

Sudan University of Sciences and Technology

College of Graduate studies

**Effect of Table Egg Production Factors, Quality Parameters and
Marketing channel on marketing indicators in Khartoum State**

**أثر العوامل الإنتاجية ومعايير الجودة وطرق التسويق لبيض المائدة على المؤشرات
التسويقية في ولاية الخرطوم.**

**A dissertation Submitted for the Fulfillment of Requirements of
the Degree of PHD in Poultry Production**

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بِسْمِ اللّٰهِ الرَّحْمٰنِ الرَّحِیْمِ

Koran Version

{ وَ قُلْ رَبِّ زِدْنِيْ عِلْمًا }

{ طه/الآية (114) }

“Omy lord increase me in knowledge“

Taha (version 114)

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Dedication

I dedicate this study to the soul of late father Dufar Ngor Arop and may his soul rest in peace.

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Abstract

A study was conducted during the period November – December 2015 and January 2016 to assess some main factors in the marketing chain that have impact on table egg marketing in Khartoum State and on the consumer attitude in the direction of table egg demand. This was through assessing the knowledge and appreciation of grocers and the consumer opinion on table egg marketing, egg quality and standard through the marketing channel flow. Sixty random samples were selected from the central markets 90, from the groceries and 150 consumers. Questionnaires, interviews and personal observation were used. Data was collected on personal characteristics, seasonal effect, marketing activities, egg handling, feasibility and reasons for business selection. Data was analyzed by simple percentages, Anova and correlation. The main findings were. Central market business group was 20 – 30 years at 43%, education 51.1 secondary, site ownership renting at 51.6, financing source 66.7% mainly personal, table egg purchase source was mainly companies at 48.3%. Base of egg purchasing was 66.7% for size, sale display 50% in open veranda and seasonal effect was high for both summer and winter at 83.3% each.

For groceries Sale display at 33.3% was open veranda, price assessment factor was supply and demand 33.3% and fixed price at 27.8%. Purchase preference was mainly external appearance at 23.3% and 17.8% for each of shape and stamp. Purchase source was farms at 48.9% and companies 46.7%. For site ownership renting ranked first 45.6% Analysis of variance between source of purchase

and quantity of daily sales was not statically significant ($P=0.99$) also NS with price of purchase ($P\leq 0.297$) and also NS with price of sale ($P\leq 0.363$). Analysis of variance between site ownership and quantity of daily sales was NS ($P\leq 0.466$) but was significant for price of purchase ($P\leq 0.021$) and also for price of sale ($P\leq 0.006$). Analysis of variance between source of financing and daily sales was NS ($P\leq 0.699$), also NS with price of Purchase ($P\leq 0.342$) and also with price of sale ($P\leq 0.205$). Transportation to groceries was mainly company cars at 31% and open cars at 24.4%. Storage period mainly 2-14 days in open veranda and for egg quality 24.4% of the respondents lacked information.

Consumption was by all age groups but less for elderly and females. Main source of table eggs was groceries at 66.7 % and Central markets at 20.7%. For size 72.3% preferred, medium, for cooking, 65.3% preferred boiled eggs and for meal preference 38% for breakfast and 24.6% all meals. For seasonal preference 29.4% autumn and 12 % summer. The study concluded that the majority of the study respondents in the table egg marketing chain knowledge on quality standards merchandising depended on personal judgment rather than recognized standards. Display methods, storing and transportation were not correctly attended to.

Site ownership and personal experience had significant effect on both purchase and sale price. The study noted absence of any organized or authorized body controlling, guiding or directing table egg flow in the marketing chain.

During the period February – April 2016 a survey study was conducted in Khartoum State on the marketing activities and egg cracks in the marketing chain and methods of disposal of cracked table egg.. From these data 40 groceries were randomly selected from Khartoum, 30 from Omdurman and 20 from Khartoum North with equal number in each locality from each of the 4 geographical directions and the center of the locality (8, 6, 4). Questionnaires, interviews and personal observation were used for data collection on personal characteristics, commercial and marketing activities, pricing, transportation, egg cracks and methods of disposal. Data was analysed using simple percentages.

The main finding were consumers preferred buying by dozen while grocery owners preferred selling by tray. Source of purchase was almost equal between companies and farm units, storing period was 2 -14 days, transport by company cares or open cars on rough roads and display methods mostly in open verandas and some good portion on the ground.

For cracked eggs some total of 18.9% of the respondent indicated high rate For cracked egg disposal it was mostly by away from the farm (32.2%) and 13.3% by garbage car which poses environmental and health hazards. The study indicated no relationship or correlation between either the educational level or SSMO type of information and the method of cracked egg disposal. The study noted complete absence of any extension programs or any regulatory presence of any official body or institution for cracked egg disposal treatment.

For studying effect of housing system and season on egg quality in Khartoum State 2 groceries were selected randomly from each of the 3 localities. One egg tray from closed and one from open housing system were randomly selected from each grocery twice per month for six months.

Five eggs were selected randomly from each tray for egg quality study during the period of January – August 2017 using the cluster method. Data was used collectively for studying housing effect and for season effect was divided into 3 seasons.

Study showed significant effect of housing on (Egg Weight) ($P < 0.1$) and (Yolk Colour) ($P < 0.01$) and (NS) on (Egg Shape), (Shell Thickness), (Yolk Index) and (Haugh Unit). Season showed significant effect on (Egg Weight), (Egg Shape), ((Shell Thickness) and (Hough Unit) each at ($P < 0.01$) and (Yolk Colour) at ($P < 0.05$). Wet season showed numerically the highest level over winter and dry summer for all parameters studied. Closed housing system also showed the better results for all parameters studied over the open.

الخلاصة

تمت دراسة بعض العوامل التي تؤثر على السلسلة التسويقية في ولاية الخرطوم في الفترة ديسمبر 2015 ويناير 2016 لتحديد بعض العناصر الرئيسية في السلسلة التسويقية والتي لها أثر على تسويق البيض المائدة بولاية الخرطوم وتوجهات واتجاهات المستهلكين في اتجاه الطلب على البيض المائدة عن طريق تقييم المعارف وادراك ورضى أصحاب البقالات ورأي المستهلكين عن تسويق البيض والجودة والمعيار القياسي في منظومة انسياب سلسلة تسويق البيض، ثم اختياره لعينة عشوائية من الأسواق المركزية و 90 من البقالات و 150 من المستهلكين وتمت الاستعانة بالاستبيانات والمقابلات والملاحظات الشخصية وتم جمع معلومات عن الخصائص الشخصية، التأثير الموسمي، المناشط التسويقية، معادلة البيض، الجدوى الاقتصادية وأسباب اختيار نوعية العمل وتم التحليل الاحصائي عن طريق النسب المئوية السببوية والتباين الاحصائي والارتباط. تراوحت أعمار العاملين بين 20- 30 عاماً بنسبة 43% وفي جانب التعليم كانت بنسبة 51.6% المستوى الثانوي ومصدر التمويل شخصي بنسبة 66.7% والمصدر الرئيسي لشراء البيض كان الشركات بنسبة 48.3% والقاعدة الشرائية للبيض بنسبة 66.7% كان بالحجم وأما بالنسبة للعرض فنسبة 50% في فترينات مفتوحة وأما لتأثير الموسم على القوة الشرائية أفاد 83.3% بأنها مرتفعة صيفاً وشتاء.

في البقالات 33.3% من العرض كان بفرندات مفتوحة والسعر يحدده العرض والطلب وثبوت الأسعار بنسبة 27.8% ولتحديد المفاضلة للشراء أفاد 23.3% بأنها المنظم الخارجي و 17.8% لكل من الشكل والخاتم ومصدر الشراء كان بنسبة 48.9% من المزارع و 46.7% الشركات وملكية المواقع كانت بنسبة 45.6% وواضح التحليل الاحصائي لتباين بين مصدر الشراء والكمية المسوقة يومياً أنه ليس هناك فرق احصائي معنوي احتمالية (0.99) وبينه وبين سعر الشراء باحتمالية 0.297 وينة وبين سعر البيع باحتمالية (0.363). وتحليل التباين بين ملكية الموقع وكمية البيض المباع يومياً إلا أنه ليس هناك فرق احصائي معنوي بينه وبين سعر الشراء باحتمالية

(0.021) وبينه وبين سعر البيع باحتمالية (≤ 0.006) كما أوضح تحليل التباين بين مصدر التمويل والمباع اليومي وسعر الشراء وسعر البيع أنه ليس هناك فرق احصائي معنوي باحتمالية (≤ 0.699) (≤ 0.342) و (≤ 0.205) بالتتالي والتوالي. وسيلة الترحيل للبقالات كانت سيارات الشركات بنسبة 31% والسيارات المفتوحة بنسبة 24.4% وفترة تخزين البيض تراوحت بين 2-14 يوم في فرنادات مفتوحة أما بالنسبة للجودة فقد أفاد 24.4% أنهم يفتقرون للمعلومات. أوضحت الدراسة أن الاستهلاك كان في كل الأعمار يتناقص عند كبار السن والنساء وأهم مصادر البيض كان البقالات بنسبة 66.7% والأسواق المركزية بنسبة 20.7% وبالنسبة للحجم فنسبة 72.3% يفضلون المتوسط وللطبخ 75.3% يفضلون الغلي وبالنسبة للوجبات فإن 38% يفضلون الافطار بينما 24.6% كل الوجبات وبالنسبة للموسم 29.4% يفضلونه في الخريف 12% في الصيف وخلصت الدراسة إلى أن معظم المبحوثين في سلسلة تسويق بيض المائدة يفتقرون لمعرفة معايير الجودة وأن عملية التسويق تعتمد على الحكم الذاتي بدلاً عن المعايير المعترف بها وأن طريقة العرض والتخزين والترحيل لا تعامل بطريقة صحيحة وأن ملكية الموقع والخبرة الشخصية كان لها تأثير معنوي احصائي في سعري الشراء والبيع ولاحظ الباحث غياب الجهات والأجهزة الرسمية المسؤولة عن التحكم في التوجيه والإرشاد في سلسلة انسياب تسويق بيض المائدة.

في الفترة فبراير - ابريل 2016 تمت دراسة مسحية في ولاية الخرطوم على المناشط التسويقية في سلسلة التسويق وأثرها على كسر البيض وعن طرق التخلص من البيض المكسور وباعتبار التشابه في سلسلة التسويق والمميزات لكل محلية وبالرجوع للاحصاء السكاني في العام 190 وبنسبة السكان في كل محلية تم اختيار 40 بقالة بالخرطوم و 30 بام درمان و 20 من الخرطوم بحري وتم توزيع البقالات بالتساوي بين الاربعة جهات الجغرافية والوسط لكل مدينة (8,6,4) لجمع المعلومات تمت الاستعانة بالاستبيانات والمقابلات الشخصية والملاحظات وتم جمع معلومات عن الخصائص الخصية والمناشط التجارية والتسويقية والتسعير والترحيل والكسر في

البيض وطرق ووسائل التخلص من البيض المكسور و تم تحليل المعلومات بالنسبة المئوية البسيطة وأهم النتائج المستخلصة كانت الشراء يتم وفق المظهر الخارجي والمستهلكون يفضلون الشراء بالدسته بينما يفضل أصحاب البقالات البيع بالطبق ومصدر الشراء كان تقريبا متساوياً بين الشركات والوحدات المزرعية وتراوحت فترة التخزين بين 2 - 14 يوماً ويتم الترحيل بسيارات الشركة وبالسيارات المفتوحة في طرق صعبة وغير معبدة جيداً وطرق العرض معظمها في فرندات مفتوحة والبعض على الأرض مما يجعل بعض هذه الممارسات تعرض البيض للكسور والتدمير ونسبة الكسر اشار 189% إلى أنها مرتفعة وبالنسبة للتخلص من البيض المكسور 32.2% أنه بالرمي بعيداً عن المزرعة اي التلوث البيئي والتلوث الصحي وأوضحت الدراسة أنه ليس هناك علاقة ارتباط بين المستوى التعليمي أو علاقة بين معلومات ومنشورات البيئة السودانية للموصفات وطريقة التخلص من البيض المكسور كما لاحظت الدراسة الغياب الكامل لأي برامج ارشادية أو أي لوائح تنظيمية أو وجود أي جهاز أو مؤسسة رسمية لمعالجة طرق التخلص من البيض المكسور.

