

بسم الله الرحمن الرحيم

Sudan University of Science and Technology

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Consumption level of Goat Milk - Survey Study in Khartoum State

مستوى استهلاك لبن الماعز - دراسة مسحية في ولاية
الخرطوم

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بسم الله الرحمن الرحيم

قال تعالى :

"وان لكم في الاتعام لعبرة نسقيكم مما في بطونه
من بين فرث ودم لبنا خالصا سائغا للشاربين"

صدق الله العظيم
الآيه (66) من سورة النحل

Dedication

To my

parents

To my sister

To my brothers

To my husband

To my kid

friends.

To my

Acknowledgement

Praise and unlimited thanks to Allah, who gave me the strength and patience to complete this work.

I wish to express my great thanks and gratitude to my supervisor Dr. Anas Mohamed Osman for his guidance, advice help encouragement throughout the period of the research.

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Research abstract

This research was conducted during the period 1st January to 28th February 2017 to assess the consumption rate of goat milk in Khartoum State. The data was obtained mainly by using questionnaire distributed randomly to 120 individuals representing three localities of Khartoum State (Khartoum, Khartoum North and Omdurman), 40 per each area. The results obtained indicated that (70%) of the respondents prefer to consume goat milk compared to other milks, irrespective of gender, age, educational level and occupation. Reasons for preference were mainly due to high nutritive value and health benefiting effects of goat milk. Goat milk food as part of the diet was given by (70.8%) of the participants. It was used fresh (47.5%), fresh with additives (46.7%), and not as finished processed dairy product (zero %). Various types of additives were added to goat milk when consumed. Use of goat milk for curing diseases was not carried out by 68.4% of the respondents, while (31.6%) used it. The type of diseases associated with goat milk consumption included: allergy, gastrointestinal, cardiovascular diseases, beside mal nutrition, especially by infants and children, cough and other diseases. Feeding children with goat milk was done by (77.5%) of the participants and health improvement was reached as given by (76.7%) of the respondents. The availability of goat milk was of no problem for (40%) of the consumers, while (60%) had no easy access to it. The source of milk was mainly from home rearing

(29.2%), farms (26.6%) and markets (24.2%). The source of goat milk was unknown to (20%) of the respondents. The price for one pound goat milk ranged from 4 to 10 Sudanese pounds. as given by (67.9%) of the participants. Most of them (50.8%) considered this price as high and expensive compared to other milks, e.g cows. Goat breeds used for milk production were known to (55.8%) of the respondents, while (44.2%) had no knowledge about milk goat breeds. Based on the obtained results, the production of goat milk is a useful tool to overcome problems of mal nutrition and cure for certain diseases, beside expected economic gains.

مستخلص البحث

اجري هذا البحث خلال الفتره من الأول من يناير حتي الثامن والعشرين من فبراير من العام 2017 بهدف تقييم معدل استهلاك لبن الماعز في ولاية الخرطوم . البيانات تم الحصول عليها بصوره اساسيه باستخدام استبيان وزع عشوائيا علي 120 فردا يمثلون المحليات الثلاث لولاية الخرطوم (الخرطوم , الخرطوم بحري , ام درمان) بواقع 40 استبيان لكل منطقه .

اشارت النتائج المتحصل عليها ان (70%) من المشاركين يفضلون استهلاك لبن الماعز مقارنة بالبان اخري دون اعتبار للجنس والعمر والمستوي التعليمي والوظيفة. أسباب التفضيل تعزي للقيمة الغذائية العاليه والفوائد الصحيه للبن الماعز. اعتبار لبن الماعز كطعام أساسي في الوجبه الغذائية ذكر من قبل (70.8%) من المشاركين ويتم استهلاكه طازجا (29.2%) , طازجا مع إضافات (46.7%) ولا يستهلك في صورة منتج مصنع (zero%). هناك أنواع مختلفه من الإضافات للبن الماعز عند الاستهلاك . لم يتم استعمال لبن الماعز كعلاج للأمراض من قبل (68.4%) من المشاركين لكن بلغت نسبة استعماله كعلاج (31.6%). الامراض المرتبطه باستهلاك لبن الماعز كعلاج تتضمن: امراض الحساسيه , الجهاز الهضمي , امراض الجهاز القلبي الوعائي بالاضافه الي امراض سوء التغذية خاصه لدي الأطفال والرضع , السعال وامراض اخري . استخدم لبن الماعز لتغذية الأطفال بواسطة (77.5%) من المشاركين ولوحظ التحسن الصحي للأطفال من قبل (76.7%). توفر لبن الماعز والحصول عليه واجه صعوبات لدي (60%) من المشاركين بينما كان سهل الحصول عليه لدى (40%) مصادر لبن الماعز من الماعز المرباه منزليا (29.2%) , المزارع (26.6%) والأسواق (24.2%) وغير معروفه لدي (20%) من المشاركين . تفاوتت أسعار رطل اللبن ما بين (4) الي (10) جنيهات سودانيه كما أوضح (67.9%) من المشاركين واعتبر (50.8%) منهم ان هذه الأسعار عاليه ومكلفه مقارنة بلبن الابقار كمثال . الأنواع المختلفه لسلاطات ماعز اللبن كانت معروفه لدي (55.8%) من المشاركين ولم تكن معروفه لدي (44.2%) .

واستنادا علي النتائج المتحصل عليها يمكن اعتبار لبن الماعز أداة مفيدة للتغلب علي المشاكل المرتبطة بسوء التغذيةه وعلاج لبعض الامراض بالاضافه الي العائد الاقتصادي المتوقع .

Chapter One

1. Introduction

The advantages of goats as producer for milk, meat and fiber has increased during the last decades. Goat's merits are stimulated by goat adaptation to adverse climate, its ability to survive extended periods of drought better than other livestock, its ability of using some of the pasture resources not available for other stock and of the advantages of a small but efficient production of meat, milk and specialty fiber (Gall, 1996). According to Slacanac *et al.*, (2004) goat milk is usually compared with cow milk, but cow milk production is much cheaper and the volumes are much larger and so cow milk has a lower market price. Also Park (2007) noticed, commercial goat milk is more expensive, because of lower productivity, seasonal variations and the need of bigger animal herds. But in spite of such factors, Haenlein (2004) pointed out, the goat sector has increased significantly during last decades.

