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Fatty acids profile in the Camel

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Abstract

There are around 16 million camels alive as of 2015, with 90% being dromedaries.Dromedaries alive today are domesticated animals (mostly living in the Africa, the Sahel, Maghreb, Middle East and South Asia), in Egypt, which has the camel herd gives milk, food, and transportation.

In this review article, illustrated fatty acids profile, characterizations constitution, distributions on the Camel with especial references to the main consuming product milk and meat with special interest to Camel hump.

Key Words: Camel, *FA; fatty acid*. ,SFA: short chain saturated fA, MUFA; monounsaturated FA, and PUFA; polyunsaturated FA, Milk, Meat and hump, Fatty acid composition,

REVIEW

A camel is an even-toed ungulate within the genus ***Camelus***, bearing distinctive fatty deposits known as "humps" on its back. The two surviving species of camel are the dromedary, or one-humped camel (C.dromedarius), which inhabits the Middle East and the Africa; and the bactrian, or two-humped camel (C. bactrianus), which inhabits Central Asia. Both species have been domesticated; they provide milk, meat, hair for textiles or goods such as felted pouches, and areworking animals with tasks ranging from human transport to bearing loads***(Worboys, et al., 2010).***

The term "camel" is derived from a Latin and Greek (*camelus* and κάμηλος *kamēlos*, respectively)from Hebrew or P hoenician *gāmāl*. The Hebrew meaning of the word *gāmāl* is derived from the verb root g.m.l, meaning (1) stopping, weaning, going without; or (2) repaying in kind. This refers to its ability to go without food or water, as well as the increased ability of service the animal provides when being properly cared for."Camel" is also used more broadly to describe any of the six camel-like mammals in the family Camelidae***(Fleming, 1909).***the two true camels and the four New World

camelids: the llama, alpaca, guanaco, and vicuña of South America***.(Douglas, 2012).***

The average life expectancy of a camel is 40 to 50 years.[8][9] A full-grown adult camel stands 1.85 m (6 ft 1 in) at the shoulder and 2.15 m (7 ft 1 in) at the hump***(National Geographic,2012)***Camels can run at up to 65 km/h (40 mph) in short bursts and sustain speeds of up to 40 km/h (25 mph***)(Safari,2012).*** Bactrian camels weigh 300 to 1,000 kg (660 to 2,200 lb) and dromedaries 300 to 600 kg (660 to 1,320 lb)***(Falconer,1868)***.

Camels do not directly store water in their humps as was once commonly believed. The humps are actually reservoirs of fatty tissue: concentrating body fat in their humps minimizes the insulating effect fat would have if distributed over the rest of their bodies, helping camels survive in hot climates***(Factsheets. 2012***). When this tissue is metabolized, it yields more than one gram of water for every gram of fat processed. This fat metabolization, while releasing energy, causes water to evaporate from the lungs during respiration (as oxygen is required for the metabolic process): overall, there is a net decrease in water***(Zidana, et ak., 2011).***

A camel's thick coat is one of its many adaptations that aid it in desert-like conditions.Camels have a series of physiological adaptations that allow them to withstand long periods of time without any external source of water***(Mukasa, 1981)***. .Unlike other mammals, their red blood cells are oval rather than circular in shape. This facilitates the flow of red blood cells during dehydration***(Rastogi, 1971)*** and makes them better at withstanding high osmotic variation without rupturing when drinking large amounts of water: a 600 kg (1,300 lb) camel can drink 200 L (53 US gal) of water in three minutes***(William, 2009).***Camels are able to withstand changes in body temperature and water consumption that would kill most other animals. Their temperature ranges from 34 °C (93 °F) at dawn and steadily increases to 40 °C (104 °F) by sunset, before they cool off at night again.[Maintaining the brain temperature within certain limits is critical for animals; to assist this, camels have a rete mirabile, a complex of arteries and veins lying very close to each other which utilizes countercurrent blood flow to cool blood flowing to the brain.***(Anette, 1999)*** Camels rarely sweat, even when ambient temperatures reach 49 °C (120 °F). Any sweat that does occur evaporates at the skin level rather than at the surface of their coat; the heat of vaporization therefore comes from body heat rather than ambient heat. Camels can withstand losing 25% of their body weight to sweating, whereas most other

mammals can withstand only about 12–14% dehydration before cardiac failure results from circulatory disturbance. (***Inside Nature's Giants,2011).***

When the camel exhales, water vapor becomes trapped in their nostrils and is reabsorbed into the body as a means to conserve water.(***Lewis, 1981)*** Camels eating green herbage can ingest sufficient moisture in milder conditions to maintain their bodies' hydrated state without the need for drinking***(Eitan, et al ,1976).***

Domesticated camel calves lying in sternal recumbency, a position that aids heat loss. The camels' thick coats insulate them from the intense heat radiated from desert sand; a shorn camel must sweat 50% more to avoid overheating.[27] During the summer the coat becomes lighter in color, reflecting light as well as helping avoid sunburn. The camel's long legs help by keeping its body farther from the ground, which can heat up to 70 °C (158 °F**.**Dromedaries have a pad of thick tissue over the sternum called the *pedestal*. When the animal lies down in a sternal recumbent position, the pedestal raises the body from the hot surface and allows cooling air to pass under the body.

Camels' mouths have a thick leathery lining, allowing them to chew thorny desert plants. Long eyelashes and ear hairs, together with nostrils that can close, form a barrier against sand. If sand gets lodged in their eyes, they can dislodge it using their transparent third eyelid. The camels' gait and widened feet help them move without sinking into the sand***.(Rundelet al., 2005).***

The kidneys and intestines of a camel are very efficient at reabsorbing water. Camel urine comes out as a thick syrup, and camel feces are so dry that they do not require drying when the Bedouins use them to fuel fires(***Fedewa,2000)***.

Camels' immune system differs from those of other mammals. Normally, the Y-shaped antibody molecules consist of two heavy (or long) chains along the length of the Y, and two light (or short) chains at each tip of the Y. Camels, in addition to these, also have antibodies made of only two heavy chains, a trait that makes them smaller and more durable. These "heavy-chain-only" antibodies, discovered in 1993, are thought to have developed 50 million years ago, after camelids split from ruminants and pigs***(Taylor et al., 1968).***.