لدراسة تأثير نظام الاسكان والموسم على جودة البيض في ولاية الخرطوم تم الاختيار العشوائي لطبيعة البيض من كل بقالة أحدهما من النظام السكني المغلق والآخرين من المفتوح مرتين في الشهر ولمدة ستة أشهر وتم اختيار خمسة بيضات عشوائية من كل طبق لدراسة الجودة في الفترة يناير - أغسطس 2017 باتباع طريقة العنقود duster حيث تم استعمال المعلومات الكلية لدراسة تأثير الاسكان وتم توزيعها لثلاث مواسم لدراسة تأثير الموسم على الجودة أوضحت الدراسة التأثير الاسكاني بنسبة احصائية معنوية باحتمالية ($P \leq 0.01$) لوزن البيض واحتمالية ($P \leq 0.01$) لوزن البيض أو اشكال البيض و سمك القشرة ومعامل الصفار ووحدة ولم تكن لأي منها احتمالية احصائية معنوية وإما بالنسبة لتأثير الموسم فقد أوضحت الدراسة احتمالات احصائية معنوية لكل من وزنها لبيض وشكل البيض وسمك القشرة ووحدها وبنسبة ($P \leq 0.01$) لكل منها أما لون البيض فأوضح احتمالية احصائية معنوية بنسبة ($P \leq 0.05$) وموسم الخريف كانت له

أعلى النتائج الرقمية على موسمي الشتاء والصيف الجاف في كل معايير الجودة في الدراسة كما كان لنظام الاسكان المغلق احسن الدرجات على النظام المفتوح في كل معايير الجودة الدراسية.

Chapter One

1-Introduction

Chapter One

1-Introduction

The economy of the Sudan depends mainly on agricultural resources of which livestock is an important sub-sector and of which poultry contribution has risen significantly.

The poultry industry is vital for its contribution in the national economy in the sphere of generating employment, creating additional income source, improvement of nutrition and eggs are one of the main products of poultry farming and industry.

To meet the increasing demand apart from egg production efficient egg marketing is necessary as it is difficult to run a profitable business without proper and organized marketing system.

Egg quality is an important contributor in production, handling, marketing and consumer preference and acceptance.

Seasonal factors exert an important effect on short-term price movements of many commodities specially farm products of which eggs are one.

Rapid transportation system and modern retail outlets with refrigerated storage areas and display methods provide consumers with the freshest high quality products possible.

Production to meet market demand and market-led egg production enables long term business survival, higher profits, consumer demand and better standard of living for the egg producer.

Poultry production, specially eggs, constitute an important component in the human diet, Sudan is not an exception yet most of the market supply comes from small and medium size farms which reflects negatively on egg quality marketed and on the marketing system.

Very few studies on the way eggs are handled from the farm to the retail store and the quality on eggs available to the consumer have been conducted since the start and the booming of the poultry industry in the Sudan.

The objective of this study is to assess factors affecting egg quality and marketing along the production and marketing channels in Khartoum State. This is through information collection on production in small and medium size farms, marketing channels, consumer preference, egg usages and buying practices to provide bases for evaluating potential market, producer practices, consumer attitude, egg quality attributes and marketing indications.

Chapter Two

2- Literature Review

Chapter Two Literature Review

2-1 Quality

Malden et al., (1979) reported that quality of egg with reference to food value or market desirability is measured by external appearance, candling, odour, flavor and physical character of an opened egg. External appearance of an egg includes size, shape, shell colour and texture, cleanliness and uniformity and the standard egg size accepted is 2 ounces per egg.

Hernandez et al., (2000) concluded that consumers define egg quality through its observable characteristics such as shell strength, albumen consistency and yolk colour.

The term "Quality" was defined by Kramer (1951) as the sum of the characteristics of a given food item which influence the acceptability or performance for that food by the consumer.

Elements of food can be divided into two groups: sensory quality elements which can be recognized and appreciated by the use of the five senses which include appearance such as size, shape, integration and colour, texture and defects, Organoleptic characteristics which include taste, odour and defects (Osman, 2010).

Manahil(2011)in a study evaluationof table egg quality according to the Sudanese StandardMetrologicalOrganization egg quality standard concluded that Haugh unit (HU) could be used for evaluation of egg internal quality,She stated that recent display practices used for table egg affected the egg quality.

USDA (United States Department of Agriculture includes AA , A , B)quality eggs are sold for supermarkets (Jacquoeline et al , (2009) .

Mouiaetal., (2013) in quality assessment of marketed eggs in Algeria found significantdifference in egg weight for different marketing channels at 58.9 grams for public markets61.2 for food shops and 62.8 for supermarkets. Shell thickness was similar for all marketingchannels .proportion of damagedegg was in public markets at 9%intermediate in good shops at 7.5% and lower in supermarkets at 5.7% ($p < 0.05$) yolk albumenratio was significantly higher .for egg form supermarket 48% other channel47.4% ($p < 0.05$) . Freshness of eggs measured by Haugh Units (HU) was Lower in public markets 74.8units , intermediate in food shops 77.6 % and higher in supermarkets 79.9 units , ($p < 0.05$). Price ofeggs was significantly lower in Public markets compared with the other two channels ($P < 0.05$).

They concluded that egg quality differed significantlyamong marketing channels with higherquality observed in supermarkets,intermediate in food shops and lower in public markets.

Bell et al , (2001) studied egg quality in egg marketing in national supermarkets in USA by surveys conducted to determine quality of eggs offered to the consumer in large supermarkets in various regions. Individual eggs were weighed candled and broken out for HU determination. Regional differences in age of eggs, number of eggs below 55(HU) and percentage of cracked eggs was observed. Age, egg weight HU and cracked eggs were statistically the same. Brown and white eggs were different relative to age and HU but egg weights and cracks were statistically the same.

Standardization means any activity aimed at achieving the optimum degree of order within a certain radius by setting conditions for the use of metrological and quality assurance. Standards intended to document out lines , rules , guide lines or characteristics of the services , product or production methods and also include terms , symbols , packaging and labeling requirements that apply the label on the products or methods of production , service or limited to any of them (SSMO, 2008).

2-2 Marketing

Brunswick (2014) the term marketing , as used , is designed to cover the complex group of services involved in the distribution of merchandise from the producer to the consumer excluding only those functions which involve alterations in the form of commodity .

Marketing to the producer is the manner in which the product is disposed of the way in which it is distributed for him often with his cooperation through the various channels of, trade. Marketing channel passes from the producer to the consumer through wholesaler, and retailer. Many traders in marketing channels lead to increase of marketing costs and hence constitute welfare cross to the final consumers.

The marketing of eggs includes grading, buying ,selling, distribution , packaging , transportation from the production source to the place of the consumer taking into account product quality maintenance during different marketing channels (Jacqueline et al , 2009) .

Manahil(2011) stated that the current situation of table egg marketing and display in the Sudan demonstrates insufficient situation that may affect the quality and the safety of the product. Agriculture marketing could be defined in many ways as all those business activities involved in the flow of goods and services from production to consumption (Abott ,1991) or the process that links production to consumption (Scott , 1995) or the performance of all business activities involved in the flow of goods

and services from point of initial agricultural production until they are in the hands of the ultimate consumer (Kohis and UhL 1990) . The chain of participants through which a commodity passes from the producer to the consumer is called the marketing channel. A typical marketing channel includes retailers, wholesalers, assemblers and transporters (Sherman, 1985).

2-3 Storage

Manahil (2011) Studying quality of table eggs compared to quality requirements by (SSMO, 751,2007) by random selection of eggs from different localities in Khartoum Stateshowedvariable findings for the same day production of, eggs stored at room temperature and refrigerated eggs at6 -10c. She also noted variation in the microbial load for the samples fromOmdurman, Khartoum and Khartoum North.

She concluded that storagetemperature affected egg quality and safety when compared to the requirements of (SSMO, 751, 2007). Also noted that recent display practices used for table eggsaffected the egg quality Scott and Silverside (2000) whenstudying effect of storage and strain of hen on egg quality using ISA Brown and ISA white hen Strains found that longerperiods of storage resulted in loweralbumenweight and albumen height and higher albumenweightthey stated that the major factor in determiningalbumen height is egg storage timeand conditions. Also that the effect of storage on egg quality can, also, be measured by increase in albumen pH with storage albumen weight decreases causing lower egg weight. yolk and shell weights were not changed by storage .

Ahnetal., (2000) reported that egg yolkpH increased as refrigeration time increased regardless of the dietary treatment. Albumen pH increased significantlyafter7 days of storage.

Scott etal, (2000) reported that the longer period of storage resulted in lower Albumen weight withhigher Albumen pH.

Allam (2000) stated that eggs should be stored under 15C° and 80% relative humidity.

Jin et al., (2011) stored fresh eggs in chambers for 2,5 and 10 days inside refrigerates at 5C° , 21 and 29C° they found that as storage time and temperature increased egg weight percentage , albumen , eggshell weight shell percentage and albumen weight significantly increased with increasing temperature, also yolk pH.

They concluded that egg weight loss, albumenpH andHU are parameters greatly influenced by storage temperature and time of eggs from hens at peak laying .

AL sobayeland Albadry (2010) reported that storage period had significant ($P<0.05$) adverse effect upon HU values ,specificgravity, air cell depth and shell thickness .HU values of white shelled eggs were most adverselyaffected by prolongedStoragePeriod .

They concluded that brown and white shelled eggs stored for 20 days at 7C° and 60% relative humidity maintained relatively good internal quality characteristics for human consumption.

2-4 Season

Panda et al. , (1987) studying effect of season on physical quality and components yield of eggs of different Lines of quail in winter (15.3C°) , Summer 31.1c and fall rainy season 29.2c in four different quail Lines , Egg – Line , white egg – Shell Line meat Line and control . They found that egg weight varied significantly ($P < 0.01$) with seasons tending to be larger in winter and smaller during periods of high temperature The meat line had the highest egg weight and white egg shell line the lowest eggs weight and shell thickness regardless of season . Significant ($p < 0.01$) Line and seasonal differences in albumen, yolk quality and shell thickness were observed and registered significant decline in summer and fall: percentage incidence of blood and meat spots was lowest in winter .

Brandao et al , (2014) studying seasonal effect on egg quality (Summer and winter) showed that for 2,7,14 , 21 and 28 days at 24 .6 to 25.8C° in Summer and for 24 to 25C° found losses in HU Scores from first to the last measurement approximately 40% regardless of egg type or season of production.

