An-Najah National University
Faculty of Graduate Studies

Effect of Feeding Sesame Oil Cake on Performance and Cheese Quality of Anglo-Nubian Goats

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Dedication

This work is dedicated to my father, mother, lovely wife, beautiful children, brothers, sisters and to my friends.

The completion of this project was not possible without their support, encouragement and help.

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إقرار

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List of Contents

List of Tables

List of Abbreviations

CP	Crude Protein
CF	Crude Fiber
ADF	Acid Detergent Fiber
DMI	Dry Matter Intake
A.O.A.C	Association of Official Analytical Chemists
Ca	Calcium
CU	Cupper
MC	Milk Composition
MY	Milk Yield
SOC	Sesame oil cake
CY	Cheese Yield
L	Lactose
F	Fat
P	Protein
TS	Total Solids
SNF	Solids Non- Fat
PPM	Part Per Million
NIS	New Israeli Shekel
NFE	Nitrogen Free Extract
OM	Organic Matter
TMR	Total Mixed Ration
CLA	Conjugated Linoleic Acid
FAO	Food and Agriculture Organization
PMA	Palestinian Ministry of Agriculture
PCBS	Palestinian Central Bureau of Statistics
I.D.F.	International Dairy Federation

List of Appendices

Effect of Feeding Sesame Oil Cake on Performance and Cheese Quality of Anglo-Nubian Goats

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Abstract

This experiment was conducted to investigate the effects of feeding sesame oil cake (SOC) on milk and cheese quality of Anglo-Nubian goats. Sixteen lactating (20 days-in-milk) Anglo- Nubian goats were used in the experiment that lasted for 60 days. Goats were divided into 4 dietary treatment groups of 4 goats in each and the goats were distributed between the groups in away they represent age, lactation stage and number of borne. Goats were housed on pens of suitable size and were managed as any other commercial goat flock. The animals had free access to straw and water. Four types of dietary treatment were prepared using SOC. The first diet was the control and the other three diets contained: 5, 10, and 15% SOC, respectively. Animals fed twice daily and milked during the feeding time. Milk yield (MY) was recorded daily and samples were taken for chemical analysis. Cheese was made on a monthly basis and samples were taken for sensory evaluation by testing flavor and texture. Incorporation of SOC in goats' diets at levels of 10 and 15% caused an increase ($P<0.05$) in MY compared to control and 5% SOC. Feeding SOC at all levels tested had a positive ($P<0.05$) on goats milk fat (F). However, the highest Fat (F) percentage was detected in milk of goats fed with 15% SOC. Sesame Oil Cake had variable effects on milk protein (P) where the highest milk P content was from milk of goats fed with 5% cake. Both total solids (TS) and solids non fat (SNF) were increased ($P<0.05$) due to feeding different levels of SOC compared to control. Similar trends were observed on cheese composition in regard to F content where feeding SOC at different levels increased significantly ($P<0.05$) cheese F content compared to control. Other cheese components such as P and ash were not affected by SOC feeding. Sensory results showed that flavor of cheese from goats consuming 10 and 15% SOC ($P<0.05$) was better than cheese from the other groups. However, opposite trend was observed regarding cheese texture. The cheese from goats fed the control diet had ($P<0.05$) better texture. The results of this study indicate that SOC can be used in goats' diets during lactation season. Similarly using SOC in goats' diets proved to be economically feasible. However, more research is needed to assure these findings.

Chapter One

Introduction

Introduction

Population in Palestine is increasing at a high rate. The population growth rate was estimated to be 3% (Palestinian Central Bureau of Statistics (PCBS), 2006). Meanwhile harsh economic conditions in one hand and long dry periods in the other hand have been prevailing over the past few years. This has already resulted in the deterioration of natural grazing areas, and lead to a marked decrease in animal performance.

It is therefore important to investigate the utilization of agricultural by-products as feed ingredients for farm animals especially ruminants.

Little data are available on type, quantity, seasonal availability, alternative uses and relative costs of these by-products. Utilization of these by-products as feed, for ruminants, needs more research.

The worldwide dairy goat population has increased during the last 20 years to 12.2 million heads (FAO, 1998). The importance of milk arises from its impact to the national economy of many countries (Haenlein, 2001). The dairy goat industry is becoming an economically viable source of income for many small farmers all over the world (Park, 1990). A large proportion of goat milk is used for drinking or as milk products (cheese manufacturing). Composition of milk and cheese varies according to season and feeding systems. Dartt *et al*. (1999) compared pasture feeding with a confinement system for production of goat milk as a tool to reduce production costs and improve economic viability of family farms. More than 380000 goats are available in Palestine (PCBS, 2007). However, feeding cost makes more than 70% of total production costs (Abo Omar, 2002). In order to reduce feeding costs, attempts were made to use agricultural and industrial by-products as feed ingredients especially for ruminants. Therefore, it is essential to incorporate local raw materials and by-products in rations of farm animals (Shqueir and Qwasmi, 1994). Among these by-products is the Sesame Oil Cake (SOC). Sesame Oil Cake is a by-product of sesame seed pressing. About 10000 tons of the SOC are produced each year (Palestinian Ministry of Agriculture (PMA), 1999). Sesame Oil Cake is a relatively good source of crude protein (CP) which can replace part of basic ingredients in diets such as soybean. The chemical composition of SOC varies according to the method of processing (mechanical or solvent extraction). It has been reported that the dry matter (DM) content ranges from 83 to 96%. Also it has been reported that the CP, ash, ether extract, nitrogen free extract (NFE) and crude fiber (CF) are 23–46%, 7.5–17.5%, 1.4–27%, 25–31% and 5–12% on DM basis, respectively (FAO, 1990). Ryu *et al*. (1998a) reported that incorporation of SOC in calves' rations had positive effects on performance. Similarly, SOC tended to improve feeding quality of rice straw when fed to steers (Ryu *et al*., 1998b), and fattening lambs at levels ranged from 5 to 20% (Abo Omar, 2002). SOC, a relatively good source of CP, can replace dried poultry excreta in calves' rations without causing harmful effects (Khan *et al*., 1998). Also, SOC improved dry matter intake (DMI) and organic matter (OM), CP, CF and ether extract digestibility.

However, it is not well understood whether incorporation of SOC in dairy ruminants will impact on composition of milk and cheese.

Given that considerable amounts of SOC are produced locally, the objectives of this study were to investigate the effect of feeding SOC on the performance of Anglo-Nubian goats, MY, quality and cheese characters.