Domesticated camels at the Pyramids of Giza, Egypt were found. The karyotypes of different camelid species have been studied earlier by many groups,***(Koenig,2007).*** but no agreement on chromosome nomenclature of camelids has been reached. A 2007 study flow sorted camel chromosomes,

building on the fact that camels have 37 pairs of chromosomes (2n=74), and found that the karyotime consisted of one metacentric, three submetacentric, and 32 acrocentric autosomes. The Y is a small metacentric chromosome, while the X is a large metacentric chromosome.***(Bunch, et al., 1985).***

According to molecular data, the New World and Old World camelids diverged 11 million years ago***(Di Berardino, et al., 2006).*** In spite of this, these species can still hybridize and produce fertile offspring. The cama is a camel–llama hybrid bred by scientists who wanted to see how closely related the parent species were***(Sapir-Hen, et al.,2013)***. Scientists collected semen from a camel via an artificial vagina and inseminated a llama after stimulating ovulation with gonadotrophin injections. The cama has ears halfway between the length of camel and llama ears, no hump, longer legs than the llama, and partially cloven hooves***.(Elena et al., 2007).*** According to cama breeder Lulu Skidmore, cama have "the fleece of the llamas" and "the strength and patience of the camel***(Bromiley, 1982)*** Like the mule,

In the world, the genus *Camelus*includes two species cohabiting in the same areas and even on the same farms: the one humped camel (*Camelusdromedarius*) and the Bactrian two-humped camel (*Camelusbactrianus*), and their hybrids (***Karray et al., 2005).*** Dietary lipids play an important role in nutrition and health. They supply calories and essential fatty acids, act as carriers of fat soluble vitamins, and increase the palatability of the food. But for decades they have been at the center of controversy with respect to toxicity, obesity, and disease A diet high in saturated fatty acids has been correlated with chronic diseases of the cardiovascular system ***(Lichtenstein et al., 1998)***. In contrast, a diet with a suitable amount of unsaturated fatty acids may have a good effect on the prevention of chronic heart disease.Therefore, the analysis and the content of fatty acids in foods are essential for nutritional and health purposes ***(Wayua et al., 2004)***.

The Canel's Milk:

Camel milk is a staple food of desert nomad tribes and is sometimes considered a meal in and of itself; a nomad can live on only camel milk for almost a month.Bulliet,**.** Camel milk is rich in vitamins, minerals, proteins, and immunoglobulins***(Shamsia, 2009)***; compared to cow's milk, it is lower in fat and lactose,***(Bulliet,1975).*** and higher in potassium, iron, and vitamin C. Bedouins believe the curative powers of camel milk are enhanced if the camel's diet consists of certain desert plants***(FAO's Animal Production,2012).*** Camel milk can readily

be made into a drinkable yogurt, as well as butter or cheese, though the yields for cheese tend to be low***(Mukasa-Mugerwa, (1981)***.

Camel's milk has supported Bedouin, nomad and pastoral cultures since the domestication of camels millennia ago. Herders may for periods survive solely on the milk when taking the camels on long distances to graze in desert and arid environments***(Abu-Zidana, et al,2011)***.

Camel dairy farming is an alternative to cow dairy farming in dry regions of the world where bovine farming consumes large amounts of water and electricity to power air-conditioned halls and cooling sprinkler systems. Camel farming, by utilising a native species well-adapted to arid regions, able to eat salty desert plants, has been linked to de-desertification by UNESCO. Camel milk can be found in supermarkets in the UAE, Somalia, Saudi Arabia, Mauritania, and the United States***(Bernstein,2009)***.

Camel milk is a rich source of proteins with potential antimicrobial and protective activities; these proteins are not found in cow milk or found only in minor amount. Camel milk has enough nutrients to sustain a person through the day. In many countries, camel milk is given to babies suffering from malnutrition***(Eitan, et al., 1976)***.

Compared to cow, buffalo and ewe milk fat, camel milk fat contains fewer short-chained fatty acids, but the same long-chained fatty acids can be found. Some researchers claim that the value of camel milk is to be found in the high concentrations of linoleic acid among other polyunsaturated fatty acids, which are essential for human nutrition***(Silverstein, et al., 2008)***. Camel milk has more fat and protein than cow's milk.[1] Cholesterol in camel milk is lower than cow or goat milk.

Camel milk has a high vitamin and mineral content and immunoglobin content.[2] Camel milk is three times higher in vitamin C than cow's milk and 10 times higher in iron. It is also high in unsaturated fatty acids and B vitamins but lower in vitamin A and B2 (than cow milk). The composition of camel milk depends on its feed and species: Bactrian milk has a higher fat content than dromedary milk***(Davidson and Davidson, 2006)***.

Camel milk is lower in lactose than cow's milk.[3] However, levels of potassium, magnesium, iron, copper, manganese, sodium and zinc are higher than in cow's milk***(Koenig, 2007)***.

Camel milk cannot be made into butter by the traditional churning method. It can be made if it is soured first, churned, and a clarifying agent is then

added.[15] Until recently, camel milk could not be made into camel cheese because rennet was unable to coagulate the milk proteins to allow the collection of curds***(McGregor, 2006)***. Developing less wasteful uses of the milk, the FAO commissioned Professor J.P. Ramet of theÉcoleNationaleSupérieured'Agronomie et des Industries Alimentaires, who was able to produce curdling by the addition of calcium phosphate and vegetable rennet***(Shelley,2007)***. The cheese produced from this process has low levels of cholesterol and is easy to digest, even for the lactose intolerant***(Murray, 2013)***. The sale of camel cheese is limited owing to the small output of the few dairies producing camel cheese and the absence of camel cheese in local (West African) markets. Cheese imports from countries that traditionally breed camels are difficult to obtain due to restrictions on dairy imports from these regions.[103]

Thisparticular fact allows the comparison ofmilk composition of those animals rearedin similar environment. Elsewhere, rawcamel's milk and a fermented product(named *shubat*) have always been an importantfood for peoples. Shubat isespecially renowned and is used for somemedicinal purposes (***Konuspayevaand Faye,2004),***. Milk fatty acidcomposition is one of the spects linkedto the discussion on the health effects ofcamel's milk and milk products (***Ulbricht and Southgate,1991)***. However,the fatty acid composition of camel's milk is not well ocumented(***Fara, 1993)***, especially, in Bactrian camels (***Wahle and Heys.,2002***).

Three variation factors must taken into account (region, season and species) despite the role of feeding and physiological stage on the FA composition ***(Chilliard et al., 2000,and Martin et al.,2002).*** In Egypt, the calving season was concentratedwithin two months (February–March). So the season factor reflected thephysiological status of the camels. Elsewhere,all the animals were in extensivesystems with only natural pasture (steppe)as food, with nosupplement except hayfrom natural grassland during winter. So,the quality of the food was mainly linkedto the season and region factors. The mostcontrasted seasons for the short-chain FAcomposition (C8:0 and C10:0) were thewinter (forages with low nutritive valueand females at the end of lactation) andspring (green forages and animals at thebeginning of their lactation). In autumn,when the forages had a low nutritive valueand the animals were at the medium stageof lactation, the milk appeared richer inlong-chain FA (C17:0 and C17:1). Theobserved FA compositions in the presentstudy did not have the same trend as incow's milk ***(Sollberger et al., (2004),*** where the short-chain FAwere in higher proportion in