Chapter Three

3- Materials and Methods

Chapter Three

3-Materials and Methods

A three years field survey study was conducted during the period June 2015 to July 2018 to study the effect of table egg production factors, quality parameters and marketing channels on marketing directions in Khartoum State (KhS). The study covered some small and medium size open system farms, the central markets, groceries and some consumers from the three localities, Khartoum (Kh), Khartoum North (KhN) and Omdurman (Omd).

3- Year One

3-1 Farm Units:

The total number of operating farms was 91 according to the Ministry of Animal Resources and Fisheries (2015) composed of 41 at KhN, 33 Kh and 17 Omdurman selected relative to the number in each town. A total of 22% of the number of operating farms at 10 farms KhN, 8 Kh and 4 Omdurman using the random number system during the period July to October 2015 was used for the study.

Questionnaires, interviews and personal observations were used for the study (appendices).

Parameters studied were personal characteristics, management conditions, production indices, biosecurity, egg handling, marketing activities and building capacities.

3-2 Central Markets:

During the period November – December.2015 and January. 2016 sixty egg traders were randomly selected taking twenty traders from each of the three Central Markets in (KhS). Equal numbers were selected from each market considering the similar merchandising activities between the traders and among the consumers. Also considering the merits of each market, Khartoum being more urbanized Omdurman the most populated among the three towns and Khartoum North harboring most of the farm units.

Questionnaires, interviews and personal observations methods were used for the study. Data was collected on personal characteristics, marketing activities, egg handling, and seasonal effect on marketing activities, feasibility and reasons for business selection.

3-3 Groceries:

Using the above, mentioned, considerations and the ratio of population of each town to the total population of Khartoum state (5274321) Fifth Population Census, 2008) a total of 90 groceries were selected comprising 40 in (Kh), 30 (Omd) and 20 (KhN).

Fieldwise these numbers of groceries were, then randomly selected from the four geographical directions and the center of each locality.

Questionnaires, interviews and personal observations were used for collecting data on personal characteristics, commercial and marketing activities, pricing and selling, egg handling specially cracks and consumer complaints and preferences during the period February through April 2016.

3-4 Consumers:

Using the population ratio of each town to the total of Khartoum State population a total of 150 consumers was used for the study at the ratios of 42% (Omd), 30% (Kh) and 28% (KhN) comprising 63,45 and 42 consumers respectively during the period May, June, July 2016.

Using the same method for Central Markets and groceries parameters studied were consumer attitude, preferences, information on egg quality and knowledge and information on Sudan Standards and Meteorological Organization (SSMO).

3-5 Year Two:

Effect of housing system and season on quality parameters was studied by dividing the year into 3 seasons being January to March as cold winter, April to June as hot summer and July to September as Autumn or rainy season.

Five groceries were selected randomly from each township twice per month (1 and 15 the day) one egg tray was obtained from each grocery and 5 eggs were randomly selected from each tray using the number method comprising a total of 25 eggs for egg quality test repeated 6 times per season (150 eggs).

Parameters for external and internal quality factors studied were:

3-6 External quality:

- Egg weight using a sensitive balance up to 0.1 decimal point.
- Shape index using a vernier and the formula $\frac{width}{length} \times 100$
- Egg shell thickness in millimeters, oven dried and using a micrometer (egg shell with membranes).

3-7 Internal egg quality:

- Albumen height using egg quality slide rule (Kaw Company Make) that reads Haugh Unit, USDA chart Score and USDA Quality.
- Yolk index using a vernier to 0.1 decimal and yolk index (yolk height/ yolk diameter $\times 100$).
- Yolk color using a Colour fan 1-15 degrees (Roch Company).

Data was statistically analyzed using distribution frequencies and percentages, ANOVA SPSS Version 16 system, correlation system was

used for price of sale and price of purchase, for price of sale and experience period and quality of daily sales and experience period.

3-8 YearThree:

Finishing data tabulation and analysis writing the thesis the third seminar and writing two scientific papers.

Chapter Four

4- Results

CHAPTER FOUR

4- Results

4- Open small and medium size farms results:

4-a Farmer's Personal Characteristics and Production System:

Table (4-a-1) Education Level of Managers

Level	Frequency	percentage
University	10	45.45
Secondary	8	36.36
Post Graduates	2	9.09
Elementray	2	9.09
Total	22	100

A total of 54.5 % were of post graduate and University level and 36.4% were of secondary education level giving a total of 91.9% of high education level.

Table (4-a-2) Project Starting Date

Date	frequency	percentage
1 – 5 years	14	63.30
6 -10 years	4	18.19
15 -16	2	9.09
More than 20 years	2	9.09
Total	22	100

A total of 63.3% were at 1 – 5 years

Table (4-a-3) Project Ownership Type

Type	frequency	percentage
Private	19	86.0
Governmental assessment	2	9.09
Renting	1	4.54
Total	22	100

Some of 86.0% were privately owned

Table (4-a-4)**Housing System..**

System	frequency	percentage
Open system	15	68.9
Closed system	6	27.27
Semi closed system	1	4.54
Total	22	100

Hous System, Open housing system was at 68.9% and the closed system at 27.3 level

Table (4-a-5)**Type of Production**

Type	frequency	percentage
Only poultry	17	86.37
Mixed Animal production	3	13.64
Mixed Animal and Plant	2	9.09
Total	22	100

Only poultry production own at 84.4%

Table (4-a-6)**Project Feasibility Study**

Study	frequency	percentage
Personal experience	15	68.18
Spelization group	4	18.8
Sudanese team	3	13.6
Total	22	100

Project Feasibility Study, Personal experience was at 68.2%

Table (4-a-7)TotalFarm Area

Area	frequency	percentage
1 – 10 Feddans	14	63.6
11 – 20 Feddans	4	18.17
21- 30Feddans	4	18.16
Total	22	100

Area of 1 – 10 fedans was at 63.3% followed by 11 – 30 fedans at 36.4%

Table (4-a-8)**Area Under Poultry Production**

Area	frequency	percentage
¼ total area	10	45.45
½ total area	6	27.27
Total area	3	13.64
Less than 1 ¼	3	13.64
Total	22	100

Area underpoultry; production 45.5 1/2ther area at 2703% .

Table (4-a-9)TotalNumber of Farm Labour..

Number	frequency	percentage
1 -10	8	36.36
11 -20	4	18.18
21 -30	8	36.36
31 -40	2	9.09
Total	22	100

A Total of 1- 10 and 21 – 30 were both at 36.4% each

Table (4-a-10)Layer Production System ;

System	Frequency	Percentage
Ground cages	14	36.63
Cages and batteries	4	18.19
Ground cages and batteries	4	18.18
Total	22	100

Ground cages were at 63.6% as the main system
system was at 50% followed by 36.4% in cool rooms

Table (4-a-11)Egg Storage Method

Method	Frequency	Percentage
Poultry House	11	50
Cool room	8	36.36
Refrigerated area	3	13.64
Total	22	100

Pen House system was at 50% followed by 36.4% in cool rooms

Table (4-a-12) Type of Records Kept

Type	frequency	percentage
Production record	17	72.27
Health record	3	13.63
Financial record	1	4.56
Administration record	1	4.55
Total	22	100

A Sum of 72.3% kept production Recordsand only 13.6% kept health records

Table (4-a-13) Insurance Converge

Coverage	Frequency	Percentage
All production project .	15	68.15
Laborers only .	4	18.19
Building and assists only .	3	13.63
Total	22	100

For Insurance coverage, all the production project were at 68.3%

2 .Feeding and Nutrition

Table (4-a-14) Feeding System;

System	Frequency	Percentage
According to production	9	31.81
According to age	7	31.81
According to Season	4	19.18
According to hybrid type	2	9.09
Total	22	100

Different system but mainly at 31.8% for each of both by production and according to age

Table (4-a-15)Feed Source;

Source	Frequency	Percentage
Farm Produced	11	50
Purchase farm	5	22.72
Feed processing Plant	2	9.09
Company agent	2	9.09
Other	2	9.09
Total	22	100

, The main source was farm processing at 50% level.

Table (4-a-16)Feed Production costlevel;

Level	Frequency	Percentage
High	11	50
Acceptable	4	18.19
Low	4	18.8
Flucting	3	13.63
Total	22	100

Price was high for 50% of the farmers while acceptable and low at 18.2 % for each

Table (4-a-17) Total Daily Egg Production

Production	Frequency	Percentage
Less than -1000 egg	19	86.34
1001 -3000 egg	2	9.09
3001 -5000egg	1	4.54
Total	22	100

Production of up to 1000 egg per day (30 – 33 egg) trays was at 86.3% level.

3. Market Orientation

Table (4-a-18) Farm Gate Egg Sale Price in Pounds /Dozen

Price	Frequency	Percentage
18 -20	18	81.81
11 -25	4	18.18
Total	22	100

, A Majority of 81.8 sale dozen egg at 18 -20 Sudanese pound a (45 – 50 pound / tray)

4. Biosecurity Management

Table (4-a-19) Farm Supervision

Supervision	Frequency	Percentage
Veterinarian	20	90.9.
Animal production specialization	2	9.09
Total	22	100

Veterinary supervision was at 90.9%

Table (4-a-20) Reference Diagnostic Laboratory

Laboratory	frequency	percentage
Veterinary hospital	15	68.19S
Soba national laboratory	7	31.81
Total	22	100

Veterinary hospital were at 68.2% followed by soba national veterinary laboratory as 31.8 Level

Table (4-a-21) Disposal of Mortality

Disposal Method	Frequency	Percentage
Burning	10	45.45
Burning and Burying	8	36.36
Buying	3	13.63
Away from unit	1	4.55
Total	22	100

Burning came at 45.5% & followed by Burning and Burying were at 36.4% while away from the unit was at 4.6%

Table (4-a-22) Manure Disposal System;

Disposal System	Frequency	Percentage
Selling	9	40.90
Burning	8	36.37
Burying	3	13.64
Private	2	9.09
Total	22	100

Selling came at 40.9% while burning or burying were at 50.5%

Table (4-a-23) Feed Additives

Additives	Frequency	Percentage
Vitamins	11	50
Antibiotics	4	18.18
Coccdiostats	3	13.63
Hormones	2	9.09
Deworming agent	2	9.09
Total	22	100

Vitamins were at 50% followed by antibiotics at 18.2% Level

Table (4-a-24) Water Source

Source	Frequency	Percentage
Tap water	15	68.14
Well and Deep bore	7	31.81
Total	22	100

Wells and deep bores were at 32.8 %

Table (4-a-25) Regular Prophylactic Programme

Program	Frequency	Percentage
Antibiotic	8	36.36
Coocidiostats	8	36.36
External insecticides	4	18.18
Deformers	2	9.09
Total	22	100

Mainly antibiotics and coccidian state were used at 36.4 % each

Table (4-a-26) Sale of Eggs after Antibiotic Use

Days	frequency	Percentage
2 -3 days	14	36.63
4 -7days	4	18.19
More than 7 days	4	18.18
Total	22	100

A total of 63.3% sold egg after 2 – 3 days of antibiotic use

Table (4-a-27) Building Capabilities and Experience by Universities and Research Centre;

Item	Frequency	Percentage
Helping solving production problems.	15	68.17
Scientific degrees	5	22.72
Farm requirement	2	9.09
Total	22	100

Target of research by universities and research institutes mainly concentrated on keeping helping solving production problems at 68.2% level