According to FAO (2008), goats are present in all of the continents and the largest numbers of goats were observed in Asia followed by Africa. Goats are important milk producers in several parts of the tropics and contribute significantly to human nutrition in many developing countries (Devendra, 1999).

Sudan is considered as one of the leaders in goat milk production, which represents about 16% of the total milk production of the country, (FAO, 2001). The milk of small ruminants, such as goat is

of a particular economic interest. In the developing countries, the production of this type of milk has to be useful strategy to tackle the problems of under nutrition (Eshraga *et al.*, 2011).

Khartoum State is one of the most highly populated areas of the country. Thus, the demand for milk and its products is expected to be considerably high. No adequate informations about goat milk consumption are available. Moreover no products processed from goat milk are found in the markets of the state, since goat milk industry is not yet established. The current study deals with, how far goat milk is consumed in Khartoum State in association with the problems in concern.

Objective:

- To evaluate the consumption rate of goat milk in Khartoum State.

Chapter Two

2. Literature Review

2.1 Classification of goats:

Goats were among the first farm animals to be domesticated, and as indicated by archeological evidence, they have been associated with man in a symbiotic relationship for up to 10000 years. (Esminger and Parker, 1986). The domestication of wild goats was evident first in Jericho (Jordan) around 7000 B.C and as well as in the Zagros mountains in Gangi Dareh (Iran) around 8000 B.C and since then, had been involved in many aspects of human culture including religion ,tradition, folklore, nutrition, livelihood and economics (Boyazoglu, *et al.*, 2005).

The scientific classification of goats is given according to Darwish (1986):

Family : Bovidae.

Subfamily : Caprinae.

Order : Artiodactyla.

Suborder: Pecora (Ruminantia).

Class : Mammalia.

Genus : Capra.

2.2 Goat in Sudan

According to Arab Organization for Agricultural Development AOAD (1990) four distinct and well known types can be enumerated as, Nilotic, Mountain, Desert and Sudanese Nubian goats.

2.2.1. Sudan Nubian Goat:

It is a dairy type goat and distributed along the river valley in Sudan north to the 12th latitude, it belongs to the general Nubian group, which characterized by the roman nose, large loop ears, relatively short silky hair of various colors and scimitar shaped background sweeping horns (ELnaim, 1979).

The color is commonly black, but pure brown, pure white as well as multi colorations of black and white are found (AOAD, 1990).

2.2.2. Desert goat:

This type is well adapted to arid, semiarid and Savanah region of western Sudan, mainly in Kordofan and Darfur states, but also cross breed types between desert and Nubian are found in White Nile and Blue Nile states; The coat is short, of different colors but mainly gray and often splashed with brown or black (Kiwuwa, 1986); (ELnaim, 1979); (AOAD, 1990).

2.2.3 Mountain goat:

Known also as Tiegri goat. The varieties are Nuba, Toker, Ingessena goats. They are distributed in Nuba Mounatians (Southern Kordofan State), Ingessena Mountain (Blue Nile State) and Red Sea Mountains (Red Sea State, at Toker and Halaib) (AOAD,1990). The most common color is dark brown or grey brown, (ALnaim, 1979) (Muffarah, 1995).

2.2.4 Nilotic goat:

Known as dwarf, equatorial or southern Sudan goats. They are distributed throughout southern Sudan with varieties: Taposa (Mangla goat), Yei (Denka goat) and Bary goat (Jongelli). The color is variable and nearly all colors are found, but the most common is a mixture of black and whitish hair, (Mason, 1951); (Muffarah, 1995).

2.2.5 Cross breed goat:

In order to improve the local goat breeds, foreign breeds were imported and introduced in Sudan, e.g Saanen, Toggenberg, Damascus and Habashi goats. The best result obtained, when crossing Nubian X Saanen followed by Nubian X Toggenberg. By these crosses the milk yield was raised markedly, (Abuisa, 2004).

2.3 Physicochemical properties of goat milk:

2.3.1. compositional properties:

The composition of milk from producing species differs from each other. According to Üçünçü (2005), the factors affecting composition are: species, geographical location and requirement for the neonate, genetic constituents of individual species, age, stage of lactation, number and time of milking, certain diseases condition and season.

Park *et al.*, (2007) noticed, goat milk composition varies appreciably according to the breed, the locality, the stage of lactation, the season of the year, the feeding and management, the incidence of estrus and the state of health of the nanny, consequently and perhaps

even more so than with cows, also there can be a significant variation between individuals.

2.3.1.1 Protein content:

The average protein content in goat's milk was 3.4% (Iqbal *et al.*, 2008). In the Sudanese Nubian goat, 3.42% and 3.46% as given by ELnaim (1979) and Koduda (1985), respectively. The protein content of Saanen goats under Sudan condition was found as 3.43% \pm 73% by Gol and Abdalla (1997).

2.3.1.2 Fat content:

Goat milk contains 3.8% fat (Park *et al.*, 2007). ELnaim (1979) and Koduda (1985) stated. The fat percentage of Nubian goat milk was 3.61% and 3.39% respectively. For Saanen goat milk under Sudan condition, 3.3 \pm 0.06% on average (Gol & Abdalla, 1997). Ibrahim (2000) estimated the fat percentage as 4.05 \pm 0.76, 3.64 \pm 0.42 and 3.4 \pm 0.54% for Nubian goat milk, cross breed Nubian (0.75) x Saanen (0.25) and Nubian (0.50) X Saanen (0.50) respectively.

2.3.1.3 Lactose content:

Lactose content as indicated by Iqbal *et al.*, (2008) and Park *et al.*, (2007) was 4.1% for Nubian goat. By Koduda (1985) and ELnaim (1997) was 4.31% and 4.67% respectively. For Saanen goat in Sudan 4.41 \pm 0.59% according to Gol and Abdalla (1997).