Chapter Two

Literature Review

2.1 Importance of small dairy ruminants

The milk of small ruminants such as goats and sheep is of particular economic interest in certain areas of the world. In the developing countries, production of this type of milk has become a useful strategy to tackle the problem of under nutrition, especially among human infants (Haenlein, 1996, 2001, 2004). An additional element of interest in the milk from small ruminants is the fact that it is a sustainable resource with excellent possibilities of economic profitability and demographic stability. It is especially important for arid, semi-arid and other problematic regions of the world. These species, which are exploited in the latter type of region under an extensive or semi-extensive management regime prioritizing autochthonous breeds, are valuable in preserving genetic variability while production costs are held down by the appropriate use of natural resources. The foods produced, namely milk and meat (from the young animals) are of excellent quality from a nutritional point of view (Boza, 1993).

Goat and sheep milk is widely used for home consumption and to produce yoghurt and different cheeses. This makes it of particular economic value in countries where goats and sheep are reared in large numbers because of climate or desert and mountainous terrain favoring goats and sheep over cattle. In Asian and African countries, especially India, goat and sheep milk plays a significant role in the national and the rural economy. The Mediterranean region produces 66% of the world's sheep milk and 18% of the world's goat milk. Of all the milk around the world produced by all species, sheep milk makes up about 1.5% and goat milk 2.0%. In the Mediterranean region the production of goat and sheep milk plays a prominent role because of tradition, and successful commercialization into products (12% for goat milk and 3% sheep milk of total milk) (International Dairy Federation (IDF), 1996).

There are an estimated total of 387123 goats including dairy goats producing approximately 32519 metric tons of milk annually with a value of 36314 thousands dollars in the Palestinian territory (Palestinian Central Bureau of Statistics, 2007). Milk and milk products from goats have been an alternative to milk from cattle in many developing countries, and become delicate specialty foods for consumers in some developed countries such as the US and Canada. However, the production cost of goat milk is traditionally higher than that of cow milk due to many factors, such as feeding and labor requirements (Redfern *et al*., 1985). Feed cost usually accounts for 35–50% of the total cost of milk production (Schmidt and Pritchard, 1987). Although concentrate supplementation to lactating goats is a major method of manipulating MY and milk composition (Sauvant and Morand-Fehr, 2000), some researchers suggested that intensive grazing could provide a sustainable alternative to reduce cost (Dartt *et al*., 1999). Landau *et al*. (1993) examined the effect of concentrate supplementation of dairy goats on milk composition (M C). Although the goats fed a high level of concentrate had more milk, there were no significant differences in total production of F, P and TS. It was suggested that the decision on concentrate supplementation to ranging dairy goats should depend on the target milk production and whether milk is sold as a liquid or a value-added product, such as cheese. If milk is used for cheese manufacturing, the low concentrate feeding is economically efficient in sustaining goat milk production. Recently, Guo *et al*. (2001) reported that the chemical composition of the commingled goat milk varied markedly during the lactation season. They suggested that milk produced in summer had the highest cheese yield (CY) potential because the milk had a high proportion of casein and a greater than one ratio of CP to F.

The macro- and micro-nutrients of ewe and goat milk depends on main production factors making up the farming system: genotype, reproduction and sanitary characteristics of animals, agro-climatic conditions and socio-economical environment, and farming methods such as feeding and milking (Morand-Fehr *et al*., 1991; Morand-Fehr, 2005; Addis *et al*., 2005). Actually, the link between these factors can be close and complex. As far as cows are concerned, breed, feeding and milking are the main factors influencing the composition of their milk (Agabriel *et al*., 2001). But amongst all these factors, feeding appears to be the most important (Agabriel *et al*., 1995). Dairy goat and dairy sheep farming is a vital part of the national economy in many countries, especially those in the Mediterranean and Middle East region (FAO, 2003), and are particularly well organized in France, Italy, Spain, and Greece (Park and Haenlein, 2006). However, large-scale industrialization of the dairy goat and dairy sheep sectors in many countries is limited by the low and seasonal cyclicity of individual milk production, which is around 50 kg annually (Jua`rez and Ramos, 1986; FAO, 1997).

2.2 Dairy goats

2.2.1 Breeding

Dairy goats are usually seasonal breeders. Most breeding occurs in late summer through early winter. The goat has an 18-21 day estrus cycle or "season." The doe's "season" lasts from a few hours to two or three days. The gestation period is five months. Twins are common, but single or triplet births are not rare. Doe milks approximately ten months following kidding, and then is held dry for two months before her next freshening. Dairy goats are hardy, gentle, intelligent animals. Their life span is eight to twelve years (American Dairy Goat Association, 2004, Mackenzie, 1985).

2.2.2 Feeding

Dairy goats need a year-round supply of roughage, such as pasture, browse or well-cured hay. Winter browse and pastures should be supplemented with hay. Milking, breeding and growing stock need a daily portion of legume hay, such as alfalfa. Kids and bucks need a balanced grain diet and milkers should be fed a standard dairy grain diet. Kids are milk fed until two to three months of age, but should be consuming forages such as pasture grass or hay by two weeks of age and grain within four. All dairy goats must have salt and fresh clean water. Mineral supplements are desirable. Dairy goats have fastidious eating habits and are particular about the cleanliness of their food. Their natural curiosity may lead them to investigate newly found items by sniffing and nibbling, but they quickly refuse anything that is dirty or distasteful. Good quality hay and a balanced grain mix appear to be the best approach in maintaining high levels of milk production. Fiber in the total diet is needed to maintain a normal milk-fat test. However, too much poor quality fiber will lead to lowered levels of milk production. Diets containing some cottonseed hulls or other fibers may be included in the grain where hay or other roughages are not readily available. Dairy goats are good eaters and can consume from 4 to 7% dry matter (DM) per 45.4 kg body weight as compared to 3-4% DM consumption for dairy cows. This high level of intake allows the dairy goat to have an abundance of nutrients readily available for the synthesis of milk. Overall, the efficiency of milk production by the dairy goat is quite similar to that of the dairy cow. The composition of goat's milk varies both within and between breeds. Various values have been reported for each of the nutrients. This has undoubtedly resulted from analyzing milk from a single breed, a single herd, or the analytical techniques used. Goat's milk contains more fat and ash than cow's milk, but has less lactose. Generally, the composition of goat's milk can be expected to fall within a specified range for each milk component. Fat, the most variable component, will usually fall between 3.0 to 6.0% in herd samples. However, values outside this range are not uncommon for individual samples. The ranges that can be expected for total solids, protein, lactose, and ash are 12-16, 3-4, 3.8-4.8 and 0.70-0.95 respectively (American Dairy Goat Association, 2004, Mackenzie, 1985).

Table (1) Average (%) composition of milks from various mammals.

Species	H2O	F	P	L	Ash	S.N.F	T.S.
Goat	87.00	4.25	3.52	4.27	0.86	8.75	13.00
Cow	87.20	3.70	3.50	4.90	0.70	9.10	12.80
Ewe	80.71	7.90	5.23	4.81	0.90	11.39	19.29
Human	87.43	3.75	1.63	6.98	0.21	8.82	12.57

Adopted from (Fundamentals of Dairy Chemistry, 1965).