Fig (4-1) Building Capabilities and Experience;

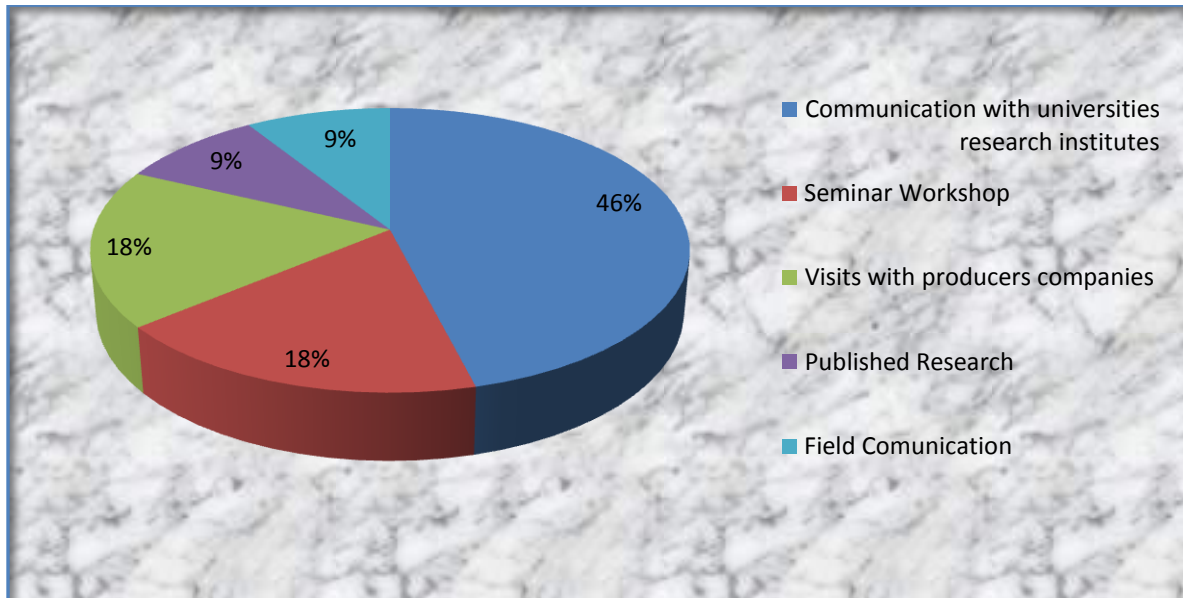
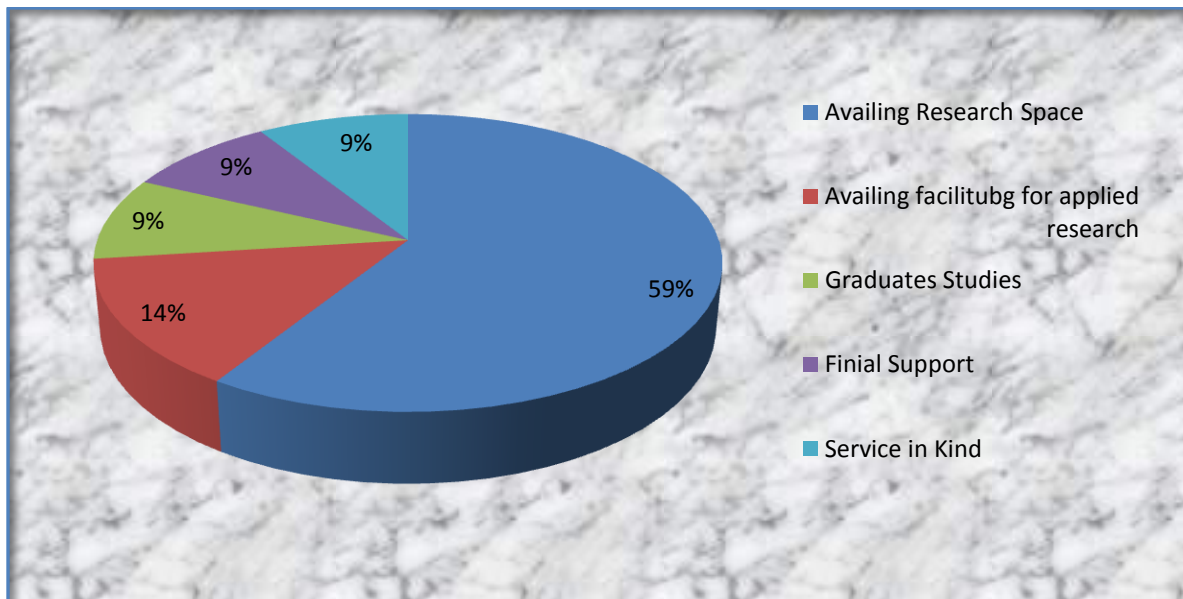
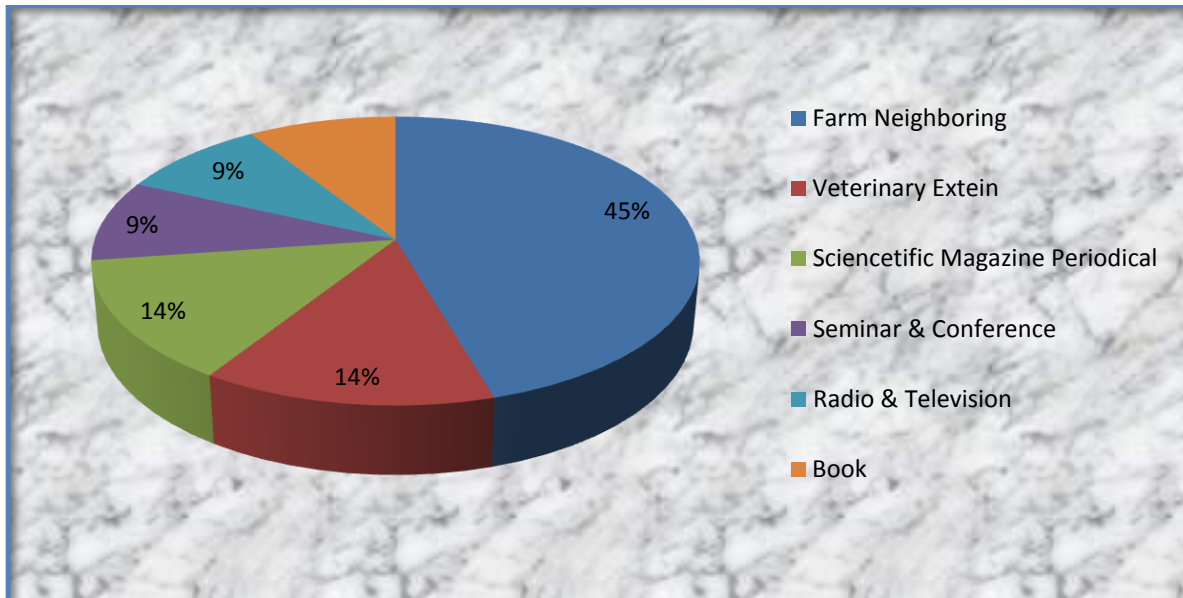


Fig (4-2) Type of Research Cooperation;



Availing research space at 59.1% level

Fig (4-3) FollowUp of Research and innovations in Poultry;



Results:

The following tables show the result on egg quality for both housing system

Table(4-28): Effect of open housing system on egg quality:

Parameter	Egg weight (g)	Egg Shape %	Egg shell thickness (mm)	Yolk Index	Haugh Unit(HU)	Yolk Colour
January	44.6	76.2	0.32	0.33	75.96	5.52
February	47.4	75.2	0.31	0.33	70.60	6.56
April	40.68	74.7	0.31	0.33	71.80	5.20
May	56.68	75.9	0.31	0.31	71.60	5.68
July	51.20	76.4	0.31	0.33	71.40	6.12
August	49.40	76	0.32	0.32	74.40	5.76
Total Average	51.29	75.74	0.32	0.33	73.08	5.51

Yolk colour:YolkcolourFan - DSM

HU:EggQuality Slide Rule - USDA

Table (4-a-29): Effect of closed housing system on egg quality:

Parameter	Egg weight	Egg Shape %	Egg shell thickness	Yolk Index	Haugh Unit(HU)	Yolk Colour
Month	(g)		(mm)			
January	57.80	75.4	0.32	0.31	75.76	6.48
February	55.71	75.1	0.33	0.33	72.89	6.56
April	56.16	74.1	0.31	0.32	76.80	5.20
May	60.20	73.6	0.34	0.33	79.00	7.12
July	59.20	74.9	0.34	0.35	73.92	5.08
August	56.16	74	0.35	0.33	76.64	6.80
Total Average	57.75	74.52	0.33	0.33	72.42	6.49

Yolk colour :YolkcolourFan - DSM

Hu: EggQuality Slide Rule - USDA

Table (4-a-30): Statistical Analysis of the effect of housing system and season on some egg quality factors:

Factors	Egg weight (g)	Egg Shape %	Egg shell thickness (mm)	Yolk Index	Haugh Unit (Hu)	Yolk Colour
Housing System						
Open	51.29	75.74	32.16	0.33	72.42	5.51
Close	57.75	74.52	32.62	0.33	73.08	6.49
SE	0.541	0.772	0.118	0.382	0.13	0.217
Significance	**	NS	NS	NS	NS	**
Season						
Winter	53.15 ^b	71.10 ^c	32.69 ^b	0.34	72.79 ^b	5.74 ^b
Dry Summer	53.50 ^b	73.02 ^b	31.25 ^c	0.33	71.49 ^c	5.14 ^{ab}
Wet Summer	56.91 ^a	79.09 ^a	33.28 ^a	0.33	73.97 ^a	6.08
SE	0.663	0.776	0.144	0.468	0.16	0.266
Significance	**	**	**	NS	**	*
System X Season						
SE	0.937	0.976	0.204	0.662	0.226	0.376
Significance	**	NS	*	NS	NS	NS

N= 30

*= significant differences at $P < 0.05$, **= significant differences $P < 0.01$, NS = No significant differences.

Different Superscript letters within the same row mean significant differences at $P < 0.05$

**Central Market Table Egg Handling
Personal Characteristics and Commercial Activities**

Table (4-b-1)

Age

Age	Frequency	Percentage
20 - 30year	26	43.3
31-40 year	11	18.3
41- 50	11	18.3
More than 50	12	20
Total	60	100

The majority range data 43.3% for 20-30 years of age.

Table (4-b-2) EducationLevel

Level	Frequency	Percentage
Secondary	31	51.66
University	15	25
Elementary	10	16.7
Illiterate	4	o.7
Total	60	100

Most were of secondary education level at 51.7%

Table (4-b-3)

Site Ownership

Type of ownership	Frequency	Percentage
Renting	31	51.6
Sharing	19	35
Private	8	13.3
Government assessment	1	1.7
Other	1	1.7
Total	60	100

Renting was at 51.6% followed by sharing at 35% level.

Market Orientation

Table (4-b-4) Type of Commercial Activity

Activity	frequency	percentage
Company agent	24	40
Distributor agent	14	23.4
Small dealer	6	20
Quantity dealer	8	13.3
Middle man	8	13.3
Total	60	100

Company agents and distributor agents were at 40% and 23.4% a total of 63.4% .

Table (4-b-5) Financing source ;

Sources	Frequency	percentage
Personal	40	66.7
Joint with other	10	16.7
Bank loan	10	16.7
Total	60	100

Private financing was at 66.7% level.

