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Effect of Fat Types on Camel Meat Emulsion

A Thesis Submitted by

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Abstract

(**Keywords:** camel meat, fats, fatty acid profile, chemical composition, camel luncheon, chitosan)

The current study was designed to evaluate the technological properties of different camel fats (hump, mesentery and renal) as well as the effect of incorporation of different camel fat in the production of a stable and acceptable camel meat emulsions. Camel fats and camel meat emulsion were subjected to investigation of the chemical composition, physicochemical properties, microstructure, fatty acid profile and sensory quality. The sensory panel scores are significantly differed between the hump and other fats. Hump fat had significantly higher moisture, protein, and collagen content, while higher fat content was recorded in mesenteric fat. The fatty acid analysis showed that hump had higher SFA and very low PUFA in comparison with both renal and mesenteric fat. Camel fats had high oxidation stability, and the mean values were very low in comparison with the levels of quality and acceptability. The ultrastructural analysis showed that hump fat had highest elastin fibres which increase its hardness. The results indicated that both renal and mesenteric fat were more suitable for the production of various meat products than the hump. For the investigation of the effect of using camel fats on quality attributes of experimentally produced camel emulsion, three trials-based experiments with three independent replicates were performed. The use of different camel fats induced significant differences in the moisture, fat, and collagen contents which affect the water-holding capacity, batter viscosity, and emulsion stability. The mean values of the fatty acids, shear force, instrumental color indices, and the ultrastructure of the luncheon sausage revealed the presence of significant differences between the treatments. The meat batter produced with mesenteric and renal fat exhibited more stable emulsion than the hump. The addition of chitosan improved the sensory parameters of camel luncheon with a distinct antioxidant effect and a pronounced emulsion stabilization. Therefore, chitosan can be applied to overcome the problems associated with the high connective tissue content and extreme thermal stability of the camel meat and to produce more stable products through 5 months of refrigerated storage.

Dedication

To My Father & Mother

MY Sisters

My Wife

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First of all, prayerful thanks to ***ALLAH,*** *for everything I have.*

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LIST OF ABBREVIATIONS

AMSA	American Meat Science Association
AOAC	Association of Official Analytical Chemists
AOCS	American Oil Chemists' Society
CIE	Commission on Illumination
FAO	Food and Agriculture Organization
FR	Fat Released
PUFA	Poly Unsaturated Fatty Acids
SEM	Scanning Electron Microscopy
SFA	Saturated Fatty Acids
TBA	Thiobarbituric Acid
TBARS	Thiobarbituric Acid Reactive
TCA	Trichloroacetic Acid
TFR	Total Fluid Released
UFA	Unsaturated Fatty Acids
USFDA	US Food and Drug Administration
WHC	Water Holding Capacity
WR	Water Released

Chapter 1

Introduction

Chapter 1
INTRODUCTION

The one-humped camel (*Camelus dromedaries*) plays an important role in the life of human beings in many parts of the world. It considered a valuable source of meat in arid regions of Africa and Asia where the climate is unfavorable for the optimal performance of the other animals **(Kadim *et al.*, 2006; Kadim and Mahgoub, 2006).** The world population of camels is 28,455,693 heads, which produces about 542198 tons of meat **(FAOSTAT, 2018).** Camel meat has comparable qualities and nutritive value to that of beef **(Kurtu, 2004, Kadim *et al.*, 2009)** however, many consumers found it of low sensory quality especially tenderness relative to other animals **(Soltanizadeh *et al.*, 2010).**

The continuous changes in the global meat market and the need for more healthy products directed the meat producers to seek healthy alternatives. Fortunately, camel meat can produce promising material to the fast-growing demand for animal protein particularly for low-income populations **(Rashed, 2002).** Camel meat and fat can be used for production of various products as a suitable solution for the consumer dissatisfaction of camel meat to improve its sensory quality **(Mansour and Ahmed, 2000; Kadim *et al.*, 2008a),** and produce more healthy products which satisfy the consumer request for low calories products **(Saparov and Annageldiyev, 2005).** Camel fats contain higher unsaturated fatty acids content as well as lower levels of saturated fats, cholesterol, and calories in comparison with other red meats **(Kadim *et al.*, 2013; Gheisari and Ranjbar, 2012).**