2.2.3 Milking

On a worldwide basis, more people drink the milk of goats than any other single animal. A dairy doe should be milked in the same manner as a dairy cow, using good dairy hygiene. Does may be milked by hand or machine. The milk requires the same careful attention to cleanliness and cooling as any other milk. Goat milk has a more easily digestible fat and protein content than cow milk. The increased digestibility of protein is of importance to infant diets (both human and animal), as well as to invalid and convalescent diets. Furthermore, glycerol ethers are much higher in goat than in cow milk which appears to be important for the nutrition of the nursing newborn. Goat milk tends to have a better buffering quality, which is good for the treatment of ulcers. Goat milk can successfully replace cow milk in diets of those who are allergic to cow milk. Many dairy goats, in their prime, average 2.72 to 3.63 kg of milk daily (roughly 3 to 4 quarts) during a ten-month lactation, giving more soon after freshening and gradually dropping in production toward the end of their lactation. The milk generally averages 3.5 % butterfat. A doe may be expected to reach her heaviest production during her third or fourth lactation. Goat milk is used for drinking, cooking and baking. It is used to make cheese, butter, ice cream, yogurt, candy, soap and other body products. Goat milk is whiter than whole cow milk. Butter and cheese made from goat milk are white, but may be colored during processing. Due to its small fat globules and soft small curd, products made with goat milk are smooth and cream-like. Goat milk is also naturally emulsified. Goat milk production is important in developed countries; goat milk is transformed into high quality cheese considered as a delicacy (Rubino *et al*., 2004). Goat milk is obtained by machine milking and milking parameters have not yet been completely understood in goat production, although the frequency of milking is an important parameter in goat management and some breeds are milked twice a day (Saanen, Anglo-Nubian and Alpina) whereas others are milked once a day (Majorera, Murciano-Granadina, Tinerfen˜a), being results uneven. Milk production was almost 26% higher in Saanen goats milked twice a day (Wilde and Knight, 1990); furthermore, a reduction of 18% in milk yield was reported by Salama *et al*. (2003) when goats were milked just once a day, although some breeds show lower reductions. Capote *et al*. (1999) reported increases of only 6.4 % and 8.4 % in the Tinerfen˜a breed milked twice a day during first In modern and high-producing dairy herds, regrouping according to age, nutrient requirements, body condition, lactation period and level of milk yield, is a common practice of management to enhance productivity and profitability. Mixing unfamiliar animals is also common in fattening animals. However, as a result of the vigorous fighting associated with the establishment of a new social hierarchy, the practice may temporally disturb social structure of the herd, which may distress animals and have adverse effects on milk production (B e and F revik, 2003).

Table (2). Average size, milk yield and milk composition of dairy goat breeds

Breed	Height (cm)	Weight (kg)	MY (kg)	F (%)	P (%)
Alpine	76.20	61.29	903.46	3.56	3.06
American La Mancha	71.12	59.02	777.25	3.80	3.29
Nubian	76.20	61.29	713.69	4.61	3.66
Saanen	76.20	61.29	942.96	3.52	3.02
Toggen-burg	66.04	54.48	896.40	3.38	3.01

Adopted from (American Dairy Goat Association, 2004)

2.3 Anglo-Nubian goats

Anglo-Nubians were developed in England by crossing British goats (Toggen-burg) with bucks of African and Indian origin. The Anglo Nubian is an all-purpose goat, useful for meat, milk and hides production. It is not a heavy milk producer but has a high average butter fat content (4-5 %). The Anglo Nubian breeding season is much longer than that of the Swiss breeds so it is possible to produce milk all year round. As it is the best suited of the dairy goat breeds to hot conditions, the Anglo Nubian has been used in grading-up programs in many tropical countries to increase the milk and meat production of local breeds. The Anglo-Nubian is a relatively large, proud, and graceful dairy goat. The Anglo-Nubian goat is named for Nubia, in northeastern Africa. The originally goats imported from Africa, Arabia and India were long-legged, hardy goats that had some characteristics desired by goat breeders in England. English breeders crossed these imported bucks on the common short-haired does of England prior to 1895 to develop the Anglo-Nubian goat. In the United States the breed is usually spoken of as the Nubian. The Anglo-Nubian is regarded as an "aristocratic" appearing goat and has very long, pendulous ears that hang close to the head. The Anglo-Nubian carries a decidedly Roman nose and is always short-haired. Any solid or parti-colored coat is permitted in the Anglo-Nubian, but black, red or tan are the most common colors, any of which may be carried on combination with white. Usually there is shorter hair on the Anglo-Nubian males, particularly along the back and on the thigh, than is commonly found on the Swiss breeds. The udder of the Anglo-Nubian is capacious but is sometimes more pendulous than that of the Swiss breeds. A mature doe should stand at least 76.2 cm at the withers and weigh 61.3 kg or over, while the males should stand at least 88.9 cm at the withers and weigh at least 79.45 kg. The Anglo-Nubian usually gives less milk than the Swiss breeds, but produces a milk of higher butterfat content. The head is the distinctive breed characteristic, with the facial profile between the eyes and the muzzle being strongly convex. The ears are long (extending at least 2.54 cm beyond the muzzle when held flat along the face), wide and pendulous. They lie close to the head at the temple and flare slightly out and well forward at the rounded tip, forming a "bell" shape. The ears are not thick, with the cartilage well defined. The hair is short, fine and glossy. Any color or colors, solid or patterned, is acceptable (Mackenzie, 1985). Many attempts have been made to increase the milk production and milk components through dietary manipulation of protein and energy in the diets of ruminants (Maiga and Schingoethe, 1997). Protein is typically the most important and expensive nutrient in dairy diet which needs to be efficiently utilized. The source of dietary CP and energy fed to the dairy animals significantly influence the utilization of N and energy in the rumen and the flow of nutrients to the small intestine. Milk yield and milk components were increased when lactating animals were fed high quality protein with good ruminal bypass potential (Garg *et al.*, 2005).