Table (4-b-6)Egg Purchase Source

Item	Frequency	Percentage
Companies	29	48.3
Farms	20	33.3
More than one	7	11.6
Middle man	2	3.4
Agent	2	3.3
Total	60	100

Companies rated highest 48.3% .

Table (4-b-7)**Bases of Purchase**

Bases	Frequency	Percentage
Size	40	66.7
Price	10	16.7
Outer appearance	7	11.7
Looking	3	5
Total	60	100

Egg size ranked best at 66.7% .for base of purchase

Table (4-b-8)**Transporting System**

System	Frequency	Percentage
Refrigerated Car	26	43.4
Chilled vehicle	17	28.3
Open car	10	16.66
Other	7	11.7
Total	60	100

Chilled and refrigerated cars comprised 71.7% .

Table (4-b-9) Sale Display Method

Method	Frequency	Percentage
Open veranda	30	50
Grocery	8	12.3
Refrigerated	7	11.6
Ground	10	3.8
Cool room	5	10
Total	60	100

Open veranda comprised 50% of total.

The Season effect on commercial activities:

Purchase Price

Table (4-b-10) Winter

Purchase price	Frequency	Percentage
High	50	83.3
Low	5	8.4
Acceptable	5	8.3
Total	60	100

Table (4-b-11) Summer

Price	Frequency	Percentage
High	50	83.3
Low	5	8.4
Acceptable	5	8.3
Total	60	100

Table (4-b-12)Autumn

Purchase price	Frequency	Percentage
High	40	61.3
Acceptable	20	33.3
Low	10	16.6
Total	60	100

Purchase price ranked high for all seasons.

**Table (4-b-13)Quantity of Daily Sales
Winter**

Tray	Frequency	Percentage
More than 20 trays	37	61.6
11- 16	15	25
17- 20	6	10
5 -10	2	3.3
Total	60	100

Table (4-b-14)Summer

Sale price	Frequency	Percentage
5 -10 (Sudan Pounds)	40	66.6
11 – 16	10	16.66
More than 20	10	16.66
Total	60	100

More sales winter as compared to summer..

Sale price by Season

Table (4-b-15)Summer

Sale price	Frequency	Percentage
High	40	66.6
Acceptable	10	16.66
Low	10	16.66
Total	60	100

Sale Price Was High for 61.3% of The Respondents.

Table (4-b-16)Winter;

Sale price	Frequency	Percentage
High	20	33.4
Acceptable	20	33.4
Low	20	33.4
Total	60	100

Sale price was high for 33.4% .

Table (4-b-17) Proportion of Cracked Eggs

Proportion	Frequency	Percentage
Few	32	53.3
Acceptable	19	31.7
High	6	15
Nothing	3	5
total	60	100

For 53.3% of the study sample was few and for 31.7% acceptable.

Table (4-b-18) Ways of Disposal of cracked eggs

Ways	Frequency	Percentage
Garbage car	41	68.3
More than one way	13	21.7
Away from unite	6	10
Total	60	100

Garbage car ranked at 68.5% level .

Table (4-b-19) Reasons for Going into the Business

Reasons	Frequency	percentage
No job	40	66.7
Interesting job	10	16.7
Profitable	5	8.4
Available for marketing	5	8.3
Total	60	100

No job topped at 66.7% .

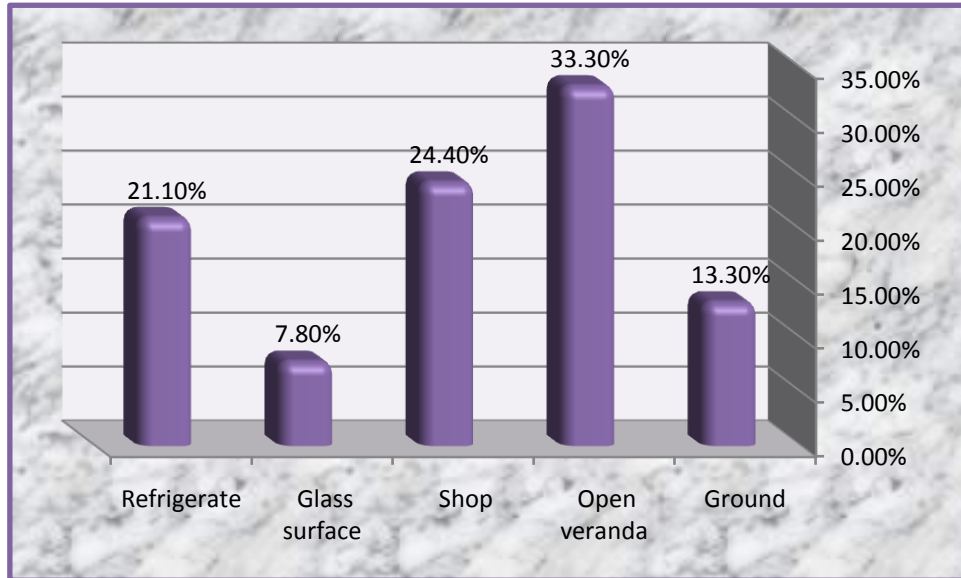
Table (4-b-20) Business Feasibility and Profit Ability

Profitability	Frequency	Percentage
profitable	50	83.3
Acceptable	5	8.4
Low	5	8.3
Total	60	100

A rate of 83.3% stated profitable.

Groceries And Marketing Activities

fig (4-1) Sale Display Method



The majority used open veranda for sale display.

Table (4-c-1)

Price Assessment Factor

factor	Frequency	Percentage
1. Fixed price	25	27.8
2. Supply and Demand	30	33.3
3. Season	21	23.3
4. Price competition	14	15.6
Total	90	100.0

Supply and demand ranked highest percent in price assessment .

Table (4-c-2)

Purchase Preference Base

preference	Frequency	Percentage
1. Looking	7	7.8
2. External appearance	21	23.3
3. Shape	16	17.8
4. Colour	13	14.4
5. Stamp	16	17.8
6. Egg cleaning	2	2.2
7. Farm	10	11.1
8. company	5	5.6
Total	90	100.0

Purchase preference base was mainly on external appearance shape and stamp .

Table (4-c-3) PreferredShell Color

color	Frequency	Percentage
1. White	68	75.6
2. Brown	19	21.1
3. Orange	3	3.3
Total	90	100.0

White color was the most preferred

Table (4-c-4) Purchase Method

Valid	Frequency	Percentage
1. Unite	6	6.7
2. Dozen	37	41.1
3. Tray (30 egg)	33	36.7
4. Carton (30 tray)	14	15.6
Total	90	100.0

Majority purchase eggs by dozen.

Table (4-c-5) Sale Method

Method	Frequency	Percentage
1. Unite	18	20.0
2. Dozen	56	62.2
3. Tray(30 egg)	13	14.4
4. Carton (30 tray)	3	3.3
Total	90	100.0

Majority sale egg by dozen at 62.2% level

Table (4-c-6) Preferred Selling Method..

Method	Frequency	Percentage
1. Dozen	2	2.2
2. Tray (30 egg)	40	44.4
3. Carton (30 tray)	2	2.2
4. All the methods	46	51.1
Total	100	100

Most preferred selling by all method followed by tray.

Table (4-c-7)

Source of Purchase of Egg

Source	Frequency	Percentage
1. Farm	44	48.9
2. Company	42	46.7
3. Company Agent	4	4.4
Total	50	100.0

Majority 95.6% purchased egg from farm and companies

Table (4-c-8) Analysis of Variance Between Sources of Purchase and Quantity of Daily Sales (tray)

Source of Purchase	No	Mean ± std	DF	F	P.value
FARM	44	45.55 ± 41.39 6	89	0.099	0.099
Company	42	43.86 ± 54.95 7			
Company agent	4	34.50 ± 47.84 2			
Total	90	44.27 ± 47.84 2			

* = $p < 0.05$, ** = $P < 0.01$, NS = Not significant

There was no significance between source purchase and quality of daily sale

Table (4-c-9) Analysis of variance Between Source of Purchase and Price of purchase

Source of Purchase	No	Mean ± std	DF	F	P.value
FARM	44	34.00 ± 7.6 64	89	1.025	0.297
Company	42	33.29 ± 7.8 62			
Company agent	4	27.75 ± 3.3 04			
Total	90	33.39 ± 7.6 71			

* = $p < 0.05$, ** = $P < 0.01$, NS = Not significant

No significant difference between source of purchase and price of purchase .

Table (4-c-10) Analysis of Variance between Source of Purchase and Price of Sale

Source of Purchase	No	Mean \pm std	DF	F	P.value
FARM	44	37.45 \pm 10.17 6	89	1.230	0.363
Company	42	36.05 \pm 11.34 5			
Company agent	4	29.75 \pm 4.349			
Total	90	36.46 \pm 10.61 4			

* = $p < 0.05$, ** = $P < 0.01$, NS = Not significant

No significant difference between source of purchase and price of sale..

Table (4-c-11)

Site Ownership

ownership	Frequency	Percentage
1. Private	16	17.8
2. Renting	41	45.6
3. Sharing	21	23.3
4. Government assignment	12	13.3
Total	90	100.0

Ownership was highest for renting and lowest for government assignment.

Table (4-c-12) Analysis of Variance Between Site Ownership and Quantity of Daily Sale (tray)

site ownerships	No	Mean \pm std	DF	F	P.value
Private	16	34.44 \pm 34.06 9	89	0.858	0.466
Renting	41	46.61 \pm 41.62 2			
Sharing	21	37.76 \pm 42.81 5			
Government assignment	12	60.75 \pm 82.25 5			
Total	90	44.27 \pm 47.84 2			

* = $p < 0.05$, ** = $P < 0.01$, NS = Not significant

There was no significant difference between mean of quantity of daily sale tray and site ownership

Table (4-c-13) Analysis of Variance between Site Ownership and Price of Purchase

site ownerships	No	Mean \pm std	DF	F	P.value
Private	16	30.69 \pm 7.097	89	3.426	0.021 *
Renting	41	32.68 \pm 7.292			
Sharing	21	37.71 \pm 7.309			
Government assignment	12	31.83 \pm 8.133			
Total	90	33.39 \pm 7.671			

* = $p < 0.05$, ** = $P < 0.01$, NS = Not significant

There was no significant difference between site ownerships and Price of purchase

Table (4-c-14) Analysis of Variance between Site Ownership the Price of Sale

Fainancing	No	Mean ± std	DF	F	P.value
Private	16	34.13 ± 8.717	89	4.373	0.006 **
Renting	41	36.27 ± 9.729			
Sharing	21	42.33 ± 9.926			
Government asignment	12	29.92 ± 12.80			
Total	90	36.46 ± 10.61			

* = $p < 0.05$, ** = $P < 0.01$, NS = Not significant

There was no significant difference between site ownership and price of sale

Table (4-c-15) Source of Financing..