Both the consumer awareness associations and the health organizations recommended the reduction of the total dietary fat, particularly saturated fatty acids and cholesterol to control cardiovascular diseases**.** However, the reduction of animal fat resulted in an unacceptable sensory quality **(Colmenero, 2000),** and the direct addition of vegetable oils as a simple fat replacer can deteriorate the physical quality of the products **(Youssef and Barbut, 2011),** therefore, the use of camel fats is considered a satisfactory technology. Incorporation of camel fat from different depots during the processing of various meat products e.g., dry sausages **(Sbihi *et al.*, 2013),** emulsion sausage **(Mohamed *et al.*, 2015),**

and ground type products **(Heydari *et al.*, 2016; Zaki, 2017)** constitute a suitable substitute due to its acceptable nutritional criteria and health aspects**.**

In recent years, the consumer demand for fast foods has been increased rapidly due to the changes in lifestyle. Emulsion sausage is one of the most popular meat products in Egypt. The most common raw meat material used for the production of luncheon sausage is beef. The increasing price of beef persuades meat processors to evaluate the possibility of utilization of other low-cost materials, e.g. camel meat. The camel meat is an excellent raw material for the formulation of various meat products, however, the heat stability of the high connective tissue content **(Kadim *et al.*, 2008a)** constitutes a problem of concern which necessitates the addition of an emulsion stabilizer**.**

Chitosan is an innovated food additive that can be used as a gelling and emulsifying agent **(Klinkesorn, 2013),** a color stabilizer **(Suman *et al.*, 2010),** antifungal, antibacterial and antioxidant agent **(Cutter, 2006; Benhabiles *et al.*, 2012; Mantilla *et al.*, 2013).** It is one of the most abundant polysaccharides. Chitosan has been approved as a food additive in many countries. The several exceptional properties e.g. non-toxic, non-allergenic **(Kumar *et al.*, 2004**), good biodegradability, biocompatibility **(Tharanathan and Kittur, 2003),** the ability to transform into gels **(Şenel and McClure, 2004),** the non-digestibility and the bland taste favor the commercial application of chitosan in various meat products **(Chhabra, 2004).** Moreover, chitosan also used as edible film coatings **(Elsabee and Abdou, 2013).**

The differences between fats from the different anatomical locations may affect the quality of the product. Moreover, the technological properties of camel meat are not fully understood. Therefore, the main objectives of the current study were to:

1. Study the quality attributes and fatty acid profile of camel fats from different anatomical locations.
2. Study the technological properties of camel meat and fats as raw materials for the manufacturing of camel luncheon sausage.
3. Study the feasibility of using chitosan to stabilize the camel meat emulsion.

Chapter 2

Review Article

Chapter 2
REVIEW ARTICLE

The impact of technological properties of camel meat and fats on the stabilization of meat emulsion

2.1. Abstract

The rapid increase of populations over recent decades is associated with concomitant increase and a great diversity in meat consumption. Camel can fulfill the basic demands of a wide spectrum of consumers. The camel can provide substantial amounts of meat at a reasonable price especially in areas where the climatic conditions are not suitable for other farm animals. The camel meat represents an integral part of the human diet in many developing countries of Asia and Africa. It can overcome the shortage of meat, processed into various products, enhance the development of the meat industry, and ultimately maintain food security. Moreover, there is an increasing demand for camel meat worldwide basically because of its unique chemical composition and health reasons. Camel meat contains lower fat and cholesterol and higher PUFA and proteins in comparison with other red meats. The technological properties of both meat and fats of camel cause several technological problems during the production of different meat products especially the highly specified products e.g., meat emulsions. Therefore, the current paper will highlight the chemical composition of camel meat and the technological characteristics of camel meat and fat as well as the probable corrections for emulsion instability.

Keywords: Camel meat, fat, technological properties, emulsion, chitosan.

2.2. Introduction

Camel is an inimitable animal that can survive unfavorable environmental conditions and the shortage of feed. It plays a critical socio-economic role to provide the food security in many of semi-dry and arid zones in Africa and Asia where the climate adversely affects the production of other red meat animals **(Gebreyohanes and Assen, 2017)**. FAO estimated that the world camel population is about 28 million, 95% of which