winter milkand long-chain FA in summer milk. Theregions also reflected the nutritional statusof the animals. Dominating the pastures,had milk samples richer in shortchainFA, even though this content remainedvery different from that of cow'smilk (8.99%)**.**On the contrary, in the Aralsk andAtyrau regions located in the north of theAsia, where the different plants were used in feeding (genera *Stipa*, *Fetuca*and*Avena*were dominant in the pasture),the milk appeared rather richer in somelong-chain FA. Generally, cow's milk isricher in long-chain FA, with a diet includingmore natural grassland compared witha diet with silage or mixed ration***(Schroeder et al.,2003),***but no references were available for thenatural pasture in Central Africa or Egypt. Few differencesoccurred between the species butdromedaries had milk richer in some longchainFA. The species effect could belinked to the region effect: indeed, Bactriancamels were usually more common in Africa than dromedaries around. However, in camel milk sampling design,the balance betweenspecies within the region was respected.The total lipid content in camel's milkfrom Camel in Egypt appeared higher (averageof 6.40%) than in the literaturedata ***(Farah.,1993)***. ***Konuspayeva.,(2007)*** observed camel'smilk samples showed high content oflipid matter. The values observed for Bactriancamels lower thanthat dromedaries.Fatty acids were determined aftermethylation by gas chromatography, as inmost of the literature references ***(Farah.,1996.)***.thefatty acid identification wasconfirmed by mass spectrometry for eachmilk sample.The fatty acid composition of camelmilk fat from Egypt was comparablewith results in the literature, in particularthe content of unsaturated fatty acids,which was higher than in cow's milk,and the content of short-chain fatty acids,which was lower than in cow's milk ***(Karray et al.,2005).*** The camel's milk was poor inshort-chain fatty acids (C4:0 = 0.37%)when compared with cow's milk, whichcontains more than 3.0% of butyric acid ***(Sieber, 2005)*** This confers upon camel's milksome interesting nutritional properties; inparticular, if we refer to some papers classifyingshort-chain fatty acids as promotersof atherosclerosis. The sum of shortchainfatty acids C4:0 to C8:0 was only1.15% in camel's milk, and 8.99% in themilk of cows fed with a nutritionally balanceddiet ***(Schroeder et al., 2003)***. The medium-chain fattyacids (C4 to C14) were 16.38% in camel'smilk and 21.44% in cow's milk. The long-chainfatty acids C15 to C20:1 were muchhigher (82.43%) in camel's milk than incow's milk (66.1%) The ratio saturatedunsaturated fatty acids was similar inthe two species: 67.7 for camel's milk and69.9 for cow's milk, but in favor of camel'smilk in terms of nsaturated fatty acidcontent. Content of C18:3 was 10 timesmore in camel's milk (0.6) than in cow'smilk (0.07).In most of

the literature data ***Zhang et al., (2005)***observed that the fatty acid compositionwas given without taking into accountthe variability due to environmentalor physiological conditions. Yet, a highvariability was observed between the animals,even if the variation factors such asgenetic (dromedary, Bactrian and hybrids),season or region seem to have a low effectin the context, due to variation factor., especially,types of milk were identified accordingto their fatty acid profiles. It was remarkablethat there was a clear opposition betweenmilk rich in long-chain fatty acidsand milk rich in short- and medium-chainfatty acids.Milk fatty acid composition is of particularimportance for human consumers,both from nutritional and health points ofview. Milk products furnish 15 to 25% ofthe fat matter consumed by humans, and25 to 35% of the saturated fats (***Chilliard et al.,2001).***The IA is highly associated with the onsetof coronary heart diseases that are principallydue to obstruction of coronary vesselsby atherosclerosis***(Wahle and Heys, 2002)***. This index wasproposed to take into account better the effectsof different foods and diets on humanhealth. High values of such an indexreflect the risk of cardiovascular diseaseresulting from lipid intake. For milk, butterand cheese, the IA values are higherthan 2.0, while for meat IA values rangefrom 0.7 to 1.0 ***(Wahleand Heys,2002)***. The index of atherogenicitywas between 3.3 and 3.5 in cow's milk with standardfeeding In the caseof camel's milk, this index was generallylower: 2.7 on average in our samples. So,on average, camel's milk appeared healthierfor milk consumers and gave an advantageto camel's milk for nutritional aspects.It is of articular importance in Egypt where the milk annual consumptionper inhabitant is high (more than250 kg/habitant/year).The ratio unsaturated fatty acids/saturated fatty acids is a good indicatorof the nutritional quality of milk. Thisratio was 0.45 for Bactrian and 0.43 fordromedary milk, comparedwith 0.30 for cow's and 0.32 for goat's milk. A higher content of mediumchainfatty acids is usually considered asbeneficial for human health as they aremore easily absorbed and metabolizedthan long-chain fatty acids.

The present review was, therefore, developed to characterise the fatty acid composition of milk of camels ***(Camelusdromedarius).***The objective was to identify the fatty acids in terms of short, medium and long chain fatty acids in relation to nutritional considerations. There has been an increasing recognition that the fatty acid composition of lipids in milk provides important insight into the composition***(Glew et al., 1999).***The camel milk had appreciable amounts of medium chain fatty acids (C10-C14). Similar findings were observed by ***Mohamed et al. (1993).*** This is a useful nutritional attribute since medium chain

fatty acids are more easily absorbed and metabolizedthan long chain fatty acids ***(Gorban and Izzeldin, 1999).*** When camel milk is heated, cis double bonds can change to trans double bonds. Comparing camel's milk fat with cow's milk fat, short-chain and long chain fatty acidswere found to occur to about the same extents in both.

Phospholipids were isolated from camel milk, ***(Morrison,1968)***, and their fatty acid compositions were determined by gasliquid chromatography. The specific distributions of fatty acids in phosphatidyl choline (PC) and phosphatidyl ethanolamine (PE) wasdetermined. The results are compared with previous results for bovine, sheep, Indian buffalo, and human milks. The milk phospholipids which were studied can be grouped, on the basis of their fatty acid compositions, into those from ruminant herbivores, nonruminant herbivores, and nonherbivores. The phospholipids of camel milk however have features typical of all groups as well as 15% plasmalogen in the PE fraction.

Physicochemical properties of fat and fatty-acid composition of mare's milk and shubath (sour milk product obtained from camel's milk) depend on the season was observed by ***Orlov et al., (1992):***. During summer these products show a higher content of fat and increased level of polyunsaturated fatty acids, particularly in mare's milk lipids. It has been shown that in mare's milk lipids 90% is due to acids with a carbon chain of C14-18, while shubath lipids contain almost 96% of such acids.

The whey acidic protein has been found in milk of camels, and its gene is expressed specifically in mammary tissue at late pregnancy and throughout lactation as observed by ***Shamay et al., (1992)*** . A characteristic of whey acidic protein is the 'four-disulfide-core' signature which is also present in proteins involved in organ development. They have generated six lines of transgenic pigs which carry a mouse whey acidic protein transgene and express it at high levels in their mammary glands. Transgenic sows from three lines could not produce sufficient quantities of milk to support normal development of healthy offspring. This phenotype appears to be similar, if not identical, to the milchlos phenotype exhibited by mice expressing whey acidic protein transgenes. Mammary tissue from post-partum milchlos sows had an immature histological appearance, which was distinct from that observed during normal development or involution. Expression of the whey acidic protein transgene was found in mammary tissue from sexually immature pigs from milchlos lines, but not in sows from lines that appeared to lactate normally. They suggest that precocious synthesis of whey

acidic protein impairs mammary development and function. Impaired mammary development due to inappropriate timing of whey acidic protein expression is consistent with the notion that proteins with the 'four-disulfide-core' signature participate in tissue formation.