Source	Frequency	Percentage
1. Personal	38	42.2
2. Sharing	36	40.0
3. Bank Loan	16	17.8
Total	90	100.0

Highest financing source was the personal and was the bank loan
(3suorce of financing)

Table (4-c-16) Analysis of Variance between Source Financing and Quantity of Daily Sales (tray)

Fainancing	No	Mean ± std	DF	F	P.value
Personal	38	40.24 ± 55.32	89	0.359	0.699
Sharing	36	44.94 ± 40.32			
Bank loan	16	52.31 ± 46.47			
Total	90	44.27 ± 47.84			

* = $p < 0.05$, ** = $P < 0.01$, NS = Not significant

No significant difference between source of financing and of quantity of daily sales

Table (4-c-17) Analysis of Variance Between Sources of Financing the Price of purchase

Fainancing	No	Mean \pm std	DF	F	P.value
Personal	38	32.21 \pm 7.55 2	89	1.085	0.342
Sharing	36	33.69 \pm 7.52 1			
Bank loan	16	35.50 \pm 8.24 6			
Total	90	33.39 \pm 7.67 1			

* = $p < 0.05$, ** = $P < 0.01$, NS = Not significant

No significant difference between source of financing and price of purchase.

Table (4-c-18) Analysis of Variance between Sourness of Financing the Price of Sale

Fainancing	No	Mean \pm std	DF	F	P.valu e
Personal	38	35.18 \pm 9.806	89	1.613	0.205
Sharing	36	35.92 \pm 11.378			
Bank loan	16	40.69 \pm 10.261			
Total	90	36.46 \pm 10.614			

* = $p < 0.05$, ** = $P < 0.01$, NS = Not significant

No significant difference between source of financing and price of sale .

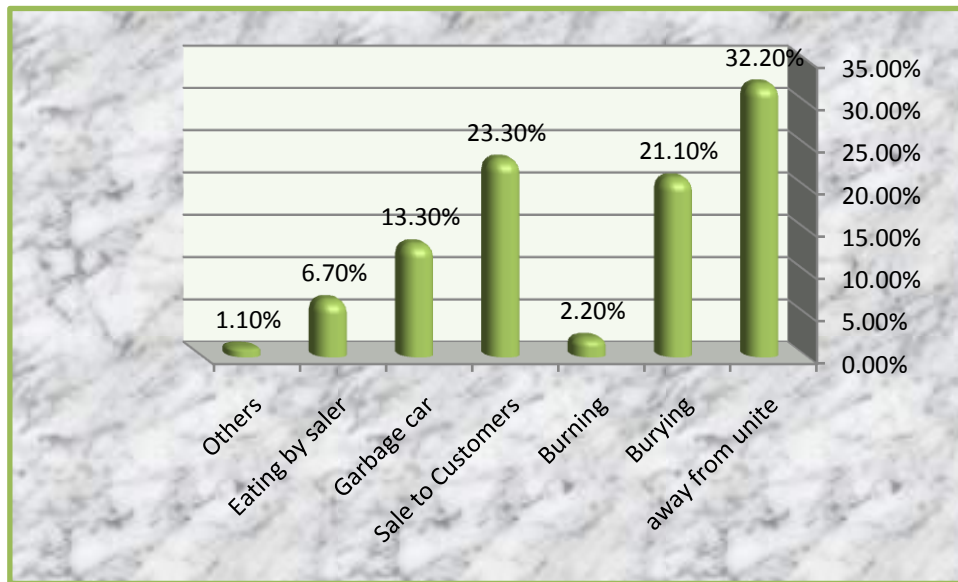
Table (4-c-19) Proportion of Cracked Egg

Valid	Frequency	Percentage
1. Few	57	63.3
2. High	17	18.9
3. None	16	17.8
Total	90	100.0

Proportion Few Ranked Highest

Table (4-c-2)

Fig (4-2) Ways of Disposal of Cracked Eggs



Many way but highest was away from unit by sale to consumers.

Table (4-c-20) Storting Period

Valid	Frequency	Percentage
1. Two days	21	23.3
2. Three day	12	13.3
3. Four days	16	17.8
5. Five days	6	6.7
6. Six days	12	13.3
7. Seven day	21	23.3
8 .fourteen dayday	2	2.2
Total	90	100.0

The sorting period ranged mostly between 2 7days.

Table (4-c-21) Distribution Frequencies and Percentage of Cracked Eggs and Storage Period

Proportion of cracked eggs	Storage Period							Total
	Day Two	Day Three	Day Four	Day Five	Day Six	Day Seven	fourteenth	
Few	14 66.7%	10 83.3%	10 62%	4 %66.7	6 %50	11 %52.4	2 100%	57 63.3%
High	2 9.5%	0 0%	3 18.8%	2 %33.3	3 %25	7 %33.3	0 0%	17 18.9%
None	5 23.8%	2 16.7%	3 18.8%	0 %0	3 %25	3 %14.3	0 0%	16 17.8%
Total	21 100%	12 100%	16 100%	6 %100	12 %100	21 %100	2 100%	90 100%

The majority of 81.1% stated no significant effect between sorting period and proportion of the cracked egg

Table (4-c-22) **Transport System**

System	Frequency	Percentage
1.farm gate	9	10.0
2. Company care	28	31.1
3. Chilled vehicle	18	20.0
4.Refrigeratedcar	12	13.3
5. Open car	22	24.4
6. Others	1	1.1
Total	90	100.0

Mostly by open care and cooled cars.

Table (4-c-23) Distribution Frequencies and Percentage of Proportion of Eggs Cracked and Transport System

Proportion of cracked eggs	Transport System						Total
	Form Gate	Company	Child Car	Refrigerated Car	Open Car	Others	
Few	7 77.8%	16 57.1%	11 61.1%	9 75.0%	14 63.6%	0 0.0%	27 63.3%
High	2 22.2%	7 25.0%	3 16.7%	2 16.7%	3 13.6%	0 0.0%	17 18.9%
None	0 0%	5 17.9%	4 22.2%	1 8.3%	5 22.7%	1 100%	16 17.8%
Total	9 100%	28 100%	18 100%	12 100%	22 100%	1 100%	90 100%

Majority of 81.1 stated no major effect of transportation system and proportion of cracked egg.

Table (4-c-24) Distribution Frequencies and Percentage of Proportion of Egg Cracked and Way of Selling Egg

Proportion of cracked eggs	way of saling egg			All the methods	Total
	Dozen	Tray	Carton		
Few	1 50%	27 67.5%	1 %50	28 60.9	57 63.3%
High	1 50%	6 15%	1 50%	9 19.6%	17 18.9%
None	0 0%	7 17.5%	0 0%	9 19.6%	16 17.8%
Total	2 100%	40 100%	2 100%	46 100%	90 100%

Majority of 57% stated minor effect of selling unit of proportion of cracked egg.

Table (4-c-25)**Educational level**

level	Frequency	Percentage
1. Illiterate	5	5.6
2. Primary	41	45.6
3. Secondary	39	43.3
4. University	5	5.6
Total	90	100.0

The highest percent was in the primarily stage at 45.6. %/which represent low level in educational level

Table (4-c-26) Distribution Frequencies and Percentage of Disposal of Cracked Eggs and Educational Level

Disposal of Cracked Egg	Education Level				Total
	Illiterate	Primary	Secondary	University	
Away from unit	1 20.0%	15 36.6%	11 26.8%	2 40.0%	29 32.2%
Burying	2 40.0%	8 19.5%	8 19.5%	1 20.0%	19 21.1\$
Burying	0 0%	1 2.4%	1 2.4%	0 0.0%	2 2.2%
Sale to Consumer	2 40%	7 17.1%	11 26.8%	2 40.0%	22 24.44%
Garbage Car	0 0%	8 19.5%	4 9.7%	0 0%	12 13.3%
Eating by Sale	0 0%	0 0%	6 14.6%	0 0%	6 6.7%
Other	0 0%	0 0%	0 0.0%	0 0.0%	1 1.1%
Total	5 100.0%	39 100.0	41 100.0%	5 100.0%	90 100.0%

The table doesn't show any direct relationship between education level and disposal away of cracked eggs

Table (4-c-27)**Role of SSMO**

role	Frequency	Percentage
1. Published papers	67	74.4
2. Training course.	14	15.6
3. Seminars and workshop	2	2.2
4. None	6	6.7
Total	100	100

Majority stated published papers on the main of SSMO .

Table (4-c-28) Disposal of cracked egg and Information on SSMO

Disposal of cracked egg	Information of Standard Meteorology		Total
	yes	No	
Away from unit	23 %35.4	6 %24	29 32.2%
Burying	12 %18.5	7 %28	19 21.1%
Burying	1 %1.5	1 %4	2 2.2%
Sale to Consumer	11 %16.9	10 %40	21 23.3%
Garbage Car	11 %16.9	1 %4	12 13.3%
Eating by Sale	6 %9.2	0 %0	6 6.7%
other	1 %1.5	0 %0	1 1.1%
total	65 %100	25 %100	90 100%

Table show no relation between information ON SSMO and way of disposal of cracked egg

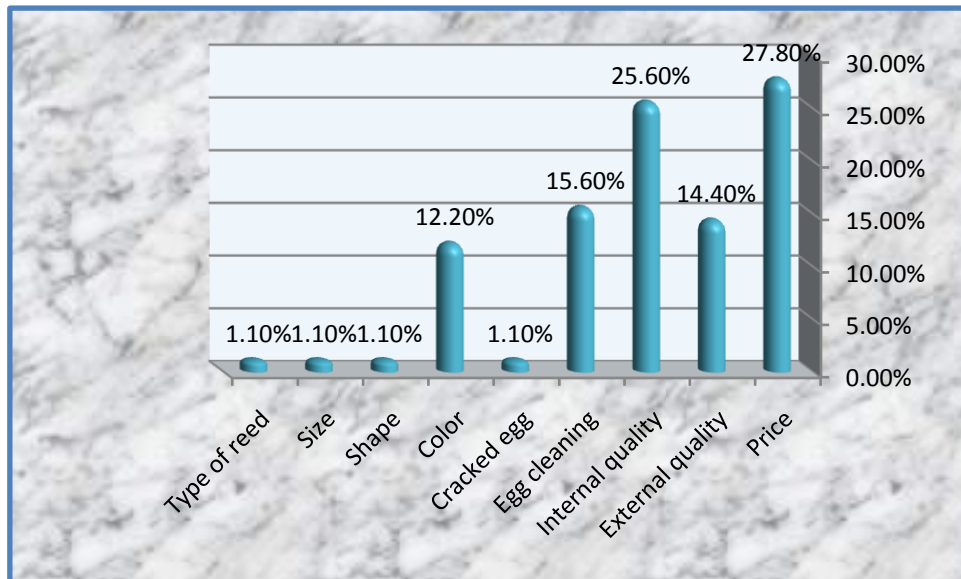
Table (4-c-29) Distribution Frequencies and Percentage of Disposal of Cracked Egg and Role of SSMO

Disposal Cracked Egg	Role of Standard Meteorology				Total
	Published Paper	Training Course	Seminar and Workshop	None	
Away From Unit	22 32.8%	5 35.7%	0 0%	1 26.7%	28 32.3%
Burying	18 26.9%	0 0%	0 0%	1 26.7%	19 21.1%
Buring	1 1.5%	0 0%	0 0%	1 26.7%	2 2.2%
Sale to Consumer	16 19.4%	6 28.6%	1 100%	1 26.7%	24 26.67
Garbage Car	9 13.4%	3 21.4%	0 0%	2 33.3%	14 15.55%
Other	1 1.5%	0 0%	0 0%	1 16.7%	3 3.33%
Total	67 100%	14 100%	2 100%	7 100%	90 100%

No relation between role of SSMO disposal of cracked egg .