2.3.1.4 Ash content:

According to ALhigrawi (1987), Park *et al.*, (2007) and Iqbal *et al.*, (2008), the ash in goat milk was 0.80%. Goat milk provides a great amount of calcium and phosphorus, (Belewu and Aiyegabusi, 2002). The calcium content of goat milk estimated by Meschy (2002) was 0.13%. The mean concentration of calcium in Nubian goats was found 0.14% while the average value in Saanen goats 0.10% (Csapo *et al.*, 1986).

2.3.1.5 Total solids content:

Koduda (1985) and ELnaim (1979) found the total solids in Nubian goats, 11.98% and 12.55% respectively. In Saanen goat milk reared under Sudan condition, 12.18±0.88% (Gol and Abdalla, 1997).

2.3.1.6 Water content:

Water content of goat milk ranged between 88% and 90% (Bencine and Pulina, 1997). In Nubian and Saanen goats it was 88.05% and 88.44% respectively (Gol and Abdalla, 1997).

2.3.1.7 Vitamin content:

According to Roy and Vadodaria (2006), the vitamins in goat milk are comparable to those of cow and human milk.

2.3.2 Physical properties:

2.3.2.1 Specific gravity:

The density of goat milk is comparable to that of cow milk, but it is higher than cow milk (Haenlein and Wendof, 2006). Asif and Sumira (2010) found the specific gravity of goat milk 1.028-1.032, while Sayed and Henna (2010) explained, the specific gravity of cow and goat milk is similar and ranged from 1.023 to 1.030.

2.3.2.2 PH-value:

The mean pH value of goat milk ranged between 6.5 to 6.9 (Roy and Vadodaria, 2006); (Sayed and Henna, 2010). A pH value of 6.48-6.64 was estimated by Asif and Sumira (2010).

2.3.2.3 Titratable acidity:

Titratable acidity as lactic acid percentage ranged from 0.11 to 0.18 (Roy and Vadodaria, 2006). According to Parakash and Jenness (1968) it ranges from 0.10 to 0.26, but most samples of the tested milk fall in the range 0.11 to 0.18%.

2.3.2.4 Freezing point:

The freezing point of goat milk is lower than that of cow milk, explained Harding (1999). Roy and Vadodaria (2006) stated, freezing point of goat milk is about 0.580 °C, which is same to that given by Parakash and Jenness (1968).

2.3.2.5 Electrical conductivity (EC):

According to Riel (1985), the range of all goat milk samples for EC was from 6.55 ± 1.65 to 11.0 ± 2.10 m/S. The highest EC in goat milk measured was 10.8 ± 2.07 m/S (Varnum and Sutheralnd, 1994).

2.3.2.6 Boiling point:

The boiling point of goat milk resembles that of cow milk (100.17°C). However, slight variations maybe found between the boiling point of the species, since the boiling point is influenced by the water content in the milk, dissolved substances in it and the pressure under which the milk is boiled (Osman, 2007).

2.4 Nutritive value of goat milk:

The basic nutrition composition of goat milk resembles cow milk, were both milks contain substantially higher protein and ash, but lower lactose content than cow milk. However, goat milk differs from cow milk in having better digestibility, alkalinity, buffering capacity and certain therapeutic values in medicine and human nutrition, (Costa *et al.*, 2015). Goat milk is considered as a good source of fatty acids, protein and minerals, in addition it has been reported to be a functional food due to its high digestibility and reported nutritional properties (Gammaga *et al.*, 2016). Many physiological functions are performed by milk constituents, it contains several bio-protective molecules that ensure health security to human including antimicrobial substances, enzymes and enzyme inhibitors and

vitamin-binding carrier protein (Fox *et al.*, 2000). The nutritive value of the different components may be given as follows:

2.4.1 Fat:

The biggest component, about 97% of the lipid fraction in goat milk is the triglycerol (TAG), including a large number of esterified fatty acids (Cerbulis *et al.*, 1982). In goat milk the lipid globules are significantly smaller than in cow milk, whereby total fat content and fat globules size and distribution affect the viscosity of milk and are of importance for the preprocesses and manufacturing of milk products. The large number of globules with small diameter makes the goat milk more digestible, (Lopez-Aliaga *et al.*, 2010).

Goat milk is also rich in medium chain triglycerides (MCTS), which is one of the primary reasons that it facilitates improved nutrient absorption and energy production in the body and have been shown to have antimicrobial activity (Van Immerseal *et al.*, 2004).

2.4.2 Protein:

There are two phases of milk proteins: casein and whey proteins. According to Slacanac *et al.*, (2010), the casein constituents about 80% of the protein and classified as α S1, α S2, β and κ -casein, while the major whey proteins are lactoglobulin and α -lactoalbumin. Goat milk contains lower amounts of α -casein, higher amounts of β -casein fractions and approximately equal amount of the κ -casein compared to cow milk (Diaz-Castro *et al.*, 2010). The more α S1 casein in milk the longer the digestion which depends on that, the α -1 casein is only

partly digested by the gastric juice enzymes and it is not totally hydrolyzed until it reaches duodenal enzymes (Ballabio *et al.*, 2011).

The casein micelles in goat milk differs from those in cow milk in having greater β -casein stabilization, more Ca and P and lower heat stability. (Jenness, 1980).

2.4.3 Lactose:

It is the major carbohydrate in goat milk and the content is slightly lower than cow milk. (Horackoval *et al.*, 2014). Lactose is valuable nutrient, because it favors intestinal absorption of Ca and P and Mg and the utilization of vitamin D (Ceballos *et al.*, 2009). Other carbohydrates found in goat milk are oligosaccharides, glycoproteins and nucleotides in small amounts, which are thought to be beneficial to human nutrition, because of their prebiotic and anti- infective properties (Kunz *et al.*, 2000).

2.4.4 Vitamins:

Goat milk has higher vitamin A content than cow milk, since goats convert all β -carotenes from foods into vitamin A in the milk (Conesa *et al.*, 2008).

Goat milk has low concentration of vitamin B6 and vitamin D, (Horacoval *et al.*, 2014). Goat milk contains similar amount of vitamins as human milk, similarly vitamin D and finally vitamin C which is found in a great amount compared to cow milk; (Geissler and Powers, 2011).