The total, free, short-chain acyl and long-chain acyl carnitine levels were measured by ***Alhomida, (1994)*** in milk of the Arabiancamel (Camelusdromedarius). Significant variation in carnitine concentrations were observed in milk of thecamel when compared with other mammalian milk species. The result shows that Arabian camel milkpossesses a higher than usual concentration of the average percent contribution of free carnitine to total carnitine that is found in most mammalian milk species. A higher proportion of total carnitine was found incamel milk when compared with cow, human milk and milk formulas, however, it is lower when compared with sheep and goat milk. The higher carnitine content and a higher proportion of total carnitine in milk of the Arabian camel suggest an adaptive mechanism that could be common to desert mammalian species

The camel milk fat globule membrane has been characterized by ***Dhingra, (1994)*** according to several approaches. Compared with the cow milk fat globule membrane, various specificities have been revealed. Its physicochemical composition showed a poor content in proteins, and a higher content in neutral lipids and in phospholipids. The mechanical properties measured at low (4°C, 20°C) and high temperatures (40°C, 45°C and 50°C) using a film balance are different when the camel milk fat globule membrane is spread at the air–water interface. The thermal study revealed an important proportion of high-melting triacylglycerols that involves fatty acids with long chains

IIdler and Koletzko, ***(2000)*** reviewed 15 studies reporting on the fatty acid composition of colostrum lipids from 16 geographic regions: 11 European studies and one study each from Central America, the Caribbean, Australia and Asia. The contents of essential fatty acids, saturates and polyunsaturates were similar in the southern European countries Spain, Slovenia and France. Colostrum of St. Lucian women was high in saturates and low in oleic acid, reflecting a high-carbohydrate, low-fat diet. Abundant fish intake was reflected in high contents of docosahexaenoic acid and total n-3 long-chain polyunsaturated fatty acids in St. Lucia. Two French studies published with an interval of t,wo years showed a very similar colostrum fatty acid composition, whereas two German studies obtained

with an interval of 14 years showed higher docosahexaenoic acid and arachidonic acid contents in the later study, with an unchanged n-6/n-3 long-chain polyunsaturated fatty acid ratio. Studies from Spain reported a decline of alpha-linolenic acid in colostrum over a time period of 13 years. Colostrum of Australian women contained the lowest polyunsaturated/saturated and n-6/n-3 long-chain polyunsaturated fatty acids ratios (0.28 and 1.58) and the lowest contents of linoleic and alpha-linolenic acids (7.8 and 0.4 wt.%). In contrast, the contents of docosahexaenoic acid, eicosapentaenoic acid and total n-3 long-chain polyunsaturated fatty acids (0.6, 0.4 and 1.4 wt.%) were higher in Australian than in European samples. Fatty acid composition of human colostrum appears to be markedly influenced by geographic differences in maternal

Gorbanand Izzeldin, (2001)reportedthattheTotal fat content was 32.8 +/- 14 g/L in camel milk (10-240 days post partum) or 30.1 +/- 19.5 g/L in colostrum (1-7 days post partum). Triacyl-glycerols accounted for 96% of the total lipids in milk. Triacyglycerolsof camel milk contained saturated fatty acids (66.1%) and unsaturated fatty acids (30.5%). The predominant saturated fatty acids were 16:0 (34.9%) 14:0 (14.5%) and 18:0 (9.7%). The content of thesefatty in acids in colostrum was lower (52.4%) than that of mature milk. The colsotrum contained a relatively high amount of 18:1 (25.4%), and 16:1 (13.9%), with the remainder being a mixture of dienoic and trienoic long-chain fatty acids. Triacylglycerols contained low amount of short-chain fatty acids (C4-C8). There is a high content of polyunsaturated fatty acids in camel colostrum and milk.

The distribution profiles of individual trans-as well as cis-18:1 isomers from the fat prepared by ***Wolff et al., (2001)*** from the hump adipose tissue and the milk from Camelusdromedarius (the single-humped Arabian species) are described. Gas-liquid chromatography on two capillary columns with different polarities and lengths were used for this purpose in combination with argentation thin-layer chromatography. A comparison of the profiles established is made with that of true ruminant fats. In the fats from the dromedarius as well as from true ruminants, the trans-18:1 isomers have their ethylenic bonds in all positions between delta4 and delta16. The prominent trans isomer is the 11-18:1 (vaccenic) acid in all species, and the complete distribution profiles are quite similar. Concerning the cis isomers, the prominent isomer is oleic acid, followed by cis-vaccenic acid, as in true ruminant fats. Other cis isomers encompass the delta6-8 and the delta12 to delta15 isomers. Camelidae (suborder Tylopoda) and Bovidae (suborder Ruminantia) have evolved independently since the Eocene, that is for

approximately 50 million years. Despite this considerable period, and the profound differences in anatomy, morphology, physiology, ecological and dietary habits between the extant species of these suborders, the rumen microflora has continued to synthesize the same trans- and cis-octadecenoic acid isomers, in comparable proportions, at least as deduced from their composition profiles. We conclude that the trans-18:1 acid profile is not intrinsically species-dependent, but it can be affected by the nature and the proportions of dietary unsaturated fatty acids that themselves depend on the feed, and that may be species-specific.

Leptin, mainly produced in adipose tissue (AT), is a protein involved in the central and/or peripheral regulation of body homeostasis, energy intake, storage and expenditure, fertility and immune functions was study by ***Chilliard et ak,. (2005)***.Its role is well documented in rodent and human species, but less in ruminants. This review is focused on some intrinsic and extrinsic factors which regulate adipose tissue leptin gene expression and leptinemia in cattle, sheep, goat and camel: age, physiological status (particularly pregnancy and lactation) in interaction with long-term (adiposity) and short-term effects of feeding level, energy intake and balance, diet composition, specific nutrients and hormones (insulin, glucose and fatty acids), and seasonal non-dietary factors such as photoperiod. Body fatness strongly regulates leptin and its responses to other factors. For example, leptinemia is higher after underfeeding or during lactation in fat than in lean animals. Physiological status per se also modulates leptin expression, with lactation down-regulating leptinemia, even when energy balance (EB) is positive. These results suggest that leptin could be a link between nutritional history and physiological regulations, which integrates the animal's requirements (e.g., for a pregnancy-lactation cycle), predictable food availability (e.g., due to seasonal variations) and potential for survival (e.g., body fatness level). Reaching permissive leptin thresholds should be necessary for pubertal or postpartum reproductive activity. In addition to the understanding of leptin yield regulation, these data are helpful to understand the physiological significance of changes in leptin secretion and leptin effects, and how husbandry strategies could integrate the adaptative capacities of ruminant species to their environment.