2.4 Importance of ruminants' milk

The importance of sheep and goat milk to human health, their characteristics and their role in some populations have been demonstrated (Rubino *et al*., 1999; Boyazoglu and Morand-Fehr, 2001; Haenlein, 2002, 2004). Haenlein (2004) states, that the quantities of these milks consumed by farmers and their neighbors (particularly goat milk) are very important, although they are not included in official statistics. Their role appears to be essential as a source of high quality P and calcium in arid areas especially for starving or malnourished people, where cattle have difficulties to be maintained. Sheep and goats are often considered by consumers as ecological animals, and their products apiaries more adapted to maintain human health. In industrial countries, sheep and goat cheeses are very well recognized by connoisseurs as gastronomic and festive products. The proportion of these milks processed into cheeses and yoghurts is higher in comparison to cow milk. The cheese quality depends closely on the composition and quality of milk. The quality of these milks can be evaluated by various criteria: sanitary, dietetic, nutritional, and technological and after cheese-making under aspects of gustative, archeological, gastronomic and hedonic parameters. All these kinds of quality depend on multi-factors and their interaction. They are mainly linked to their main components (F, P, lactose (L)) and to their physico-chemical characteristics, as well as to micro-compounds present regularly or occasionally such as minerals, vitamins, minor fatty acids, Conjugated Linoleic Acid (CLA), cholesterol and terpenes. Accounting for the dietetic importance of milk lipids and particularly fatty acids, Sanz Sampelayo *et al*. (2007) reports on the effects of the nature of feeds and particularly to fats consumed by ewes and goats on milk F composition. Cheese yield depends on the P content. Milk lipids and consequently the F content are very likely to influence texture and fineness of the cheese paste and the quantities of different fatty acids, cholesterol, lipo-soluble vitamins and compounds modifying flavor important to consumers.

Low or reduced DM content in goat milk has been related to a negative energy balance resulting from low energy intake, high MY or both (Sutton, 1989). Goats are efficient in mobilizing energy from their adipose tissue reserves in order to maintain milk production when faced with a shortage of feed (Santucci *et al*., 1991). Thus, in a grazing situation, poor pasture quality or reduced pasture intake, due for instance to adverse weather conditions, may lower the energy intake, induce F mobilization and possibly increase the frequency of milk with taste defects and a reduced DM content. Under Norwegian practical conditions, the amounts of concentrate fed to dairy goats has traditionally been reduced when goats are grazing, possibly to an extent which may induce taste defects.

Cheese yield is defined as the amount of cheese manufactured from a given amount of milk (Fenelon and Guinee, 1999). It is considered a major factor affecting efficiency and profitability of cheese manufacturing (Emmons *et al*, 1993). Factors influencing cheese yield include milk composition, amount and genetic variants of casein, milk quality, somatic cell count (SCC) in milk, milk pasteurization, coagulant type, curd firmness at cutting, and manufacturing parameters (Fenelon and Guinee, 1999). Cheese yield potential of milk is largely dependent on milk composition, particularly fat and protein (Lawrence, 1991a; Brito *et al*., 2002; Guo *et al*., 2004). The casein fraction of milk protein is the dominant factor affecting curd firmness, syneresis rate, moisture retention, and ultimately affecting cheese quality and yield (Lawrence, 1991b).

2.5 Using of by-products in ruminants feeds

Some Mediterranean countries are characterized by harsh climate conditions. In these regions, pasture is available only for short periods or is not available at all. Moreover, the use of cereals in animal diets creates a competitive conflict with human nutrition, and the use of soybean is expensive. An interesting challenge for scientists in the field of animal nutrition is the introduction of alternative feedstuffs that could overcome the problems of environmental harshness and production costs. At the same time, the preservation of animal health, production yield and product quality is essential. Several studies have shown that the exploitation of some shrubs (*e.g.* saltbush, *Atriplex nummularia*; *Acacia cyanophylla*; and cactus, *Opuntia ficus-indica*), legume seeds and pods (*e.g.* peas, *Pisum sativum*; chickpeas, *Cicer arietinum*; faba beans, *Vicia faba*; and carob pods, *Ceratonia siliqua*), or some agro-industrial by-products (*e.g.* olive cake, sugar beet pulp, extruded linseed cake and citrus pulp), can be successfully used as supplements in small ruminant diets, without compromising animal performance (Makkar, 2003, Min *et al*, 2003)

Oilseeds are regarded as one of the most important field crops produced in the world. This is not only true regarding their contribution to the gross value of production for agricultural commodities, but also in terms of their value in the value-adding system of other commodities and products. The demand for oilseeds originates mainly from animal feed manufacturers, who use it for feed diets and from demand for vegetable oils for industrial use and human consumption. The largest increase in the demand for oilseeds for feed diets in South Africa was from the dairy industry that bought 13.91% more diets between 1999 and 2001. The dairy industry is followed closely by the cattle and sheep industry with an increase of

13.49% for the same period (AFMA, 2003). Soybean oilcake constitutes the largest portion of the imported oilcake.

Processing oilseeds provides inputs to various other sectors of the economy, including agricultural inputs in the form of animal feedstuffs and industrial inputs in the manufacturing of products such as paints and lubricants.

Feeding oilseeds and vegetable oils is an effective method to manipulate fatty acid composition of cow's milk (Mustafa *et al*., 2003; Sarrazin *et al*., 2004) and goat's milk (Mir *et al*., 1999) by reducing saturated: unsaturated fatty acid ratio of the milk. Furthermore, some oilseeds can be fed to increase concentrations of specific fatty acids.

For instance, feeding flaxseed had been found to increase linolenic acid while feeding sunflower seed and soybean increased CLA content in cow's milk (Dhiman *et al*., 1999; Mustafa *et al*., 2003; Sarrazin *et al*., 2004). Ryu *et al*. (1998a) reported that incorporation of SOC in calves' diets had positive effects on performance. Similarly, SOC tended to improve feeding quality of rice straw when fed to steers (Ryu *et al*., 1998b). SOC, a relatively good source of CP, can replace dried poultry excreta in calves' diets without causing harmful effects (Ryu *et al*., 1998b) SOC improved DMI and OM, CP, CF and ether extract digestibility.

Chapter Three
Materials and Methods

3.1 Diet preparation

The experimental diets were formulated at the experimental site. Raw SOC was collected from a local sesame pressing factories (Nablus and Tulkarm, Palestinian National Authority) during the summer of 2007. The fresh material was transported to the experimental site. It was spread on a large plastic sheet for sun-drying for 3 days. The material was covered during night to avoid moisture accumulation.

The experimental diets were formulated to meet NRC (1994) requirements.

Four diets were formulated. SOC was added to replace similar amounts of soybean meal and corn where all diets had the same amount of P. Diets used in the experiment are shown in table 3.

Table (3). Composition and chemical analysis of the 4 experimental diet used in the experiment

Diet	**Control**	**Group 1**	**Group 2**	**Group 3**
Corn	26	23	20	17
Soybean meal	14	12	10	8
SOC	0	5	10	15
Bran	27	27	27	27
Barely	18	18	18	18
Wheat	11	11	11	11
Salt	0.7	0.7	0.7	0.7
Oil	0.6	0.6	0.6	0.6
Limestone	1.8	1.8	1.8	1.8
Di-calcium Phosphate	0.4	0.4	0.4	0.4
Premix*	0.5	0.5	0.5	0.5
Calculated Chemical analysis%				
DM	90.1	90.7	91	90.6
CP	17.0	16.9	17.1	17.0
Crude Fat	2.00	2.91	4.24	5.7
CF	4.1	4.24	4.72	5.18
Cu (ppm)	8.3	9.2	10.1	11.1
Ash	6.1	6.22	6.5	6.4
Ca	1.03	1.05	1.07	1.09
Phosphorus	0.45	0.43	0.41	0.40

* Premix: (Vit. A-8mg, Vit. D3-1.6mg, Vit. E-20mg, Cobalt-1gm, Manganeze-30gm, Iodine-0.5gm, Selenium-0.1gm, Calcium-441.44gm,phosphorus 100mg, iron-20 mg, Antioxidant-13gm) / ton.