2.4.5 Minerals:

Goat milk was reported to have high amounts of potassium, calcium, chloride, phosphorus, selenium, zinc and copper than cow milk (Krstanovic *et al.*, 2010).

2.5 Medicinal properties of goat milk:

Goat milk proved to have therapeutic effects against certain diseases. The medicinal properties and the diseases involved are described as follows:

2.5.1 Antimicrobial properties:

The milk proteins have been proved to be precursors for antimicrobial peptides, especially those derived from the iron- bind lactoferrin. Lactoferrin is involved in many physiological functions, including regulation of iron absorption and immune responses as well as exhibiting antioxidant activity and has both anti carcinogenic and anti-inflammatory properties, as described by Garcia- Montoya *et al.*, (2011).

2.5.2 Treatment of gastrointestinal diseases:

The oligosaccharides from goat milk were shown to have anti-inflammatory activities. They prevent expected decrease in body weight, increased colon size and extension of necrotic lesions. Also, decreased clinical symptoms (Diarrhea and Bloody stools), as pointed out by Daddaoua *et al.*, (2006).

Haenlein (2004) explained, the soft curd of goat milk may be an advantage for adults humans suffering from gastro intestinal disturbances and ulcers.

2.5.3 Treatment of cardiovascular diseases:

Goat milk stimulates the proper anti oxidation system of the body; it has stronger degrading act on cholesterol that decreases concentration of cholesterol, and higher concentration in the component that make cholesterol in the blood decreases (Vlaamse, 2007). Furthermore, he added goat milk is recommended to slow down aging process, for people suffering from schizophrenia and for men subject to reduced fertility, preventing over weight and elderly diabetes (tybe II), diminishes formation of blood clots and preventing hyper homocysteine.

2.5.4 Treatment of cancer, allergy:

Goat milk has a high content conjugated linoleic acid, (Jirillo et al., 2010), which has anti carcinogenic properties, that have been reported against mammary and colon cancer (Liew *et al.*,1995), colorectal and breast cancer, (Dugram and Fernandes, 2000).

Park *et al.*, (2011) explained, numerous studied and anectodal evidences suggest that goat milk is a much less allergenic alternative for cow milk due to its differing protein structure, namely its casein micelle components, and goat milk has been recommended as substitute for individual allergic to cow milk (Lactose tolerant). Goat milk has also demonstrated significant improvement in colic, minor digestive disorders, asthma, and eczema over cow milk, as well as in infants and children with cow milk sensitizes (Mc. calbugh, 2003).

2.5.5 Immunological properties:

Goat milk plays a key role in almost all biological reactions and exert anti oxidantal and anti inflammatory effects in the body. This is important, inflammation is the body's primary responses to infection and oxidation also has been linked with the development of many diseases (Shea *et al.*, 2004).

Chapter three

3. Material and Methods

The study on goat milk consumption was conducted during the period January/ February 2017 in Khartoum State (Khartoum, Khartoum North and Omdurman). This was done by using questionnaire distributed (see appendix) randomly to 120 individuals, 40 per each area, including producers and persons. Questionnaire and data related were enhanced by more supporting informations obtained from reviewing previous literature, scientific publications, social media as well as personal communications.

Analysis

Data tabulation by frequency tables and simple percentage method of analysis were used.

Chapter four

4. Results and Discussion

4.1. Results:

Results obtained are given in the following tables:

Table (1): Distribution of respondents according to area:

| Area | Frequency | Percent |
|----------------|------------------|----------------|
| Khartoum | 40 | 33.3% |
| Khartoum north | 40 | 33.3% |
| Omdurman | 40 | 33.3% |
| Total | 120 | 100% |

Table (2): Distribution of respondents according to gender:

| Gender | Frequency | Percent |
|---------------|------------------|----------------|
| Male | 66 | 55% |
| Female | 54 | 45% |
| Total | 120 | 100% |

Table (3): Distribution of respondents according to age:

| Age | Frequency | percent |
|-----------------|------------------|----------------|
| Less than 25 | 24 | 20% |
| Between 25 , 35 | 50 | 41.7% |
| Between 35 , 50 | 32 | 26.7% |
| More than 50 | 14 | 11.6% |
| Total | 120 | 100% |

Table (4): Distribution of respondents according to educational level:

| Educational level | Frequency | Percent |
|--------------------------|------------------|----------------|
| Illiterate | 10 | 8.4% |
| Khalwa | 04 | 3.3% |
| Basic | 15 | 12.5% |
| Secondary | 30 | 25% |
| University graduate | 45 | 37.5% |
| Post graduate | 16 | 13.3% |
| Total | 120 | 100% |

Table (5): Distribution of respondents according to occupation:

| Occupation | Frequency | percent |
|-------------------|------------------|----------------|
| house wife | 24 | 20% |
| Labour | 28 | 23.3% |
| Student | 17 | 14.2% |
| employee | 43 | 35.8% |
| Others | 08 | 6.7% |
| Total | 120 | 100% |

Table (6): Preference of goat milk against other milks:

| Performance | Frequency | Percent |
|--------------------|------------------|----------------|
| Prefered | 84 | 70% |
| Not Prefered | 36 | 30% |
| Total | 120 | 100% |

Table (7): Reason for preference of goat milk:

| Reason | Frequency | percent |
|---|------------------|----------------|
| High nutritive value | 37 | 30.8% |
| Under nutrition by infants and children | 17 | 14.2% |
| Easily digestible | 07 | 5.8% |
| Low fat content | 10 | 8.3% |
| Concentrated | 08 | 6.7% |
| Others | 05 | 4.2% |
| Not identified | 36 | 30% |
| Total | 120 | 100% |

Table (8): Use of goat milk as part of the food diet:

| Use | Frequency | percent |
|--------------|------------------|----------------|
| Use | 85 | 70.8% |
| Not use | 35 | 29.2% |
| Total | 120 | 100% |

Table (9): Consumption rate of goat milk / week:

| Times/ day | Frequency | percent |
|-------------------|------------------|----------------|
| Once | 04 | 47.5% |
| Twice | 04 | 3.3% |
| Three | 15 | 12.5% |
| More than three | 62 | 51.7% |
| Not consumed | 35 | 29.2% |
| Total | 120 | 100% |