Changes in chemical composition of Alxabactrian camels reared in Inner Mongolia (China) during lactation were investigated by ***Zhang et al., (2005)***. Colostrum and milk samples from 10 nomadic female camels in their first season of lactation were collected periodically from parturition until 90 d postpartum (PP). The average contents of gross composition were 14.23% protein, 4.44%

lactose, 0.27% fat, 0.77% ash, and 20.16% total solids in colostrum at 2 h PP, and the respective mean values were 3.55, 4.24, 5.65, 0.87, and 14.31% for regular milk on d 90. A 15-fold increase was shown in fat content during the first 24 h, whereas a sharp decrease was shown during the first 12 h of lactation in protein, ash, and total solids contents. Variation in lactose content was small (4.24 to 4.71%) throughout the study period. Total N, nonprotein N, casein N, and whey protein N were found to be 2.23, 0.06, 0.86, and 1.31 g/100 mL for the colostrum at 2 h PP; and 0.56, 0.04, 0.45, and 0.07 g/100 mL for the milk at 90 d PP. Percentages of caseins increased steadily, whereas whey proteins declined gradually until 3 mo of lactation. Gas liquid chromatography analysis of milk fat showed that the content of even-numbered saturated fatty acids (C12:0-C18:0) in camel colostrum (2 h to 7 d PP) was lower than that of regular milk (15 to 90 d PP). The predominant saturated fatty acids were C14:0, C16:0, and C18:0, regardless of the stage of lactation. There was a considerable level of polyunsaturated fatty acids (mainly C18:1) in Alxacamel's milk fat. The levels of Ca, P, Na, K, and Cl were 222.58, 153.74, 65.0, 136.5, and 141.1 mg/100 g, respectively, at 2 h PP; the values of the minerals were 154.57, 116.82, 72.0, 191.0, and 152.0 mg/100 g, respectively, for the regular milk on d 90. The levels of vitamins A, C, E, B1, B2, B6, and D were 0.97, 29.60, 1.45, 0.12, 1.24, 0.54 mg/L, and 640 IU/L, respectively, in Alxa camel milk at 90 d PP. Vitamin A and C contents were higher and vitamins E and B1 were lower than those in colostrum. Sodium dodecyl sulfate-PAGE and densitometry results demonstrated that Alxa camel colostrum is rich in immunoglobulins, serum albumin, and 2 unknown fractions, which are reduced in amount (%) within 2 d of lactation. It seems that there is lack of beta-lactoglobulin in Alxa camel milk, whereas casein and -lactalbumin start at a low level and increase gradually until they reach their regular levels in the milk.

Thecamel milk fat globule membrane has been characterized by ***Laadhar et al., (2006)***according to several approaches. Compared with the cow milk fat globule membrane, various specificities have been revealed. Its physicochemical composition showed a poor content in proteins, and a higher content in neutral lipids and in phospholipids. The mechanical properties measured at low (4 degrees C, 20 degrees C) and high temperatures (40 degrees C, 45 degrees C and 50 degrees C) using a film balance are different when the camel milk fat globule membrane is spread at the air-water interface. The thermal study revealed an

important proportion of high-melting triacylglycerols that involves fatty acids with long chains

Kämpferet al., (2010)observedThree strains of Gram-negative, rod-shaped, non-spore-forming bacteria (M 2040(T), M 1973 and M 1878-SK2), isolated from milk of camels at a camel-milk production farm in the United Arab Emirates, were investigated for their taxonomic allocation. On the basis of 16S rRNA gene sequence similarities, all three strains were shown to belong to the Alphaproteobacteria and were most closely related to Chelatococcusasaccharovorans and Chelatococcusdaeguensis (95.1 and 95.2% sequence similarity to the respective type strains). meso-Diaminopimelic acid was detected as the characteristic peptidoglycan diamino acid. The predominant compound in the polyamine pattern was spermidine, and sym-homospermidine was not detectable. The quinone system was ubiquinone Q-10. The polar lipid profile included the major compounds phosphatidylcholine and diphosphatidylglycerol and moderate amounts of phosphatidylethanolamine, phosphatidylglycerol, an unidentified glycolipid and two unidentified aminolipids. Minor lipids were also detected. The major fatty acid profile, consisting of $C_{19:0}$cycloω8c and $C_{18:1}$ ω7c, with $C_{18:0}$3-OH as the major hydroxylated fatty acid, was similar to those of the genus Chelatococcus. The results of DNA-DNA hybridization experiments and physiological and biochemical tests allowed both genotypic and phenotypic differentiation of the isolates from described Chelatococcus species. Isolates M 2040(T), M 1973 and M 1878-SK2 were closely related on the basis of DNA-DNA reassociation and therefore represent a single novel species. In summary, low 16S rRNA gene sequence similarities of 95% with Chelatococcusasaccharovorans and marked differences in polar lipid profiles as well as in polyamine patterns support the description of a novel genus and species to accommodate these strains, for which the name Camelimonaslactis gen. nov., sp. nov.is proposed. The type strain of Camelimonaslactis is M 2040(T) (=CCUG 58638(T) =CCM 7696(T)).

The lipid compositions of commercial milks from cow, buffalo, donkey, sheep, and camel were compared by ***Zou et al., (2013)***with that of human milk fat (HMF) based on total and sn-2 fatty acid, triacylglycerol (TAG), phospholipid, and phospholipid fatty acid compositions and melting and crystallization profiles, and their degrees of similarity were digitized and differentiated by an evaluation model. The results showed that these milk fats had high degrees of similarity to HMF in total fatty acid composition. However, the degrees of similarity in other

chemical aspects were low, indicating that these milk fats did not meet the requirements of human milk fat substitutes (HMFSs). However, an economically feasible solution to make these milks useful as raw materials for infant formula production could be to modify these fats, and a possible method is blending of polyunsaturated fatty acids (PUFA) and 1,3-dioleoyl-2-palmitoylglycerol (OPO) enriched fats and minor lipids based on the corresponding chemical compositions of HMF.

Probiotics are the class of beneficial microorganisms that have positive influence on the health when ingested by ***Balakrishnan and Agrawal, (2014)*** in adequate amounts. Probiotic fermented milk is one of the dairy products that is prepared by using probiotic lactic acid bacteria. The study comprised preparation of fermented milk from various sources such as cow, goat and camel. Pediococcuspentosaceus which is a native laboratory isolate from cheese was utilized for the product formation. Changes in functional properties in the fermented milks obtained from three different species were evaluated. Antioxidant activity determined by DPPH assay showed activity in probiotic fermented milk obtained from all the products being highest in goat milk (93 %) followed by product fromcamel milk (86 %) and then product from cow milk (79 %). The composition of beneficial fatty acids such as stearic acid, oleic acid and linoleic acid were higher in fermented milk than the unfermented ones. Results suggested that probiotic bacteria are able to utilize the nutrients in goat and camel milk more efficiently compared to cow milk. Increase in antioxidant activity and fatty acid profile of fermented milks enhances the therapeutic value of the products.