Fig (4-3)

Fig (4-3) CustomersComplaint



Price and internal quality ranked high for consumer complaint

Table (4-c-30)**Reason for Choosing the Business**

Reason	Frequency	Percentage
1. Interesting job	21	23.3
2. Added sourceOf income	28	31.1
4.Profitability	33	36.7
5.Habit	8	8.9
Total	90	100.0

Added source of income and profitability ranked most

Table (4-c-31) Distribution Frequencies and Percentage of Disposal of Cracked Egg and Information on Egg Quality

Disposal of cracked egg	have you information of eggs quality		Total
	yes	No	
Away from unit	24 35.3%	2 22.7%	28 32.3%
Burying	16 23.5%	3 13.6%	19 21.1%
Burying	1 1.5%	1 4.5%	2 2.2%
Sale to Consumer	10 14.7%	11 50%	21 23.3%
Garbage Car	10 14.7%	2 9.1%	12 13.3%
Eating by Sale	6 8.8%	0 0.0%	6 6.7%
other	1 1.5%^	0 0.0%	1 1.1%
total	68 100%	22 100%	90 100%

No relation between disposal of cracked egg and information on egg quality

Table (4-c-32)

Information of Standard Metrology

Valid	Frequency	Percentage
1. Yes	65	72.2
2. No	25	27.8
Total	90	100.0

Sudanese Standard and Metrology Organization

Table (4-c-33)

ContinuousInterest

Valid	Frequency	Percentage
1. Yes	49	54.4
2. No	41	45.6
Total	90	100.0

Table (4-c-34)

Encouraging others in the egg market

Valid	Frequency	Percentage
1. Yes	59	65.6
2. No	31	34.4
Total	90	100.0

Table (4-c-35)

Type of Commercial Activities

Valid	Frequency	Percentage
1. Company agent	85	94.4
2. Small dealer	5	5.6
Total	90	100

94.4% was company agent and 5.6% was small dealer.

Table (4-c-36)

Information on Eggs Quality

Valid	Frequency	Percentage
1. Yes	68	75.6
2. No	22	24.4
Total	90	100.0

Table (4-c-37) Correlations between Price of Sale and Price of Purchase

	Person of Correlation	Sig.(p.value)
Price of sale		
Price of purchase	0.830**	0.000

TT * = $p < 0.05$, ** = $P < 0.01$, NS = Not significant

There e was high correlation between price of sale and price of purchase.

Table (4-c-38) Correlations between Price of Sale and Experience Period

Price of sale Experience period		Person of Correlation	Sig.(p.value).
		0.152**	0.154

* = $p < 0.05$, ** = $P < 0.01$, NS = Not significant

There was no correlation between price of sale and experience period

Table (4-c-39) Correlations between Quantity of Daily sales (tray and experience period

Quality of daily sale per (tray) Experience period		Person of Correlation	Sig.(p.value)
		0.042	0.694

* = $p < 0.05$, ** = $P < 0.01$, NS = Not significant

There was no correlation between quantity of daily sales and experience period .

4-dTable Egg Consumer Attitudes

4-dPersonal Characteristics

Table (4-d-1)

Consumer Age

Age	Frequency	percentage
20-31years	40	26,7
30-40 years	49	32.8
41-50	42	2.8
More than 50	19	12.7
Total	150	100

Most respondents were between 20-40 years at 59.5% .

Table (4-d-2)Consumer sex ...

<i>Sex</i>	<i>frequency</i>	<i>percentage</i>
male	92	61.4
female	58	38.6
Total	150	100

Male ranked high rate at 61.4 %

2/ Egg Quality Attributes

Table (4-d-3)Source of Table Eggs;

Source	Frequency	Percentage
Groceries	91	66.7
Central market	31	20.7
Farms	28	18.7
Total	150	100

Mostly Groceries at 66.7% level.

Table (4-d-4)Preferred Edible Size

Preferred size	Frequency	percentage
medium	48	72.33
small	45	32
large	41	10.66
No preference	16	10.66
Total	150	100

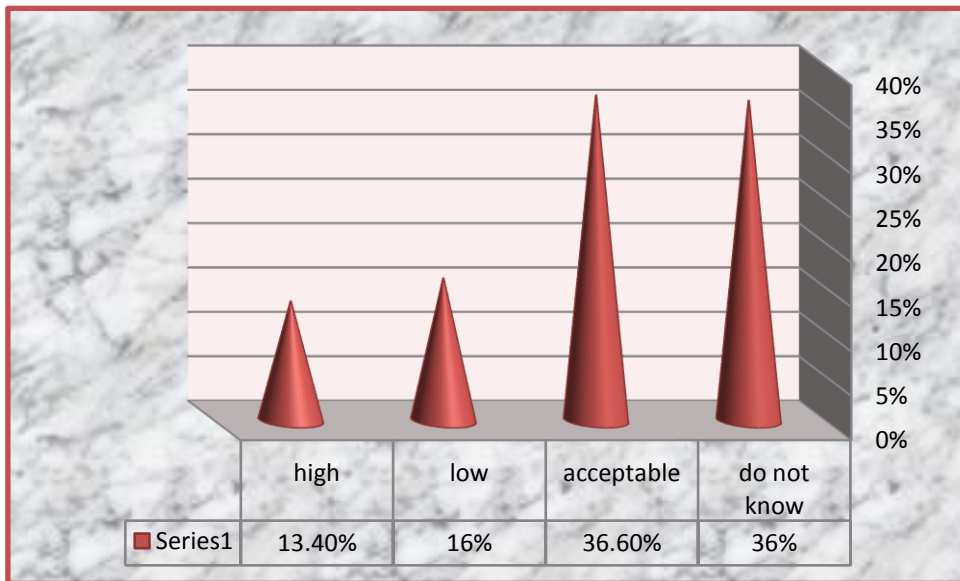
No marked difference for egg size preference.

Table (4-d-5) Preferred Yolk Color;

Color	Frequency	Percentage
yellow	66	44
Deep yellow	42	28
Faint yellow	36	24
Yellow white	6	4
Total	150	100

Mostly the yellow at 45% followed by deep yellow at 28% level.

Fig (4-1) Egg Quality of Displayed eggs



The majority of 36% not know and 34.7% stated acceptable.

Table (4-d-6) Egg Cooking Preference

Preference	Frequency	Percentage
Boiled	98	65.33
In pan	52	34.66
Total	150	100

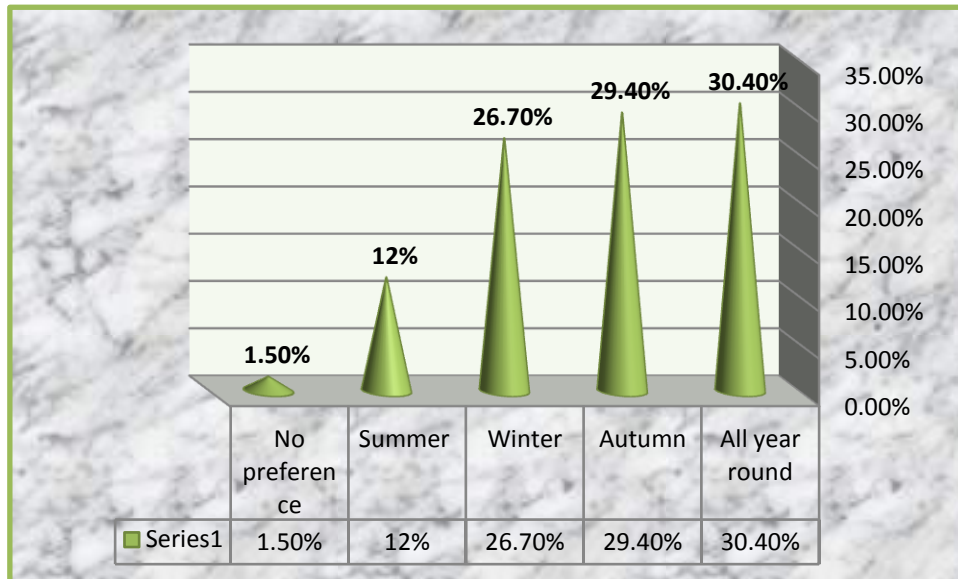
The majority of 65.3% preferred boiled eggs

Table (4-d-7)Egg Meal Preference;

Preference	Frequency	Percentage
Breakfast	57	38
Lunch	34	22.6
All meal	37	24.6
supper	22	14.6
Total	150	100

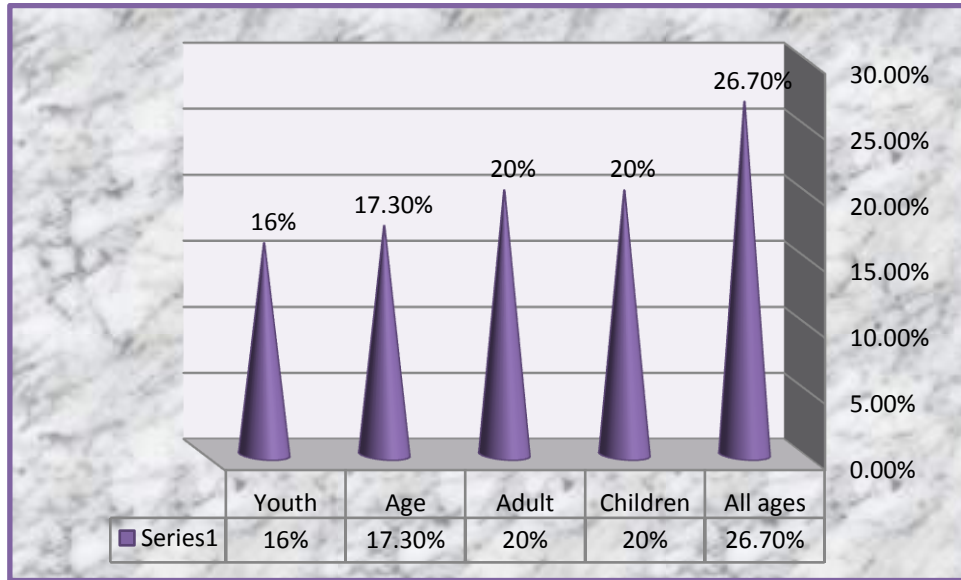
Most respondents preferred breakfast meal .

Fig (4-2) Egg Preference BySeason



Mostly all the year-round at 30% and with cool month at 26.29%.

Fig (4-3) Consumption Preference By Age



All ages preferred egg consumption

Table (4-d-8) Investment in Table Egg Marketing

Item	Frequency	Percentage
profitable	98	65.4
Acceptable	34	22.6
Do not know	18	12
Total	150	100

For investment in table egg marketing 65.4%

Chapter Five

5-Discussion

CHAPTER FIVE

5 - Discussion

5-1 Open Medium Size Farms:

Considering farmers personal characteristics and production system, the study results showed that secondary and university levels were 36.36% and 45.45% indicating high educational level of farm owners. One reason could be more student producers went to the business and the increasing small financed producers.

This is supported by that 63.3% of the producers starting date was 1 -5 years of going into the business and that 86% of the farmers stated private ownership. A majorly of 68.9% used simple open housing system capital investment being the limiting factor and for the same reason most of the farm areas were about 10 feddans and most of which only $\frac{1}{4}$ at 45.45% and $\frac{1}{2}$ at 27.2% levels were in operation use. A total of 86.37% raised only poultry. Farm labour ranged between less than 10 to 30 indicating dependence on hand labour rather than modern equipment as only 18.19% used battery system.