3.2 Feeding trial

A total 16 lactating Anglo-Nubian goats were used in the experiment. Goats were housed in the farm of the faculty of agriculture/ An- Najah National University, Tulkarm, Palestine. Goats were divided into four dietary treatment groups of four goats in each and the goats were distributed between the groups in away they represent age, lactation stage and number of borne (in every group one doe at the first lactation stage and its age is about 1.5 year, two does at the second lactation stage and their age is about 2 years and the last doe at the third lactation stage and its age is about 2.5 year). Goats were housed on pens of suitable size and were managed as any commercial goats flock. The animals had free access to straw and water. Animals fed twice daily (4kg of experimental diet for each group/ day) at 0700 and 1800 h and milked during the feeding time. These goats had been 20 days-in-milk when the first batch of milk had been collected. MY of each group weighed daily till the end of the experiment which lasted for 60 days. Milk samples were taken for chemical analysis twice per month and one time per month for cheese processing.

3.3 Processing of Nabulsi white cheese

Goat milk was heated to 73c̊ and then cooled to 37c̊ and then the rennet (enzyme) was added (1drop/1kg of milk) to the milk and mixed well. The milk was set at the same temperature, (37 c̊) to coagulate for 45 minuets. Curd was scooped into cheese cloth and drained for 30 minuets and cheese was taken out of the cheese cloth and weighed. The cheese was cut into blocks (5 x 5 x 1 cm). Samples were taken for sensory evaluation and chemical analysis. The cheese blocks was maintained in salt solution (8 %) in separate plastic containers kept in the cooler at 4 c̊ and sample was taken one time monthly for two months. All cheese samples were frozen at (– 18 c̊) for later chemical analyses.

3.4 Chemical analysis of feed

Feed were analyzed for DM, CP, CF, crude fat, Ash, Cu, utilizing the A.O.A.C (1995) procedures. (Appendices). The Ca and P contents were determined using the flame photometry instrument.

3.5 Chemical analysis of milk and cheese

F content of milk and cheese was determined by Ether Extract procedure (Ether Extract, A. O. A. C, 1995). P content was determined by the Kjeldahl procedure. Total solid content of milk and cheese was determined by the drying method the gravimetric method. L content of milk was determined by the lactoscan (milk analyzer) instrument.[**]

3.6 Sensory evaluation

Cheese samples were judged for sensory quality by a panel of three trained judges. The sensory quality was evaluated on a 15-point scale, with 10 points designated to flavor and five points to body and texture (Bodyfelt *et al*., 1988).

3.7 Data analysis:

All data were analyzed by ANOVA using the linear model procedure of SAS (SAS, 1988) to determine the effect of addition of SOC to goat's diets on M C, M Y, C Y and cheese quality. LSD test was used to separate the significant means.

[**]Lactoscan instrument produced by Milkotronic Ltd (Nova Zagora, Bulgaria), phone/ fax: +35945767082 e-mail: www.lactoscan.com or www.milkoscan.com. Usage of the milkoscan based on the infrared measurement principle to determine L content.

Chapter Four

Results and Discussion

4.1 Composition of SOC

Table 4 shows the chemical composition of raw SOC. Composition values are in agreement with previous research (Abo Omar, 2002; Ryu *et al.*, 1998b).

Table (4): Composition and chemical analysis of SOC.

Nutrient	%
DM	95.7
CP	22.7
CF	11.9
ADF	33.0
Crude Fat	26.9
NFE	31.0
Ash	7.50
Ca	0.60
Phosphorus	0.10
Cu (ppm)	33.0

4.2 Milk yield and composition

The results obtained from this experiment indicated that goats fed with high levels of SOC (Groups 2 and 3) produced higher (P<0.05) yield of milk compared with goats in other two groups (Table 5).

Table (5). Milk yield and milk composition from goats fed different levels of SOC.

	Control	Group 1	Group 2	Group 3
M Y , kg	7.4b	7.3b	7.6a	7.7a
F %	4.3c	4.8b	5.1a	5.1a
P %	3.68b	3.74a	3.67b	3.69ab
L%	4.83	4.89	4.82	4.84
TS %	13.59b	14.48a	14.39a	14.40a
SNF %	9.26b	9.67a	9.24a	9.29a
Ash%	0.73	0.74	0.73	0.74

[abc] Rows of different superscripts are significantly different (P<0.05).

Milk F percentage was higher (P<0.05) in milks of goats fed with 10 and 15 % SOC compared to the control goats. However, milk of goats fed the two high levels had more (P<0.05) F compared to milk of goats fed the lowest level of SOC (Table 5).

This result is in agreement with previous research where feeding SOC increased milk fat for ewes (Zhang *et al*., 2006; Horton et al., 1992; Casals et al., 1999) and goats (Baldi et al., 1992; Mir et al., 1999) fed supplemental fats.

However, it contrasted previous results of Kitessa *et al*.(2003) where oil seeds had no or negative effects on ewes milk F and of cows milk F (Mustafa *et al*., 2003; Sarrazin *et al*., 2004). NRC (2001) showed that factors affecting the response of milk F percentage to F supplementation include level and type of F, forage source, and other ingredients in the diet. Results of this study show that feeding SOC to lactating goats up to 15% had a positive effect on milk F percentage. As a result of higher milk F percentage, milk from goats fed SOC contained more (P<0.05) TS and solids non F compared to control group (Zhang *et al*., 2006; Casals *et al*., 1999).

Milk P was not affected by dietary treatments (Table 5). This result is in agreement with others (Mir *et al*., 1999; Kitessa *et al*., 2003; Zhang *et al*., 2006). Similar trends were observed in cow milk (Mustafa *et al*., 2003). Our results, however, are different from Casals *et al*. (1999) and Rotunno *et al*. (1998) where a negative effect was found on milk P percentages of ewes. Oilseed supplementation also caused significant reduction in milk P percentage in dairy cows (Khorasani *et al*., 1991; Dhiman *et al*., 1995). This reduction might be attributed to a lack of increase in amino acids available to the mammary gland for P syntheses as M Y increases during F supplementation (Wu and Huber, 1994; Zhang *et al*., 2006). The lack of response of milk P to oilseed addition might be related to the shorten term supplementation used in previous research (Schinoethe *et al*., 1996).

SOC increased (P<0.05) percentages of TS and solids non fat (SNF) compared to control group but had no effects on other milk fractions as ash content. These results are in agreement with previous research (Khorasani *et al*., 1991).