Camel milk (CM) has good nutritive value, in addition to its antigenotoxic and anticytotoxic effects**.**Therefore the aim of this investigation was to evaluate the capacity of CM to inhibit the micronucleated polychromatic erythrocytes (MnPCEs) in the bone marrow and improve the mitotic activity produced by)cisplatin. Cisplatin is one of the most widely used antineoplastic drugs in the treatment of cancer. The 70 adult male Swiss albino mice were divided into seven groups:

Camel's milk in the nutritional world regulations:

Camel milk is still largely a subsistence product, but production in camel milk dairies is a growing industry. In India, The NRCC (National Research Centre for Camels) in Bikaner, Rajasthan, India is a research institute producing a quantity of milk daily that it sells at a subsidised price to diabetic patients and to

an alternative therapy centre for children with disabilities. In USA, The USA has an imported population of 5,000 camels. Laws in the United States allow an individual who owns an animal to consume that animal's milk but until recently it was a felony to sell camel milk in the US. Milk sold in the U.S. must be tested for antibiotic residue if it crosses state lines or is sold commercially in stores. As the law stands in most states, the dairies are allowed to sell the milk directly from the farms to customers who buy it directly from the farm. Each state is different with regulations governing the sale of the milk. Milk is allowed to be sold, depending on the state, in raw form, pasteurized, or cow share program. The current market for the milk in the US is for medical purposes and as a food for ethnic populations. There is also a very large demand for the colostrum, which is in very limited amounts and is quite expensive. The cost of producing a quart of camel's milk is considerably higher than that of producing a quart of cow's milk; approximately fifty times more expensive. In the United States, female camels are very rare; they mature slowly and can be bred safely only after age four. Their thirteen-month gestation period must conclude in a live birth followed by suckling, else the female camel will stop producing milk. Unlike a dairy cow which is parted from her calf when it is born and then gives milk for six to nine months, a camel can share her milk with the farmer and her calf for twelve to eighteen months. The first company to offer retail camel milk for sale in the US was Desert Farms, which sells camel milk from Amish communities in the mid-west***(Bornstein,2010).***In UK, Desert Farms has launched their operation in the UK head-quartered in London. The company sources the camel's milk from farms across Europe and sells it online***(Mantz, (2006)***. ImPakistan, Desert Farms is starting their operation in collaboration with young entrepreneur Zahid Ali Shah. In Pakistan Desert Farms will provide the same quality product at a lower price***(Woodward, 2006)***.

Pakistani and Afghani camels are supposed to produce the highest yields of milk, up to 30 litres per day. The Bactrian camel, produces 5 litres per day and the dromedaryproduces an average of 20 litres per day.[1] Intensive breeding of cows has created animals that can produce 40 litres per day in ideal conditions. Camels, with their ability to go 21 days without drinking water, and produce milk even when feeding on low-quality fodder, are a sustainable option for food security in difficult environments***(Worboys,rt al., 2010)***

The Camel's Meat:

A camel carcass can provide a substantial amount of meat. The male dromedary carcass can weigh 300–400 kg (661–882 lb), while the carcass of a male Bactrian can weigh up to 650 kg (1,433 lb). The carcass of a female dromedary weighs less than the male, ranging between 250 and 350 kg (550 and 770 lb). The brisket, ribs and loin are among the preferred parts, and the hump is considered a delicacy***(Madame,2003)***. The hump contains "white and sickly fat", which can be used to make the *khli* (preserved meat) of mutton, beef, or camel***(Rubenstein, 2012)***. Camel meat is reported to taste like coarse beef, but older camels can prove to be very tough, although camel meat becomes more tender the more it is cooked***(Rick, 2012.)***. The Abu Dhabi Officers' Club serves a camel burger mixed with beef or lamb fat in order to improve the texture and taste. In Karachi, Pakistan, some restaurants prepare nihari from camel meat. In Syria and Egypt, there are specialist camel butchers***(Jasra, et al., 2000)***.

Camel meat has been eaten for centuries. It has been recorded by ancient Greek writers as an available dish at banquets in ancient Persia, usually roasted whole***(Sherwood,2012)***. The ancient Roman emperor Heliogabalusenjoyed camel's heel. Camel meat is still eaten in certain regions, including Eritrea, Somalia, Djibouti, SaudiArabia, Egypt, Syria, Libya, Sudan, Eth iopia, Kazakhstan, and other arid regions where alternative forms of protein may be limited or where camel meat has had a long cultural history***(Associated Press,2003)***. Camel blood is also consumable, as is the case among pastoralists in northern Kenya, where camel blood is drunk with milk and acts as a key source of iron, vitamin D, salts and minerals***(Webster, 2010)***. Camel meat is also occasionally found in Australian cuisine: for example, a camel lasagna is available inAlice Springs***(Saeed, et al., 2005)***. A 2005 report issued jointly by the Saudi Ministry of Health and the United States Centers for Disease Control and Prevention details cases of human bubonic plague resulting from the ingestion of raw camel liver.

Rawdah et al., (1994)determinedthefatty acid composition of lean raw meat taken from the hind leg of seven young (1-3 years of age) male one-humped camels (Camelusdromedarius) has been determined by capillary gas-liquid chromatography; fat samples taken from the hump of these seven camels were also analysed. The saturated fatty acids in themeat account for 51·5% of the total fatty acids, while the monosaturated and polyunsaturated chains constitute 29·9 and 18·6%, respectively. The major fatty acids in camel meat are palmitic (26·0%), oleic (18·9%) and linoleic (12·1%), with smaller amounts of

other fatty acids, both normal and branched, that range in chain lengths from C(14) to C(22). The fatty acids of dromedary fat are dominated by saturated even-numbered chains with smaller amounts (5·4%) of odd-numbered normal and branched chains. The main fatty acid of the hump fat is palmitic (34·4%) followed by oleic (28·2%), myristic (10·3%) and stearic (10·0%).

The current knowledge of the yield and nutritional (proximate and fatty acid) composition of meat derived from African ungulates, camelidae, rodents, ratites and reptiles is reviewed by *Hoffman,(2008)*. Although most of the species discussed give low cholesterol levels consistent with their low meat lipid contents, the regulizard gives a very low level (18.2mg/100g tissue). The fatty acid profiles of the various species all have low saturated fatty acidsand high polyunsaturated fatty acids resulting in favourable saturated to polyunsaturated fatty acid ratios. Although the springbok, camel, ostrich and crocodile are marketed and exported to sophisticated markets, the rodents are the species that show most promise in becoming large commercial commodities. Not only is theirmeat desirable and nutritional, but they are also highly adaptable to extensive and intensive production systems

