consisting of 30 trained members, of the following cheese qualities; Color, Taste, Aroma, Texture and Acceptability (Lammond, 1970; Badmos and Joseph, 2102), using a nine point hedonic scale. The most acceptable cheese sample was scored 1, and the most unacceptable scored 9.

Statistical Analysis: The data obtained was subjected to analysis of variance using a complete randomized design. Duncan's multiple range test was used to analyze the difference between the means of the results (Steel and Torrie, 1980).

RESULTS AND DISCUSSION

Bacteria Population : The 2% and 3% ether extracts of MO seed had the least bacterial count while control had the highest bacteria count ($p < 0.05$), 1% aqueous extract of MO seed also showed high antibacterial properties ($p < 0.05$). According to Aney *et al.* (2009) Moringa seeds contain an antibiotic principle known as pterygospermin which is responsible for destruction of micro-organisms in water. Ether is commonly used selectively for the extraction of coumarins and fatty acids (Cowan, 1999). Plant extracts from organic solvents have been found to give more consistent antimicrobial activity compared to water extract. Also water soluble flavonoids (mostly anthocyanins) have no antimicrobial significance and water soluble phenolics only important as antioxidant compound (Das *et al.*, 2010). Many fatty acids are known to have antibacterial properties (Russel, 1991), which may have resulted in the low bacteria load of the ether extracts in the present study. It was observed that 3% of MO ether extract was most effective in reducing the bacterial count. The extra effectiveness of MO ether extract could be attributed to the solvent and method of extraction used for the experiment (Okigbo *et al.*, 2004).

Table 2: Some Proximate and Microbial Assay of West African Soft Cheese Treated with *Moringa oleifera* Seed Extract.

Parameters	Moisture (%)	Ash (%)	Fat (%)	Protein (%)	Bacteria Count (10 ⁴ cfu/g)
CONTROL	56.02 ^b	0.84 ^a	15.93 ^a	9.61 ^a	88.00 ^d
1% ETH	46.88 ^a	2.80 ^c	20.98 ^c	10.50 ^{ab}	67.00 ^c
2% ETH	47.28 ^a	0.95 ^a	21.63 ^d	10.35 ^{ab}	1.63 ^a
3% ETH	47.18 ^a	2.70 ^{bc}	22.63 ^e	23.10 ^e	1.70 ^a
1% AQ	56.48 ^b	2.15 ^b	20.95 ^c	15.40 ^b	51.33 ^b
2% AQ	56.40 ^b	3.80 ^d	22.75 ^f	10.50 ^{ab}	88.33 ^d
3% AQ	68.18 ^c	2.25 ^{bc}	20.55 ^b	9.40 ^a	85.33 ^d

*abc value within columns not sharing common superscripts are significantly different (P<0.05)

Note: Aq/Eth/cfu means: Aqueous/ Ether/ Colony forming unit, respectively.

Nutritional Quality: Cheese from 3% aqueous MO extract had the highest moisture content at 68.18 %, and aqueous extract cheese were high in moisture (p<0.05), which may be as a result of the seed being extracted with water. The ether extracts had moderate moisture content, which may be due to the oil that was in the extract. Control cheese also had a high moisture content at 56.02 % (p<0.05). This may be responsible for the high bacteria count. The influence of MO seed extract on the moisture content of cheese did not however follow any clear pattern. This may have been as a result of the lack of a standard pressing and draining process. High moisture content is very important for microbial growth and the shelf life of cheese (Fraizier and Westhoff, 2008). Internationally, moisture content of up to 80% is acceptable for (soft) cottage cheese (Potter and Hotchkiss, 1995). All the moisture content recorded in this work fall within this range. Cheese treated with 3% MO ether extract had the highest protein content. The 3% aqueous extract MO cheese had the least protein content of 9.40%, followed by control which may be due to its high moisture content. This does not agree with Mahanmi *et al.* (2011) who stated that protein contents of cheese increased directly with increases in aqueous extract MO levels in cheese. This was however true for the ether extracts. The high concentration of the nutrients in MO seed may have accounted for the observed increase in protein, fat, ash contents in the cheese samples. Cheese treated with 3% had the highest fat content, this is due to the addition of the oil from the ether extract. Aqueous extract also had high fat content which is perhaps a result of the oil extracted by the water in the aqueous extract, and the control had the lowest fat content. Research indicates that fatty acids have antimicrobial properties (Russel, 1991; Debois and Smith 2010), which may be the reason why ether extract had higher antibacterial property than aqueous extract of MO seed. The 2% aqueous treated cheese had the highest ash content (3.80 %), with control having the lowest (0.84 %). The control cheese was lowest in ash content. High ash content of cheese

appear generally linked to high mineral content of MO seed. This observation suggests that MO seed enrichment may have generally increased the mineral content of cheese.

Table 3: Sensory Analysis of West African Soft Cheese Treated with *Moringa oleifera* Seed Extract.

	Colour	Texture	Aroma	Taste	Acceptability
Control	8.05 ^c	7.90 ^g	7.70 ^g	7.83 ^g	7.77 ^g
1% ETH	8.03 ^e	7.77 ^f	7.37 ^e	7.20 ^f	7.17 ^f
2% ETH	7.43 ^b	7.13 ^c	6.97 ^b	6.77 ^b	6.57 ^b
3% ETH	6.60 ^a	6.13 ^a	5.87 ^a	5.57 ^a	5.60 ^a
1% AQ	7.47 ^{bc}	7.23 ^d	7.47 ^e	7.00 ^d	6.87 ^e
2% AQ	7.60 ^d	7.27 ^e	7.17 ^d	7.03 ^e	6.73 ^d
3% AQ	7.50 ^c	6.57 ^b	7.07 ^c	6.80 ^c	6.67 ^b

*abc value within columns not sharing common superscripts are significantly different (P<0.05)

Note: Aq/Eth/ means: Aqueous/ Ether, respectively.

Sensory Quality: The 3% ether extracted cheese supported better colour, taste, aroma, texture, and general acceptability. The taste of the ether extracted MO seed cheese was preferred to the aqueous and the control. This could be attributed to flavour of the MO seed oil that is non-sticking, non-drying oil and that resists rancidity (Tsaknis *et al.*, 1999). The control samples were least preferred, closely followed by the aqueous sample, and the ether treated samples were the most accepted, apparently for the value of the MO seed oil.

CONCLUSION AND RECOMMENDATION

MO seed extract enrichment resulted in significant increase in the protein content and mineral content of West African soft cheese and therefore has the potential to be used in improving the yield and quality of soft cheese. Ether extract was better in microbial inhibitory potential and nutritive cum sensory quality enhancement than aqueous and control. It is therefore recommended that ether extract of MO seed (at 3%) be used as preservative for West African soft cheese. There is need for more research to be carried out on the use of ether extracts of MO seed, particularly being complemented with other additives as preservative (blends) of West African soft cheese.

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