4.3 Cheese yield and composition

C Y and composition is shown in Table 6. Cheese making efficiency was not affected by dietary treatments. The yield of cheese was the same by all treatments.

Table (6). Cheese yield and Cheese composition from goats fed different levels of SOC.

	Control	Group 1	Group 2	Group 3
C Y %	24.4	24.3	24.4	24.5
DM %	48.1	47.2	49.5	51.2
F %	16.2c	19.7b	20.9b	23.5a
P %	11.9	12.0	11.9	12.1
Ash%	1.56	1.52	1.53	1.60

[abc] Rows of different superscripts are significantly different (P<0.05).

Cheese DM, P and ash were not affected by dietary treatments and averaged 49.0, 11.9 and 1.55%, respectively. Our results are consistent with Dhiman *et al*. (1999) and Zhang *et al*. (2006) where no difference was found in the composition of cheese between oilseeds diets and control diet. However, feeding SOC increased cheese F content compared to control diet. The two highest levels of SOC had more (P<0.05) increase in cheese F compared to the lowest level (Table 6). The high level of F in milk may explain the significant increase in cheese F. Our results in regard to cheese F content are in contrast to other reports (Zhang *et al*., 2006).

4.4. Sensory analysis

The results of sensory analysis are shown in Table 7. These results were based on a scale of 10 for the flavor and a five point scale for texture.

Table (7). Results of sensory analysis

	Control	Group 1	Group 2	Group 3
Flavor	6.17b	6.33b	7.66a	8.5a
Texture	4.16a	3.8b	3.66b	3.66b

[ab] Rows of different superscripts are significantly different (P<0.05).

Feeding SOC at the levels of 10 and 15% in goats diets produced more (P<0.05) accepted flavor of cheese compared to control and the low SOC level. Similar findings were observed by previous research (Eknaes and Skeie, 2006). Flavor of milk from goats fed with high roughage levels was superior compared to milk from goat fed with high concentrate levels as in the current experiment (Eknaes and Skeie, 2006). However, the texture of cheese was better (P<0.05) from goats fed the control diet compared to cheese from goats fed SOC at different level.

The fresh cheese of goats fed 15% SOC was rated highly acceptable with a mean flavor score of 8.5 (out of 10). Cheese from goats fed 10% of SOC came in the second place. The main defect was found to be “acid” or “lack of flavor”. A “goaty” flavor was identified in cheese as a characteristic sensory attribute of goat cheese in most of the cheeses. This “goaty” flavor was attributed to the abundant amount of short-chain fatty acids in goat milk, as compared with cow milk (Zeng and Escobar, 1995). Mehanna and Hefnawy (1991) made Domiati cheese from goat milk and reported a mean flavor score of 8.67. Domiati cheese had an overall organoleptic score (sum of flavor and texture) of 12.51 (out of 15). The body and texture of Domiati cheese was smooth and creamy. The main defect was identified as “pasty”. Zeng and Escobar (1995) reported a similar total organoleptic score of

12.55 in a similar soft cheese using Alpine goat milk. The pasty texture was observed in our experiment as level of SOC increased in diets, the similar trend as other research when feeding oil seeds (Zeng and Escobar, 1995).

Both cheese flavor and texture were the same during goats lactation season. Similar scores were observed for both characters.

Table (8). Economic impacts of the feeding trial and milk yield

Parameter	Control	Group 1	Group 2	Group 3
Number of goats	4	4	4	4
Duration of the experiment, day	60	60	60	60
Daily feed intake, kg/goat	1	1	1	1
Cost of kg diet, NIS.	1.8	1.78	1.65	1.58
Cost of total feed intake/ goat, NIS	108.0	106.8	99.0	94.8
Average daily milk yield, kg	1.85	1.83	1.90	1.92
Price of goat milk, kg, NIS	3.5	3.5	3.5	3.5
Price of daily milk yield/goat, NIS	6.47	6.41	6.65	6.72
Price of total milk yield/goat, NIS	388.8	384.6	399.0	403.2

4.5 Cost of feeding and milk yield

The cost per kg diet is shown in Table (8). The highest cost of diet was observed in goats fed the control diet. Cost of diet was reduced through groups from 1 to 3. This can be explained by the differences in prices of these diets. The reported figures from this experiment show the economic feasibility of feeding such type of ingredients and saving that can be achieved. A net of 0.22 NIS/kg can be saved when using 15% SOC in group 3 compared to control. Numerically, about 220 NIS can be saved/ton diet. Increasing in milk yield can be observed through groups from 1 to 3.and this means that the income from milk will be increased as shown in Table (8).

Chapter Five

Conclusions and Recommendations

5.1 Conclusions

The following conclusions can be raised:

1. It is possible to utilize raw SOC material available locally since it proves to have no harm effect and is easy to handle.
2. Feeding the raw material at levels up to 15% had positive effects on several milk and cheese parameters.
3. Although cheese produced from goats fed 15% SOC had low texture score, the quality of the milk was acceptable.
4. Feeding SOC at levels used, especially at 15% has a potential economical advantage.

5.2 Recommendations

The current study suggests that feeding SOC at levels up to 15% had no harm effects on lactating goats and had advantages in improving milk yield and quality.

No differences in milk or cheese quality parameters were noticed when SOC was included in goats' rations at different levels. It is recommended that additional research is needed when high rate of SOC inclusion is used.

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Appendices

Appendix 1:- Determination of Ash (A.O.A.C., 1995)

Procedure

1. Heat the crucible for one hour in a muffle furnace at 500c, cool and weigh as quickly as possible.
2. Weigh by difference 2g into the crucible.
3. Place it in a cool furnace and slowly bring the temperature up to 600c, leave to overnight.
4. Remove the crucible from furnace then transfer to a desiccators.
5. Allow to cool to room temperature then weigh.

Calculation

% Ash = (Weight of ash) ×100% Weight of sample (DM)

Appendix 2:- CP Determination (Kjeldahl Method, A.O.A.C., 1995)

Reagents:-

1. Sulfuric acid (concentrated 98%)
2. Boric acid 4% solution. (Dissolve 4g boric acid in 100ml volumetric flask and complete to the mark).
3. Sodium hydroxide dissolves 500g. sodium hydroxide in 100ml volumetric flask cools and make up to 1000ml.
4. Indicator solution screened methyl red indicator solution. (Dissolve 2g. methyl red in 100ml of 96% v/v ethanol. Dissolve. 1g. methyl red in 100 ml of 96% v/v ethanol).
5. Digestion mixture add to each digestion flask. 19g of CuSo4 0.5g. H2O and 9.7g. K2SO4 and mix.
6. Add anti foaming granules if necessary.