Table (10): Method of goat milk consumption:

| Method | Frequency | percent |
|----------------------|------------------|----------------|
| Fresh | 57 | 47.5% |
| Fresh with additives | 56 | 46.7% |
| Not identified | 07 | 5.8% |
| Processed | 0 | 0 |
| Total | 120 | 100% |

Table (11): Type of additives.

| Additives | Frequency | Percent |
|-------------------|------------------|----------------|
| Spices | 33 | 27.5% |
| Water | 03 | 2.5% |
| Cocoa and ovaltin | 04 | 3.3% |
| Sugar and tea | 10 | 8.4% |
| Not identified | 13 | 10.8% |
| No additives | 57 | 47.5% |
| Total | 120 | 100% |

Table (12): therapeutic use:

| Use | Frequency | Percent |
|--------------|------------------|----------------|
| For curing | 38 | 31.6% |
| Not used | 82 | 68.4% |
| Total | 120 | 100% |

Table (13): Diseases cured by goat milk:

| Type of diseases | Frequency | Percent |
|-----------------------------------|------------------|----------------|
| Malnutrition infants and children | 03 | 2.5% |
| Eczema and psoriasis | 01 | 0.8% |
| Anti zaheimer | 01 | 0.8% |
| Bilharzia | 01 | 0.8% |
| Allergy | 15 | 12.5% |
| Cardio vascular diseases | 04 | 3.3% |
| Gastro intestinal diseases | 11 | 9.3% |
| Lcterus | 01 | 0.8% |
| Cough | 01 | 0.8% |
| Total | 38 | 31.6% |

Table (14): Consumption of goat milk by children:

| Type of using | Frequency | Percent |
|----------------------|------------------|----------------|
| Cosumed | 93 | 77.5% |
| Not consumed | 27 | 22.5 |
| Total | 120 | 100% |

Table (15): Health improvement after consumption:

| Improvement | Frequency | Percent |
|--------------------|------------------|----------------|
| Improved | 92 | 76.7% |
| Not improved | 06 | 5% |
| Not identified | 22 | 18.3% |
| Total | 120 | 100% |

Table (16): Availability of goat milk in all seasons of the year:

| Availability | Frequency | Percent |
|----------------------|------------------|----------------|
| Available | 48 | 40% |
| Not easily available | 72 | 60% |
| Total | 120 | 100% |

Table (17): Source of goat milk:

| Source of goat milk | Frequency | Percent |
|----------------------------|------------------|----------------|
| Farm | 32 | 26.6% |
| Market | 29 | 24.2% |
| Home rearing | 35 | 29.2% |
| Unknown | 24 | 20% |
| Total | 120 | 100% |

Table (18): Price/ pound (SDG):

| Price/SDG | Frequency | Percent |
|------------------|------------------|----------------|
| 4 – 5 | 17 | 14.2% |
| 6 – 7 | 48 | 40% |
| 8 – 10 | 14 | 11.7% |
| Others | 41 | 34.1% |
| Total | 120 | 100% |

Table (19): Goat milk Price expensive or cheap compared to other milks:

| Price/SDG | Frequency | percent |
|------------------|------------------|----------------|
| High | 61 | 50.8% |
| Low | 24 | 20% |
| Equal | 02 | 1.7% |
| Unknown | 33 | 27.5% |
| Total | 120 | 100% |

Table (20): Knowledge of goat milk breeds:

| | Frequency | percent |
|--------------|------------------|----------------|
| Known | 67 | 55.8% |
| Unknown | 53 | 44.2% |
| Total | 120 | 100% |

4.2 Discussion

Table (1) showed the number of the participants (120=100%), who were chosen randomly and distributed equally (40=33,3%) throughout the 3 localities in Khartoum State (Khartoum, Khartoum North and Omdurman).

According to gender 55% and 45% of the questioned individuals were males and females respectively (Table 2). The age of the respondents ranged from less than 25 to more than 50 years, whereby the dominating ages were between 25-35 (41.7%) and 35-50 years (26.7%). Age above 50 years (11.6%) and less than 25 (20%) are the lowest (Table 3).

Concerning the educational level of the respondents (75.8%) were post, university and secondary school graduates (Table 4). The occupations of the participants were diversified: employees, labours and house wives calculated as (35.8), (23.3) and (20) % respectively, followed by students (14.2%) and others (6.7) %. This indicated the wide range of the jobs performed by the respondents (Table 5).

Compared to milk of other species, goat milk was highly preferable by the participants, since (70%) of them use goat milk for one reason or another (Table 6). The main reasons for such preference according to respondent is related to the high nutritive value (30.8%), overcoming under nutrition (14.2%), its fat content (8.3%), ease digestability (5.8%) and others including therapeutic effects (4.2%). (Table 7). This agreed with that mentioned by Costa *et al.*, (2015),

Gammaga *et al.*, (2016) and Fox *et al.*, (2000). However, (30%) of the respondents gave no reason for their preference of goat milk, since the majority of them do not consume goat milk.

Goat milk was used in the diet as food by (70.8%) of the respondents, while (29.2%) did not use it as shown in table (8). The quantity of goat milk consumed weekly by respondents varies a lot; (51.7%) consume the milk more than 3 times /week, (12.5%) 3 times /week, while (29.2%) do not use it at all. (Table 9). This measured to which extent goat milk is consumed by the questioned participants.

Table (10) showed the different methods of goat milk consumption used by the respondents. It is consumed by (47.5) and (46.7) % of them as fresh, and fresh with additives respectively. Consumption of products processed from goat milk was not found. This might be associated with the absence of such products, e.g cheese, yoghurt and other in the markets of Khartoum State, due to no establishment of goat milk processing plants compared to western countries. In these countries the consumers acceptance of goat milk products is reported to be excellent. (Roy and Vadodaria, 2006). No additives were added to goat milk by (47.5%) of the consumers, while (27.5%) use different kinds of species. Other add sugar and tea (8.4%), cocoa and ovaltin (3.3%), water (2.5%), and no identified additives were given by (10.8%). (Table 11).