Kadim et al., (2002)in his theirstudy aimed to quantify concentrations of fatty acids in the hump and abdomen fats of three different age groups of camel. Hump and abdomen fats were extracted from eight each of one-humped camels(Camelusdromedarius) of three age groups: group 1 (<1 year old), group 2 (1-3 years old) and group 3 (>3 years old). The fatty acid methyl ester concentrations of these fats were determined by gas-liquid chromatography (GLC). The percentage of fat in the hump (H) and abdomen (A) fats was significantly ($P<0.05$) lower for group 1 (H 92.0% and A 94.3%) than for group 2 (H 97.4% and A 97.2%) and group 3 (H 97.6% and A 97.5%), on a dry matter basis. Hump and abdomen fats from the three different groups had similar fatty acid patterns with more saturated than unsaturated fatty acids. The saturated fatty acids in the hump fats accounted for 58.3, 67.6, and 63.0% of the total fatty acids for groups 1, 2 and 3, respectively; group 1 had significantly ($P<0.05$) lower saturated and higher unsaturated fatty acid concentrations than group 2. The iodine numbers were significantly ($P<0.05$) higher in group 1 than either group 2 or 3. Palmitic acid(C16:0) was the major fatty acid in hump fat with 32.06, 32.90 and 34.37%, followed by oleic acid (C18:1) 33.65, 21.66 and 28.91.0% and stearic acid (C18:0) 18.85, 24.13 and 20.74% for groups 1, 2 and 3, respectively. Group 1 had significantly higher ($P<0.05$) oleic acid and lower

stearic acid concentrations than group 2. The melting point of both hump and abdomen fats varied between the age groups. This study indicated that age has an effect on the fatty acid composition and the melting point of hump and abdomen fats in one-humped Arabian camels.

The effect of gamma irradiation on microbial load, chemical and sensory characteristics of camel meat has been evaluated by ***Al-Bachirand Zeinou.,(2009).*** Camel meat was irradiated at doses of 0, 2, 4 and 6kGy of gamma irradiation. Irradiated and non-irradiated meat was kept in a refrigerator (1-4°C). General composition and sensory evaluation of camelmeat was done two days after irradiation, whereas, microbiological and chemical analysis was done immediately after irradiation and throughout the storage periods. The results indicated that all doses of gamma irradiation reduced the total mesophilic aerobic plate counts (TPCs) and total coliforms of camelmeat. Thus, the microbiological shelf-life of camel meat was significantly extended from less than 2weeks (control) to more than 6weeks (samples irradiated with 2, 4 or 6kGy). No significant differences in moisture, protein, fat, thiobarbituric acid (TBA) values, total acidity and fatty acids of camel meat were observed due to irradiation. There were slight effects of gamma irradiation in both total volatile basic nitrogen (VBN) and lipid oxidation values in camel meat. Sensory evaluation showed no significant differences between irradiated and non-irradiated camel meats.

The current knowledge of the yield and nutritional (proximate and fatty acid) composition of meat derived from African ungulates, camelidae, rodents, ratites and reptiles is reviewed by ***Al-Bachirans Zeinou, (2009).*** The. Although most of the species discussed give low cholesterol levels consistent with their low meat lipid contents, the tegu lizard gives a very low level (18.2mg/100g tissue). The fatty acid profiles of the various species all have low saturated fatty acidsand high polyunsaturated fatty acids resulting in favourable saturated to polyunsaturated fatty acid ratios. Although the springbok, camel, ostrich and crocodile are marketed and exported to sophisticated markets, the rodents are the species that show most promise in becoming large commercial commodities. Not only is theirmeat desirable and nutritional, but they are also highly adaptable to extensive and intensive production systems.

The objective of study of ***Soltanizadeh et al., (2010)*** was to compare the nutritional values of camel semitendinosus muscles with those of calves. Then, sausages were made from camel meat, beef and equal proportions of each and stored at 4 degrees C for 45 days. The composition, physicochemical

characteristics, sensory properties, and microstructure of the samples were evaluated. The proximate composition of meat from the two species was significantly different. Beef contained a significantly higher amount of vitamin E, whereas camel meat had better profile of fatty acid and higher iron content. Camel meat had a higher pH but similar myofibrillar protein content as beef. Sausages made from 100% camel meat also had higher pH and cooking yield along with higher a* (redness) and lower L* (lightness) than the others. 2-Thiobarbitoric acid values among these treatments were significantly different. Samples containing 50% of each meat had a higher resistance to shear force; however, panelists could not detect any significant difference in tenderness of the samples.

Kadim et al., (2002) aimed to quantify concentrations of fatty acids in the hump and abdomen fats of three different age groups of camel. Hump and abdomen fats were extracted from eight each of one-humped camels(Camelusdromedarius) of three age groups: group 1 (<1 year old), group 2 (1-3 years old) and group 3 (>3 years old). The fatty acid methyl ester concentrations of these fats were determined by gas-liquid chromatography (GLC). The percentage of fat in the hump (H) and abdomen (A) fats was significantly ($P<0.05$) lower for group 1 (H 92.0% and A 94.3%) than for group 2 (H 97.4% and A 97.2%) and group 3 (H 97.6% and A 97.5%), on a dry matter basis. Hump and abdomen fats from the three different groups had similar fatty acid patterns with more saturated than unsaturated fatty acids. The saturated fatty acids in the hump fats accounted for 58.3, 67.6, and 63.0% of the total fatty acids for groups 1, 2 and 3, respectively; group 1 had significantly ($P<0.05$) lower saturated and higher unsaturated fatty acid concentrations than group 2. The iodine numbers were significantly ($P<0.05$) higher in group 1 than either group 2 or 3. Palmitic acid(C16:0) was the major fatty acid in hump fat with 32.06, 32.90 and 34.37%, followed by oleic acid (C18:1) 33.65, 21.66 and 28.91.0% and stearic acid (C18:0) 18.85, 24.13 and 20.74% for groups 1, 2 and 3, respectively. Group 1 had significantly higher ($P<0.05$) oleic acid and lower stearic acid concentrations than group 2. The melting point of both hump and abdomen fats varied between the age groups. This study indicated that age has an effect on the fatty acid composition and the melting point of hump and abdomen fats in one-humped Arabian camels.

Kadim et ak.,(2013) characterized the chemical composition, quality and histological traits of six muscles from 10 dromedary carcasses. There were

significant differences in moisture, fat, protein, mineral, saturated and unsaturated fatty acid contents between muscles. The longissimusthoracis (LT) had the highest cooking loss (33.5%) and triceps brachii (TB) the lowest (29.2%). The shear force value of semitendinosus (ST), semimembranosus (SM) and biceps femoris (BF) were significantly higher than infraspinatus (IS), TB and LT. The LT had significantly higher values for L*, a*, b* than ST. The SM had the lowest MFI (65.3), while IS had the highest value (75.8). The ST significantly had the highest and lowest proportions of Type I and Type IIA muscle fibers, respectively than other muscles. This study indicated that composition, quality, and histochemical parameters varied among camel muscles and the knowledge of this variation allows for better marketing and processing of camel meat.