7. Hydrochloric acid solution.01N.

Procedure:-

1. Weigh about 1.0g sample into 100 ml Kjeldahl flask.
2. Add 20ml of concentrated sulfuric acid, and then add 10g of digestion mixture and few antifoaming granules into the digestion flask.
3. Digest the mixture until the solution becomes clear.
4. Transfer the digestion tube and connect to the distillation unit, add 50ml of distilled water into the cooled digestion tube.
5. Add 40ml of sodium hydroxide (50%) to digestion tube.
6. Place a receiving flask containing 30ml of 4% boric acid with few drops of mixed indicator.
7. Allow distillation to proceed to assure ammonia is free from the sample.
8. Titrate the ammonia collected in the receiving flask with standard 0.1N HCL solution.

Calculation

% Nitrogen = V0.1 HCL×N.HCL×14.007×100×100

100×Weight of dry sample

% CP =%Nitrogen×6.25

Appendix 3:- Crude Fat Determination (Ether Extract, A.O.A.C., 1995)

1. Weigh 2g sample into the extraction thimble.
2. Clean and dry solvent flasks at 105c for one hour, then cool to room temperature and weigh.
3. Place thimble at the extraction apparatus.

4. Add 40ml diethyl ether to the solvent flask.
5. Turn on water that cools the hot plates until they are in contact with the flasks and on the heaters.
6. After the extraction is completed, remove the thimble and allow the solvent to evaporate.
7. Dry the flask at 105c for 30 minutes, cool to room temperature and weigh.

Calculation

%Crude Fat = Weight of flask after extraction – Weight of flask before extraction ×100/Weight of dry sample.

Appendix 4:- CF Determination **(**A.O.A.C., 1995)

Reagents:-

1. Sulfuric acid solution 0.255N.
2. Sodium hydroxide 0.313N.(Dissolve 1.25g fresh sodium hydroxide in 100ml volumetric flask and complete with distilled water to the mark).
3. Methyl alcohol and diethyl ether.

Procedure:-

1. Weigh 2g sample and transfer to 600ml flask.
2. Add 200ml of 0.255N sulfuric acid.
3. Place the beaker on the heating unit, turn heat on, and boil for exactly 30 minutes.
4. Filter through filter paper.
5. Transfer to 600ml beaker and add 200ml 0.313 sodium hydroxide.

6. Boil for 30 minutes from the onset of boiling.
7. Filter through a new filter paper.
8. Rinse the filter with 15ml of alcohol and then with about 15ml of diethyl ether.
9. Dry the filter paper at 105c, cool and weigh.

Calculation

% CF = M1-M0×100/M2

Where, M0=Weight of filter paper and the sample before drying.

M1=Weight of filter paper and the sample after drying.

M2=Weight of the sample (DM basis).

Appendix 5:- Acid Detergent Fiber (Robertson and Van Soest, 1981)

Dissolve 20g of cetylmethylammonium bromide in 1L Sulfuric acid (1N).

Procedure:-

1. Weigh 1g sample and put into a 600ml beaker.
2. Add 100ml of acid detergent solution using a measuring cylinder.
3. Add 2ml of decahhyronphalene.
4. Heat to boiling and reflux for 60 minutes from the onset of boiling.
5. Filter using glass crucibles and with hot distilled water.
6. Wash the fiber with acetone.
7. Wash the fiber with hexane.
8. Dry at 105c overnight, cool and weigh.
9. Ash at 600c overnight cools and weigh.

Calculation

Acid Detergent Fiber =M0-M1×100/M2

Where, M0=weight of crucible and fiber.

M1= weight of crucible and ash.

M2=weight of sample.

Appendix 6:- Daily Milk Yield from the Experimental Goat Groups.

Days	*G1*	*G2*	*G3*	*G4*
1	7.55	6.8	7.12	6.82
2	7.5	6.66	6.99	6.76
3	7.39	6.87	7.11	6.72
4	7.33	6.82	7.21	6.88
5	7.44	6.99	7.19	7.02
6	7.44	6.89	7.24	7.09
7	7.64	6.94	7.27	7.14
8	7.59	7.04	7.21	7.09
9	7.7	6.82	7.13	7.16
10	7.42	6.88	7.19	7.22
11	7.44	6.98	7.23	7.1
12	7.32	6.9	7.32	7.13
13	7.49	6.94	7.09	7.32
14	7.52	6.83	7.34	7.24
15	7.56	6.88	7.29	7.26
16	7.69	6.84	7.33	7.35
17	7.42	6.82	7.21	7.44
18	7.44	6.88	7.3	7.67
19	7.54	7.04	7.29	7.42
20	7.52	7.09	7.42	7.5
21	7.66	7.18	7.31	7.55
22	7.58	7.1	7.34	7.44
23	7.44	7.13	7.22	7.5
24	7.52	6.87	7.14	7.32
25	7.37	6.94	7.18	7.14

26	7.32	7.02	7.1	7.02
27	7.4	6.88	7.04	6.99
28	7.34	7.03	7.1	7.04
29	7.27	7.06	7.08	7.02
30	7.22	7	7.32	7.31
31	7.29	7.19	7.19	7.17
32	7.39	7.32	7.44	7.4
33	7.34	7.36	7.64	7.44
34	7.31	7.32	7.77	7.86
35	7.32	7.39	7.72	7.77
36	7.1	7.29	7.85	7.89
37	7.23	7.39	7.77	7.88
38	7.19	7.44	7.64	7.67
39	7.31	7.59	7.67	8.22
40	7	7.52	7.88	7.99
41	7.12	7.72	7.93	8.37
42	7.09	7.67	8.04	8.16
43	7.32	7.88	7.79	8.29
44	7.3	7.94	7.76	8.39
45	7.39	7.77	7.89	8.36
46	7.21	7.84	7.96	8.34
47	7.1	7.98	7.99	8.46
48	7.14	7.89	8.06	8.44
49	7.22	7.67	7.88	8.4
50	7.32	7.91	8.02	8.32
51	7.29	7.69	8.24	8.34
52	7.32	7.74	8.15	8.41
53	7.34	7.77	8.09	8.32
54	7.19	7.62	8.05	8.19
55	7.29	7.72	8.02	8.16
56	7.34	7.77	8.04	8.29
57	7.88	8.04	8.44	8.52
58	7.82	8.12	8.46	8.55
59	7.9	8.09	8.42	8.67
60	7.86	8.14	8.59	8.62

Appendix 7:- Chemical analysis of milk during week 2.

group	F	P	T. S.	S.N.F.	L	Ash
1	3.85	3.63	13	9.15	4.77	0.73
2	4.2	3.73	13.57	9.37	4.89	0.74
3	4.46	3.62	13.58	9.12	4.78	0.72
4	4.83	3.74	14.24	9.41	4.91	0.74

Appendix 8:- Chemical analysis of milk during week 4.

