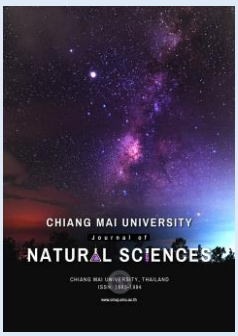

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Research article

Antioxidant and Antimicrobial Properties of *Moringa oleifera* Leaves and Pods Extracts in Pork Meatballs During Cold Storage

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Abstract Effects of *M. oleifera* leaves and pods extracts on physicochemical properties, free radical scavenging properties, antimicrobial activities and sensory attributes of pork meatballs were evaluated during cold storage at 4°C for 15 days. The preparation of pork meatballs was divided into eight treatments as control, 0.02% butylated hydroxytoluene (BHT), 0.2% leaves and pods aqueous extract, 0.4% leaves and pods aqueous extract, 0.8% leaves and pods aqueous extract. Aqueous leaves extract showed highest level of total phenolic (67.18 mg GAE/g extract) and flavonoid contents (5.60 mg CE/g extract) compared to those observed in aqueous pods extract as 55.17 mg GAE/g extract and 3.54 mg CE/g extract, respectively. The leaves extract had strongest antioxidant activity against DPPH radicals with IC_{50} 49.85 µg/ml while the pods extract exhibited IC_{50} 99.31 µg/ml. According to pork meatballs analysis, meatballs samples with addition of aqueous leaves extract exerted higher antioxidant activities in a concentration-dependent manner that were performed by higher DPPH scavenging activity and lower TBARs values in comparison with aqueous pods extract. Conversely, *M. oleifera* pods extract showed highest antibacterial activity against all tested foodborne bacterial strains including *Staphylococcus aureus* (TISTR 1466), *Bacillus cereus* (TISTR 678), *Escherichia coli* (TISTR 780), *Salmonella typhimurium* (ATCC 13311) with lowest MIC (1.56 mg/ml) and MBC (3.13 mg/ml) in agreement with the decrease of total microbial counts as compared to control and BHT samples. The meatballs with pods extract possessed higher sensory attributes scores than those added with the leaves extract. In conclusion, 0.8% pods extracts effectively retarded lipid oxidation as well as decreased microbial growth in pork meatballs during cold storage. However, it was point out that inferior sensory scores were affected by increasing additional the extract in the meatballs. Therefore, the use of Moringa extracts should be carefully applied in the meatballs for avoidance of lowering consumer acceptance.

Keywords: Antimicrobial, Antioxidant, *M. oleifera*, Pork meatballs

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