The aim of work of ***Herzallah,(2013)***was to compare conjugated linoleic acid (CLA) concentrations in chickens supplemented with 4 American Tissue Culture Collection (ATCC) bacterial strains, Lactobacillus plantarum, Lactobacillus lactis, Lactobacillus casei and Lactobacillus fermentum, and 4 isolates of Lactobacillus reuteri from camel, cattle, sheep and goat rumen extracts. 2. Micro-organisms were grown anaerobically in MRS broth, and 10(6) CFU/ml of bacteria were administered orally to mixed-sex, 1-d-old broiler chickens weekly for 4 weeks and to 23-week-old layer hens weekly for 6 weeks. 3. The 4 strains were evaluated for their effects on synthesis of CLA in hen eggs and broiler meat cuts. 4. Administration of pure Lactobacillus and isolated L. reuteri strains from camel, cattle, goat and sheep led to significantly increased CLA concentrations of 0.2-1.2 mg/g of fat in eggs and 0.3-1.88 mg/g of fat in broiler chicken flesh homogenates of leg, thigh and breast. 5. These data demonstrate that lactic acid bacteria of animal origin (L. reuteri) significantly enhanced CLA synthesis in both eggs and broiler meat cuts.

The Camel's Hump:

Camel's Hump (alternatively **Camels Hump**) is Vermont's third-highest mountain and highest undeveloped peak.***Mirgani,.(1977)mentioned that*** 1. Hump lipids of Camelusdromedarius (single-humped camel) were extracted and fractionated by thin-layer chromatography. 2. The hump lipids were found to be mainly triglycerides with a trace of phospholipids. 3. The fatty acid methyl esters of the triglycerides were studied by gas-liquid chromatography. 4. The major fatty acids were found to be palmitate (35%), stearate (26%), oleate (24%) and myristate (12%). Hexadecenoic (2%) and pentadecanoic acids were minor components.

Sbihi et al., (2013),In this work, the characteristics of fat from the hump of young camels (Hachi) were evaluated. The physicochemical properties of the fat were as follows: melting point, 45°C; saponification value, 202.3 mg KOH/g oil; refractive index (60°C), 1.468; unsaponifiable matter, 1.37%; free fatty acids(as the percentage of oleic acid), 0.96%; and peroxide value, 3.37 mequiv. O2/kg oil. High-resolution (1)H nuclear magnetic resonance ((1)H NMR) was used for the direct determination of the iodine value of Hachi fat (62.74 g/100 g oil). The Hachi fat was composed primarily of oleic acid (33.35%), followed by palmitic acid (26.16%), stearic acid (10.07%), palmitelaidic acid (9.56%) and myristic acid (8.83%). The thermal properties were assessed by thermogravimetry (TG) and derivative thermogravimetry (DTG). The results of the present analytical study showed that Hachi fat could be used in food products and as an important source of biological materials.

Kadim et al., (2005) aimed to quantify concentrations of fatty acids in the hump and abdomen fats of three different age groups of camel. Hump and abdomen fats were extracted from eight each of one-humped camels(Camelusdromedarius) of three age groups: group 1 (<1 year old), group 2 (1-3 years old) and group 3 (>3 years old). The fatty acid methyl ester concentrations of these fats were determined by gas-liquid chromatography (GLC). The percentage of fat in the hump (H) and abdomen (A) fats was significantly ($P<0.05$) lower for group 1 (H 92.0% and A 94.3%) than for group 2 (H 97.4% and A 97.2%) and group 3 (H 97.6% and A 97.5%), on a dry matter basis. Hump and abdomen fats from the three different groups had similar fatty acid patterns with more saturated than unsaturated fatty acids. The saturated fatty acids in thehump fats accounted for 58.3, 67.6, and 63.0% of the total fatty acids for groups 1, 2 and 3, respectively; group 1 had significantly ($P<0.05$) lower saturated and higher unsaturated fatty acid concentrations than group 2. The iodine numbers were significantly ($P<0.05$) higher in group 1 than either group 2 or 3. Palmitic acid(C16:0) was the major fatty acid in hump fat with 32.06, 32.90 and 34.37%, followed by oleic acid (C18:1) 33.65, 21.66 and 28.91.0% and stearic acid (C18:0) 18.85, 24.13 and 20.74% for groups 1, 2 and 3, respectively. Group 1 had significantly higher ($P<0.05$) oleic acid and lower stearic acid concentrations than group 2. The melting point of both hump and abdomen fats varied between the age groups. This study indicated that age has an effect on the fatty acid composition and the melting point of hump and abdomen fats in one-humped Arabian camels.

Wolff et al., (2001)Thedistributiod profiles of individual trans- as well as cis-18:1 isomers from the fat prepared from the humpadipose tissue and the milk from Camelusdromedarius (the single-humped Arabian species) are described. Gas-liquid chromatography on two capillary columns with different polarities and lengths were used for this purpose in combination with argentation thin-layer chromatography. A comparison of the profiles established is made with that of true ruminant fats. In the fats from the dromedarius as well as from true ruminants, the trans-18:1 isomers have their ethylenic bonds in all positions between delta4 and delta16. The prominent trans isomer is the 11-18:1 (vaccenic) acid in all species, and the complete distribution profiles are quite similar. Concerning the cis isomers, the prominent isomer is oleic acid, followed by cis-vaccenic acid, as in true ruminant fats. Other cis isomers encompass the delta6-8 and the delta12 to delta15 isomers. Camelidae (suborder Tylopoda) and Bovidae (suborder Ruminantia) have evolved independently since the Eocene, that is for approximately 50 million years. Despite this considerable period, and the profound differences in anatomy, morphology, physiology, ecological and dietary habits between the extant species of these suborders, the rumen microflora has continued to synthesize the same trans- and cis-octadecenoic acid isomers, in comparable proportions, at least as deduced from their composition profiles. We conclude that the trans-18:1acid profile is not intrinsically species-dependent, but it can be affected by the nature and the proportions of dietary unsaturated fatty acids that themselves depend on the feed, and that may be species-specifi

Hump lipids of Camelusdromedarius (single-humped camel) were extracted and fractionated by ***Mirgani(1997)*** Through thin-layer chromatography. 2. The hump lipids were found to be mainly triglycerides with a trace of phospholipids. 3. The fatty acid methyl esters of the triglycerides were studied by gas-liquid chromatography. 4. The major fatty acids were found to be palmitate (35%), stearate (26%), oleate (24%) and myristate (12%). Hexadecenoic (2%) and pentadecanoic acids were minor components.

Conclousion:

The fatty acid composition of camel's milk, meat and hump confirmed the nutritional and health interest of this product in spite of a higher content of cholesterol compared with cow's milk and meat. Camel's milk, meat and humpseems to be very different from other mammalian milks and meat consumed by humans in terms of nsaturated fatty acid composition and in its low content of

short-chain fatty acids.Anecessary was to understand better the variability in lipid composition. Indeed, it was possible to identify some types of milk and meat according to their fatty acid profiles, variable factors (species, season and region) allowing the confirmation of a statistical link with any factor.

Recommendations

The renew from this preliminary study are fragmentary to make recommendations on the fattyacid profile of camel milk, meat and camel hump. However, more extensive studies are needed to fully characterize fatty acids in milk, meat and hump fat from camels and put it into a physiologically relevant perspective.

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