group	F	P	T. S.	S.N.F.	L	Ash
1	4.13	3.75	13.58	9.45	4.92	0.75
2	4.85	3.87	14.58	9.73	5.07	0.77
3	4.96	3.65	14.64	9.68	4.78	0.73
4	5.33	3.72	15.15	9.82	4.8	0.73

Appendix 9:- Chemical analysis of milk during week 6.

group	F	P	T. S.	S.N.F.	L	Ash
1	4.55	3.59	13.59	9.04	4.71	0.72
2	5.14	3.78	14.66	9.52	4.96	0.75
3	5.32	3.58	14.32	9	4.7	0.71
4	5.58	3.74	14.99	9.41	4.91	0.74

Appendix 10:- Chemical analysis of milk during week 8.

group	F	P	T. S.	S.N.F.	L	Ash
1	4.66	3.68	13.92	9.26	4.82	0.74
2	5.06	3.77	14.56	9.5	4.95	0.76
3	5.26	3.63	14.41	9.15	4.76	0.73
4	5.43	3.69	14.71	9.28	4.84	0.73

Appendix 11:- yield of cheese at the first month.

group	***1***	***2***	***3***	***4***
milk(gm)	3000	3000	3000	3000
cheese(gm)	728	728	731	736
cheese%	24.27	24.27	24.37	24.53

Appendix 12:- yield of cheese at the second month.

group	***1***	***2***	***3***	***4***
milk(gm)	3000	3000	3000	3000
cheese(gm)	732	735	740	748
cheese%	24.4	24.5	24.67	24.93

Appendix 13:- Chemical analysis of cheese at the first month.

Group	**F %**	**P %**	**DM%**	**Ash%**
1	16.18	11.83	49.56	1.59
2	19.88	12.16	48.32	1.53
4	22.92	11.94	49.21	1.57

Appendix 14:- Chemical analysis of cheese at the second month.

Group	**F %**	**P %**	**DM%**	**13**
1	16.25	12.08	47.97	1.54
2	20.44	11.87	46.77	1.49
3	21.24	12.12	51.86	1.51
4	24.78	12.06	52.82	1.66

Appendix 15:- Sensory evaluation of the cheese at the first month.

	Judgment	***G1***	***G2***	***G3***	***G4***
flavor (10 scores)	***1***	6	5	8	7
	2	7	6	7	9
	3	5	7	8	8
	Mean	6	6	7.67	8
texture(5 scores)	***1***	3	4	3	4
	2	4	3	4	3
	3	5	4	4	4
	Mean	4	3.67	3.67	3.67

Appendix 16:- Sensory evaluation of the cheese at the first month.

	Judgment	*G1*	*G2*	*G3*	*G4*
flavor (10 scores)	***1***	7	8	7	9
	2	6	6	8	10
	3	6	6	8	8
	Mean	6.33	6.67	7.67	9
texture(5 scores)	***1***	4	5	3	3
	2	4	3	3	4
	3	5	4	5	4
	Mean	4.33	4	3.67	3.67

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جامعة النجاح الوطنية
كلية الدراسات العليا

تأثير التغذية بكسبة السمسم على أداء ماعز الأنجلونوبي وعلى نوعية الجبنة

إعداد
أيمن منير عبدالله حجازي

إشراف
أ.د. جمال ابوعمر

قدمت هذه الأطروحة استكمالا لمتطلبات درجة الماجستير في الإنتاج الحيواني بكلية الدراسات العليا في جامعة النجاح الوطنية في نابلس، فلسطين.
2008

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الملخص

تم إجراء هذه التجربة للتعرف على اثر التغذية بنسب مختلفة من كسبة السمسم على كمية و نوعية الحليب والجبن المأخوذة من ماعز الانجلونوبي, استخدم في هذه التجربة 16 ماعز انجلونوبي دخلت في فترة الحلب منذ 20 يوم حيث أن التجربة استمرت لمدة 60 يوم. قسمت الماعز إلى 4 مجموعات غذائية في كل مجموعة 4 من الماعز وأسكنت في حظائر مقسمة ومناسبة من حيث الاتساع وكذلك تمت رعايتها كأي قطيع ماعز تجاري, حصلت الحيوانات على القش والماء طوال الوقت, اربعة علائق مركزة حضرت باستخدام كسبة السمسم بحيث ان الاولى كانت الشاهد و الثلاث معاملات الاخرى كانت تحتوي على نسب من كسبة السمسم كبديل لنفس النسب من فول الصويا و الذرة كالتالي: 5, 10 و 15% من كسبة السمسم وغذيت الماعز بالعلائق المحضرة للتجربة مرتين يوميا وتم حلبها بنفس الوقت . كميات الحليب سجلت يوميا بينما تم تصنيع الجبن مرة شهريا. أظهرت نتائج الدراسة أن كسبة السمسم الخام التي استخدمت في التجربة كانت تشبه من حيث التركيب ما هو مستخدم عالميا. احدث خلط كسبة السمسم في علائق الماعز بنسب 10 و 15% زيادة ($P<0.05$) في كمية الحليب مقارنة مع الشاهد والعليقة المخلوطة بنسبة 5% من كسبة السمسم, أعطت التغذية بكسبة السمسم على جميع المستويات نتيجة ايجابية ($P<0.05$) بالنسبة لدهن الحليب حيث كانت أعلى نسبة دهن من الماعز التي غذيت على عليقة مخلوطة بنسبة 15% كسبة السمسم. كسبة السمسم لها تأثيرات متفاوتة على بروتين الحليب حيث كانت أعلى نسبة بروتين حليب من الماعز التي غذيت على عليقة مخلوطة بنسبة 5% من كسبة السمسم, المواد الصلبة الكلية والمواد الصلبة اللادهنية زادت ($P<0.05$) مع المستويات المختلفة من كسبة السمسم مقارنة مع الشاهد. نفس الاتجاهات لوحظت على تركيب الجبن خاصة محتوى الدهن حيث أن التغذية بنسب مختلفة من كسبة السمسم زادت ($P<0.05$) محتوى الدهن في الجبن مقارنة بالشاهد, المحتويات الأخرى في الجبن مثل البروتين والرماد لم تتأثر بالتغذية على كسبة السمسم .النتائج الحسية أظهرت أن مذاق الجبن التي صنعت من حليب الماعز التي غذيت بنسب 10 و 15% من كسبة السمسم

كانت (P<0.05) الأفضل مقارنة مع المجموعات الأخرى, بينما كان الاتجاه عكسيا بالنسبة للقوام حيث لوحظ أن الجبن الذي صنع من حليب الماعز الشاهد كان (P<0.05) أفضل قوام. نتائج هذه التجربة اشارت الى انه يمكن استخدام كسبة السمسم في تغذية الماعز الحلوب. يفضل من الناحية الاقتصادية استخدام كسبة السمسم بشكل عملي, هناك حاجة إلى أبحاث أخرى لتدعيم مثل هذه النتائج.