As given in table (12), (68.4%) of the participants did not use goat milk for therapeutic purposes, while (31.6%) made use of it, although the therapeutic effects of goat milk has been reported by many

investigators. Cured diseases in association with goat milk consumption as given by the respondents included: allergy, Gastrointestinal disease (e.g ulcer), Cardiovascular diseases, malnutrition in infants and children, cough, zaheimer, lectrus and others (Table 13). This in full agreement with that reported by Haeinlein (2004), Daddaoua *et al.*, (2006), Vlaamse, (2007), Park *et al.*, (2011) and Gracia-montaya *et al.*, (2011). However (68.4%) seem to miss the knowledge about the health benefiting effects of goat milk against diseases and do not use it for such purpose.

The feeding of children by goat milk was very high (77.5%), in most cases as replacement for humans milk and also against diseases (Table 14). Children health has improved significantly after use as given by (76.7%) questioned participants (Table 15).

The availability of goat milk during all seasons of the year was limited for (60%) of the respondents, while (40%) has access to goat milk throughout the year (Table 16). Difficulties in goat milk provision to consumers is dependant on several factors e.g lower productivity, need of bigger herd and seasonal variations (Park, 2007).

The source of goat milk was from home rearing (29.2%), farms (26.6%) and markets (24.2%), while (20%) of the respondents could not identify the milk source (Table 17). In Khartoum State, some families and individuals rear a small stock of goats for seif consumption and economic purposes. For this reason goats are

important milk producers in several parts of the tropics (Devendra, 1999).

The price of one pound goat milk ranged from 4 to 10 Sudanese pounds (Table 18). The price volatility might be attributed to the different methods of goat milk production, associated with the volumes of milk produced compared to that of cows, which is more cheaper. This agreed with that reported by Slacanac *et al.*, (2004).

The price of goat milk was considered by (50.8%) of the participants as high and expensive (Table 19).

The different types of goat breeds were known to (55.8%) of the respondents, while (44.2%) had no idea about them (Table 20). This might be related to the educational level of questioned participants.

Chapter Five

5. Conclusion and Recommendations

5.1 Conclusion

The demand for milk and milk products in Khartoum State has risen during the last years, due to increase in population. Milk of goats can assist by overcoming the shortage in milk, that is essential from nutritional point of view, health benefits as well as economic impact. Consumption of goat milk was accepted by many individuals in Khartoum State, regardless of gender, age, educational level or occupation. Yet, the consumption of goat milk is practiced, mostly fresh. In other cases, it is fed to infants and children as replacement for human's milk and against certain diseases and proved to be effective. One of the problems facing goat milk consumption is the availability and providing the consumers with it, since the sources of the milk are very limited, and consequently the volumes of milk produced. This resulted in unstable and higher prices compared to other milks, e.g cow milk.

5.2 Recommendations

- Establishing modern and commercial goat milk farms.
- Improving the factors influencing the milk productivity of goat animals.
- Manufacturing goat milk products to promote milk consumption.
- Increasing the awareness of nutritional, therapeutic and economic benefits of goat milk.
- Carrying out more studies and research works on the values of goats.

References

- Abu isa, R.T. (2004). Comparative study on components of Nubian and cross-breed Saanen and Nubian goat milk. M.sc Thesis. Sudan university of science and Technology. (Arabic ref.).
- Alhigrawi, I.S. (1987). Liquid Milk and its Products. Publ. Dar Almaarf. Egypt (Arabic ref.).
- AOAD (1990) Arab Organization For Agricultural Development. Goat Resource's in Arab States -11- Sudan. (In Arabic). Aoad printing press, Khartoum Sudan.
- Asif, M. and Sumira, U. (2010). Comparative study on the physicochemical Parameters of Milk samples Collected from Buffalo, Cow, Goat and Sheep of Gujrat. Pak. J. of Dairy sci. 84:600-608.
- Ballabio, C.; S. Chessa; D. Rignanese; C. Gigliotti; G. Pagnacco; L. Terracciano; A. Fiocchi; P. Restani and A.M. Caroli, (2011). Goat milk allergenicity as a function of alpha-s-casein genetic polymorphism. J. Dairy Sci., 94: 998-1004.
- Belewu, M.A. and Aiygabusi, O.F. (2002). Comparison of the Mineral Content and Apparent Biological Value of Milk from Human, Cow and Goat. J. Food Tech. in Africa. 37:485-504.
- Bencine, R and Pulina, E.O. (1997). The Quality of sheep Milk: A review: Aust. J. Experi. Agric. 37:485-504.
- Boyazoglu , J.; I. Hatziminaoglu and P. Morand - Fehr. (2005). The role of the goat in society: past, present and perspectives for the future. Small Rumin. Res. 60: 13 – 24.

- Ceballos, L.S.; E.R. Morales; T. Dela; G. OrreAdarve; J.D. Castro; L.P. Martinez and M.R.S. Sampelayo. (2009). Composition of goat and cow milk produced under similar condition and analyzed by identical methodology. *Journal of Food Composition and Analysis*, 22: 322-329.
- Cerbulis, J.; O.W. Parks and H.M. Farrellr. (1982). Composition and Distribution of Lipids of Goats' Milk. *Journal of Dairy Science*, 65: 2301-2307.
- Conesa, C.; L. Sanchez; C. Rota; M. Perez; M. Calvo and S. Farnoud. (2008). Isolation of lactoferrin from milk of different species; calorimetric and antimicrobial studies. *Comp. Biochem Physiol.* 150: 131-139.
- Costa, M.P.; B.S, Frasao; AC.O, Silva and R.M., Franco. (2015). Influence On color, Apparent Viscosity and Texture of Goat Milk Yoghurt. *J. of Dairy sci.* 98(9): 5995-6003.
- Csapo, J.; Serrgi, T. and Kiss, Z. (1986). Protein content Amino acid composition, Biological Value and Macro and Micro Element content of Goat Milk .*J. Aliatenyesztes. Takar Myozaes*, 35: 372-382.
- Daddaoua, A.; V. Puerta; P. Requena; A. Martinez Ferez; E. Guadix; F. SanchezdeMedina; A. Zarzuelo; M.D. Suarez; J. Boza and O. MartinezAugustin. (2006). Goat milk oligosaccharide sare anti-inflammatory in rats with hapten induced colitis. *Journal of Nutrition*, 136: 672-676.

- Darwish, M. Y. H., (1986). Goat Breeding and Production. Dar Elmaktbaat Elhaditha Egypt. (Arabic Ref.).
- Devendra, C. (1999). Goats: Challenges for increased productivity and improved livelihoods . Outlk. on Agri. 28: 215 –226.
- Díaz-Castro, J.; S. Hijano; M.J.M. Alférez; I. López-Aliaga and T. Nestares. (2010). Goat milk consumption protects DNA against damage induced by chronic iron overload in anaemic rats. Int Dairy, J. 20: 495-499.
- Durgam, V.R. and G. Fernandes. (2000). The growth inhibitory effect of conjugated linoleic acid on MCF7 Dietary fatty acids and human health. Animal Research, 49: 165.
- Elnaim, Y.A. (1979). Some productive traits of Sudan Nubian goats. M.V.SC Thesis University of Khartoum.
- Ensminger, M.E. and R.O. Parker, (1986). Sheep and Goat Science. 5 ed. Danville, Illinois: The Interstate Printers and Publishers Inc.
- Eshraga, A.; Eissa, A.; Elfadil, E.; Babiker, B. and Abu Elgasim, A. (2011). Physical, Microbial and sensory properties of Sudanese yoghurt (Zabadi). Made from goat milk. Anim. Prod. Sci. (51): 53-59.
- FAOSTAT, (2008). <http://faostat.fao.org/default.aspx>.
- FAO (2001). Food and Agriculture Organization. Production year Book Vol. 53 statistical Series. No 156. Rome Italy.

- Fox, P.F.; Timothy, B; Timothy, M. and Paul, L.H. (2000). Fundamentals of Chees science. Gaithersburg, Mary land. Aspen.
- Gall, C. (1996). Goat Breeds of the World. Margraf Verlag.
- Gammaga, G.G.A.; AM. B. Adikas; W.A.D. Nayananj Ailic and R.H.G.R. Wathasala (2016). Physicochemical, microbiological and Sensory properties of probiotic drinking yoghurt evetoped with Goat milk. Int.J. of Scientific and Research Publications, Vol.6 issue 6 issiv.
- Garcia-Montoya.I.A.; T.S. Cendon; S. Arevalo-Gallegos and Q. Rascon-Cruz. (2011). Lactoferrin a multiple bioactive protein: An overview.
- Geissler, C. and H. Powers, (2011). Human Nutrition London, UK: Churchill Livingstone, pp: 509-532.
- Gol, M.Y. and Abdalla M.O. (1997). Milk Yield and composition of Saanen Goats under Sudan condition. Sud. J. Vet. Sci. Anim. Husb. 36(1,2):36: 43.
- Haenlein G. F. W. and Wendorff W. L. (2006). Sheep milk. production and utilization of sheep milk. In: Park, Y.W. and Haenlein, G.F.W. Eds.; Handbook of Milk of Non-Bovine Mammals. Blackwell Publishing Professional, Oxford, UK, and Ames, Iwa, USA, pp. 137. 194.
- Haenlein, G.F.W. (2004). Goat milk in human nutrition. Small Ruminant Research, 51: 155-163.

- Harding, F. (1999). Milk Quality. Chapman and Hall Food Science Book. 2nd ed. Aspen publishers.
- Horackoval, S.; P. Sedlackova¹; M. Slukova and P. Milada. (2014). Influence of whey, whey component and Malt on the Growth and Acids Production of Lactobacilli in Milk. Czech J. Food Sci., 32: 526-531.
- Ibrahim, M.T. (2000). Studies on some productive and Reproductive parameters of Nubian Goat and Their Saanen cross-breeds under Local environmental conditions. Ph.D. Thesis. Uni. Of Khartoum, Sudan.
- Iqbal A.; Khan B.B.; Tariq M. and Mirza M.A. (2008). Goat-A Potential Dairy Animal: Present and Future Prospects. *Pak .J. Agri. Sci.*, 45(2): 227-230.
- Jenness, R. (1980). Composition and Characteristics of Goat Milk: Review, *Journal of Dairy Science* 63: 1605-1630.
- jirillo, F.; G.D. Martemucci; A.G. Alessandro; M.A. Panaro; A. Cianciulli; M. Superbo and T. Magrone. (2010). Ability of goat milk to modulate healthy human peripheral blood lymphomonocyte and polymorpho. nuclear cell function: In vitro effects and clinical implications. *Current Pharmaceutical Design*, 16: 870-876.
- Kiwuwa, G.H. (1986). Breeding strategies for small ruminant production in eastern and South Africa.1. Breed characters and general performance. Proceeding of workshop on improvement

of small ruminants in eastern and South Africa. Nairobi, Kenya, 16-22. October 1986.

- Koduda, M.E.M. (1985). Growth, Reproduction, and production performance of Sudanese Nubian Goats. M.Sc. Thesis. Uni. Of Khartoum, Sudan.
- Krstanovic, V.; V. Slacanac; R. Bozanic; J. Hardi; J. Rezessyne and M. Lucan, (2010). Nutritional and therapeutic value of fermented caprine milk. *International Journal of Dairy Technology*, 63: 171-189.
- Kunz, C.; S. Rudloff; W. Baier; N. Klein and S. Strobel. (2000). Oligosaccharides in human milk: structural, functional and metabolic aspects. *Annu. Rev. Nutr*, 20: 699-722.
- Liew, C.; H.A. Schut; S.F. Chin; M.W. Pariza and R.H. Dashwood. (1995). Protection of conjugated linoleic acids against 2-amino-3-methylimidazo-4, 5-quinoline-induced colon carcinogenesis in the F344.
- Lopez-Aliaga, I.; J. DiazCastro; M.J.M. Alferez; M. Barrionuevo and M.S. Campos. (2010). A review of the nutritional and health aspects of goat milk in cases of intestinal resection. *Dairy Science and Technology*, 90: 611-622.
- Mason, I.I. (1951) *World Dictionary of live stock breeds and varieties*. CAB international third edition (1988). Edinburgh Scotland.
- Mc Cullough, F. (2003). Nutritional evaluation of goat's milk. *Health Food Journal*, 105: 239-251.

- Meschy, F. (2002). Mineral Nutrition (Macro Elements) Recent progress in goats. *Inra production Animal*, 15(4): 271-276.
- Muffareh, M.B. (1995). Goats' breeds and varieties in Sudan. Proceedings of training course on sheep and goat production, held by Arab Center for studies of Arid zones and dry land (ACSAD), Khartoum, 17-27 January, 1995.
- Osman, A.M. (2007). Handouts for Graduate Studies Students. College of Animal Production Science and Technology Sudan Uni. Of Sci. and Tech.
- Parkash S. and Jenness R. (1968). The composition and characteristics of goat milk: Review. *Dairy Sci. Abstr.*, 30: 67-72.
- Park, Y.W. (2007). Hypoallergenic and therapeutic significance of goat milk. *Small Ruminant Research*, 14: 151-159.
- Park Y.W.; Juárez M.; Ramos M. and Haenlein G.F.W. (2007). Physico- chemical characteristics of goat and sheep milk. *Small Rumin. Res.* 68:88. 113.
- Park, Y.W.; M. Juárez; M. Ramos and G.F.W. Haenlein. (2011). Physicochemical characteristics of goat and sheep milk, 15: 223-250.
- Riel, R. (1985). Composition and Physicochemical Structure of Iron, Cooper and Zinc in Human and Powdered Infant Formula. *Int. J. Food Sci. Nutr.* 51(5): 373: 380.

- Roy S.K. and Vadodaria V.P. (2006). Goat Milk and Its Importance. *Indian Dairyman*, 58 (3): 65-69.
- Sayed, F.B. and Henna, J. (2010). Goat Adour in Milk and its Prevention. *Ind. Res. J. of Agric. Sci.*, 1(4): 487: 490.
- Shea, O.; M. Bassaganya; J. Riera and I.C.M. Mohede. (2004). Immunomodulatory properties of conjugated linoleic acid. *American Society for Clinical Nutrition*, 79: 1199-1206.
- Slacanac, V.; J. Hardi; H. Pavlovic; D. Vukovic and V. Èutic. (2004). Inhibitory effect of goat and cow milk fermented by ABT-2 culture (Lactobacillus acidophilus La-5, Bifidobacteriumlactis Bb-12 and Streptococcus thermophilus) on the growth of some uropathogenic E. coli strains. *Italian Journal of Food Science*, 16: 209-219.
- Slacanac, V.; R. Bozanic; J. Hardi; J. Rezessyne; M. Lucan and V. Krstanovic. (2010). Nutritional and therapeutic value of fermented caprine milk. *International J. of Dairy Technology*, 63: 171-189.
- Üçüñçü, M. (2005). *Sut Ve Mamulleri Teknolojisi*. Izmir: Meta Basim.
- Van Immerseel, F.; J. De Buck; F. Boyen; L. Bohez; F. Pasmans; J. Volf; M. Sevcik; I. Rychlick; F. Haesebrouck and R. Ductaelle (2004). Medium chain fatty acids decrease colonization and invasion through hila suppression shortly after infection of chickens with Salmonella enteric serovar

enteritidis. Applied and Environmental Microbiology 70: 3582-3587.

- Varnum, A.H. and Sutherland, J.D. (1994). Milk and Milk products. Chapman and Hall. U.S.A.
- Vlaamse, B. (2007). (Review on Medicinal and Nutritional value of goat milk) Study club of the professional goat milk producers.

بسم الله الرحمن الرحيم

إستبيان: إستهلاك لبن الماعز في ولاية الخرطوم

1. المنطقة السكنية:
أ- الخرطوم ب- الخرطوم بحري ج- امدمان
2. النوع :
أ- ذكر ب- أنثى
3. العمر:
أ- أقل من 25 ب- بين 25 و 35 ج- بين 35 و 50
د- أكثر من 50
4. المستوى التعليمي:
أ- امي ب- خلوه ج- أساس
د- ثانوي هـ- جامعي و- فوق جامعي
5. المهنة:
أ- ربة منزل ب- عامل ج- طالب د- موظف هـ- أخرى
6. هل تفضل لبن الماعز علي بقية أنواع الألبان الأخرى؟
أ- نعم ب- لا
7. إذا كانت الإجابة بنعم لماذا؟
.....
8. هل تستخدم لبن الماعز كجزء في الوجبة الغذائية؟
أ- نعم ب- لا
9. إذا كانت إجابتك بنعم كم مرة تستخدمه في الأسبوع؟
أ- مرة واحدة ب- مرتين ج- ثلاث مرات د- أكثر من ثلاث مرات
10. ما هي طريقة إستخدامك للبن الماعز؟
أ- طازج ب- طازجا مع إضافات ج- منتج مصنع د- غير محدد

11. إذا كنت تستخدم إضافات ماهي هذه الإضافات؟

.....

12. هل تستخدم لبن الماعز للعلاج؟

أ- نعم ب- لا

13. إذا كنت تستخدمه كعلاج ماهي الأمراض؟

.....

14. هل تستخدم لبن الماعز للأطفال؟

أ- نعم ب- لا

15. إذا كنت تستخدمه للأطفال هل لاحظت بعد استخدامه تحسن الأطفال صحياً؟

أ- نعم ب- لا

16. هل لبن الماعز متوفر أو سهل الحصول عليه؟

أ- نعم ب- لا

17. من أين تتحصل على لبن الماعز؟

أ- مزارع ب- منزلي ج- أماكن تجارية

18. كم يبلغ سعر رطل لبن الماعز في السوق؟

.....

19. مقارنةً باللبان سلالات أخرى أيهما أقل تكلفة؟

.....

20. هل تعرف سلالات ماعز اللبن؟

أ- نعم ب- لا