Egg storage mostly used at 50% level was in the pen which necessitates quick disposal and marketing or possible quality deterioration.

Equal level of 31.81% followed feeding system according to production or according to age while 19.18% according hybrid – breed type directions and all are accepted systems. For feed source 50% was farm

produced which poses possibility of imbalance, deficiency or improper mixing and most farmers' 50% indicated high feed cost.

Most farms at 86.34% produced about 30 egg trays per day which is economically small. For feed additives a total of 50% added vitamins, 18.18% antibiotics and 9.09% named hormones which indicates possible health hazard irrespective of the small percentage. Also 54.82% sell egg within 2 – 7 days of antibiotic addition which is less than the safe period of 10 days or more.

For the water source 31.81% resorted to wells which necessitates frequent quality and safety tests which in practice most farmers do not go for.

On the biosecurity side 90.9% have veterinary supervision and 100% resorted to diagnostic laboratories. For mortality disposal 45.45% by burning 36.36% by burning and 4.55% by throwing away from the unit. The last two systems present potential health and disease hazard and possibly epidemics again irrespective of the small percent. For manure disposal 13.84% only by burying again a potential disease hazard. The study noted that farmers in different percentages used different prophylactic measure programs.

For type of records, administrative records at 72.27% followed in order by health records but no farmers were for all records which makes policy making and business analysis difficult. For insurance coverage

68.15% covered all the production project and 18.19% the labour force only. For project feasibility study personal experience topped at 68.18% which is questionable.

For building capacities 46% cooperated with research institutions by providing research space at 59% or by financial support or services in kind. For updating and follow up neighboring companies came on top at 45.45% and from scientific magazines, books and audio visual aids as well.

Holt et al., (2011) stated that many factors act and interact to affect egg quality. This statement can be supported by some studies including seasonal and chicken maturity egg effect. Jones et al., 1961, chicken genotype and season Islam et al., 2001 breed and strain Lu et al. , 2007 age and season Ojedupo, 2013, housing and age Dikmenetal .,2017 as examples and in this study housing and season as factors that affect egg quality.

On the effect of housing the overall result of this study showed significant effect on egg weight and yolk colour at ($P < 0.01$) but all the numerical figures for the closed system were better than the open for all parameters studied . Possible explanation could be attributed to better bioclimatic control that meets the bird biological needs and by better energy utilization. Results agree with Janabi and Jobori (1989) in open

houses and with Jones et al., (1961) who found better egg weight for closed than open houses for all months studied.

On the effect of season on egg quality many workers stated that best egg quality was obtained in the cool months of spring and winter (Lorenz and Almquist(1936), Izat et al ., (1958), Islametal,. 2001). In this study the best quality parameters were obtained in wet summer which agrees with the finding of Ojeduipo(2013) in Nigeria.Thisfinding indicates temperature humidity effect an area that needs more in depth study.Shell thickness yolk index and HU showed the lowest numerical values in the dry summer which agrees with(Izat et al .1958, Jones et al , (1961), Islam etal.,(2001), Ojedupo, (2013).This indicates temperature effect as was noted by Usayra et al., (2004), Smith , (2005) and Rozenboin et al.,(2007).

Season effect showed high significance for egg weight, shape, shell thickness, HU at ($P < 0.01$), yolkcolour at ($p < 0.05$) and no significance for yolk index. Wet summer showed the best numerical values for all parameters studied.

Housing system X season interaction showed high significance for egg weight ($P < 0.01$) andshell thickness at ($P < 0.05$) supporting the move to closed housing system for the open.

Comparing the numerical data with other findings and standards the study findings showed that the average egg weight for all months and

seasons was 57.75g which is placed a medium size and was 51.29g for the open system which lies in the small size according to the following references. FAO (Food and Agriculture Organization, 2003) stated that in African countries 65+ g is considered large size 55-65 g as medium and 45 -55 g as small. SSMO (Sudan Standardization Metrological Organization, 2001) puts 60-64 g as large 55 – 59 g a medium, 50-54 g as under average and 40 g as small size. This same reference puts HU at 72 units for high quality eggs and for first class fresh egg at 60-71 units. Bertechini (2013) puts acceptable HU at more than 75.

In the study HU ranged between 71 – 76 units for open system and 72-79 for the closed. For egg shape the figure ranged between 74-75 for the closed and 74-76% for the open system with no significant difference. Most references stated that 74 % is the acceptable number for the proper oval egg shape (Kamel 2005). The same reference puts yolk index at 0.42-0.49 and shell thickness at 0.31 mm.

In this study yolk index ranged between 0.31-0.32 mm for the open system and 0.31 – 0.35 for the closed indicating possible storage and time-duration - effect in the groceries studied. Shell thickness was better in the closed than the open system. yolk colour using (Colour Fan DSM divided into 1-15 degrees) was found at the range of 5.2- 6.6 for the open house and 5.2 – 7.1 for the closed system indicating pale yellow colour for both systems though better for the closed system . This could be attributed to deficiency of yolk colour pigments as nutritional problem

in both housing systems and seasons. Colour preference varies with individual customers and various countries; Gerber (20012) puts it at 13 degree in newZeland.

The study concludes that both housing system and season have direct effect on egg quality. The study recommends more drive to the closed system for better egg quality specially egg size. As at present more than 80 % of table eggs marketed in the Sudan come from the open housing system. This is in addition to that the international trend is marketing eggs by quality and not just by numbers as is practiced now in the Sudan which strengthens the move to better egg quality production .

5-2 Central Markets:

Data on central markets information included personal characteristics and commercial activities. The main findings were for age groups in the business 20 – 30 years at 43% for education secondary level at 51.1%, for site ownership renting at 51.6% , 35 % sharing for commercial activity 40% company agents, 23.4% distribution agents 20% small dealers and quantity dealers and middle men at 13.3% each. For financing source personal was at 66.7 % joint and bank loan were at 16.7 % each .Table egg purchase source was companies at 48.3%

Egg size ranked first followed by price which are generally and globally the accepted bases for egg selection.

For the transportation system refrigerated and chilled vehicles were at 71, 7 % and open car at 16.7% - risk of damage and cracks.

Open veranda ranked first for display method which might expose eggs to damage and deterioration especially those transported by open cars.

Prices were high at 83.3% for both summer and winter but for Autumn the figure was 61.3% and acceptable at 33.3 % without offering any convincing reason but probably for more supply and demand in winter and less supply in summer.

For reasons of going into the business 66.7% of the respondents answered for no other job; and for the business feasibility and profitability 83.3% answered that egg production business is profitable.

5-3 Groceries:

The sale display methods in the groceries was 33.3 % in open veranda, 24.4% Food Shops 21% refrigerators, 13.3 ground and 7.8 % glass surfaces. Here again open veranda makes the bulk as in central markets which predisposes eggs to unsuitable environmental conditions and fast deterioration.

For the price assessment supply and demand topped at 33.3% and price competition came last at 15.6% of the respondents on price assessment.

For purchase preference base external appearance ranked first at 23.3% while egg cleaning last at 2.2% which indicates hygienic hazard for both the egg product and human health and indicates absence of the

responsible authorities specially SSMO (Sudan Standardization Metrological Organization) and health inspection.

This rating differs from Forbis (2002) who stated that the consumer preference factors in order are yolk colour, shell cleanliness, albumen quality and egg weight in addition to shell thickness and yolk size, colour being not important.

Preference comes within the range of external quality factors as defined by Coutts et al. (2006) as texture, colour, smoothness, cleanliness and shell shape.

The preferred colour was white at 73.6% level and brown at 21.1%. Preferred purchase method was by dozen at 41.1% followed by tray (30 eggs) at 36.7%. The sale method was at 62.2 % for by dozen and 14.4% for by tray. This indicates limited purchased amounts.

The two main purchase sources were the poultry farms and poultry companies in almost close percent ratios.

Analysis of variance (ANOVA) between source of purchase and price of purchase showed no significance (value (0.099) and (0.0797) for source of purchase and price of purchase and also (NS P (0.363) between source of purchase and price of sale. Purchase source showed no statistical significant effect on table egg marketing through the marketing channel flow.

For site ownership renting ranked first at 45.6 and government assignment least 13.3%. ANOVA between site ownership and quantity

of daily sales was (NS) $P \leq (0.466)$ but was significant $P (0.021)$ between site ownership and price of purchase as shown on the study.

Analysis of variance between site ownership and price of sale showed significance $P (0.006)$ at 0.01 level between site ownership and price of sale.

Site ownership significantly affected both price of purchase and price of sale of table eggs in the groceries.

For egg transportation to groceries by company cars was at 31%, open cars 24.4% chilled vehicles at 20%. Open cars are hazzard for up - keep of egg quality and for possible damage. FAO (Food and Agriculture Organization 2003) stated that producers, wholesalers and retailers must move eggs to consumers fast to avoid delays in all distribution channels as a primary consideration determining marketing arrangement.

For the role of (SSMO) for egg quality control and table egg marketing 74.4% indicated no role other than publications and some training at 15.6%.

Manahil (2011) in a Survey in Khartoum State found that quality requirements provided by (SSMO) standards for table eggs varied a lot among Khartoum Localities especially for eggs stored at different temperatures. This study confirms these finding as 27.8% of the grocery

owners stated that they have no information on (SSMO) which indicates leakage in contact and information delivery.

For type of commercial activity 94.4% were company agents and 5.6% small dealers. For the interest in continuity in the job 54.4% answered positively and 45.6% negatively which necessitates more in depth study for encouragement of others to go into the business.

Site ownership showed statistically significant effect on both purchase and sale of table eggs in the groceries.

There was no significant difference between Financing source and daily sales by tray was (NS $P \geq (0.699)$) also NS for purchase price ($P \leq 0.342$) and for sale price ($P \geq 0.205$).

Storing period was 2 days for 23.3% for 7 days 23.8% and for 4 days 17.8%; the majority of respondent grocery owners stored for 2 – 7 days. Storage, mainly in open verandas under unsuitable environmental conditions which might speed up quality deterioration unless fast marked.

Samli (2005) reported that eggs should be stored under 15 °C and 80% relative humidity. Jocobbot et al, (2003) noted that fresh eggs are laid with best quality but storage conditions affect quality negatively specially temperature, humidity, air movement and prolonged storage period as is predicted here in Khartoum State AbdElwahid (2002,

Halajet al, 2000, Scott and Silverside 2000) stated that storage time and dirt have negative effect on egg quality characteristics.

Absobayel and Albadry (2010) in Riyadh area in Saudi Arabia found that storage period had a significant ($P \leq 0.05$) adverse effect upon Haugh unit (HU) values, specific gravity, and air cell depth and shell thickness storing in veranda strengthens these negative effects in the central market and groceries.

On information on egg quality 24.4% stated lack of information and knowledge.

Correlation between price of sale and experience period indicated high significance ($p < 0.000$) but between daily sales and experience period P value was (0.694) NS.

5-4 Consumers:

For consumer age all ages answered positively for egg consumption more so for 20 -50 years and less so for elderly people. Sex-wise male consumers were at 61.4 % and females 31.6% indictating sex difference in consumption.

For the preferred edible size a majority of 72.3% preferred the medium size but not sticking to numerical weight values as stated by (SSMO) or any other authority as was also found by Manahil (2011). The preferred Yolk colour was yellow for 44% deep yellow 25% and 24% faint

yellow. For egg quality of displayed eggs 13.4 % stated high, 16% low 36.6 acceptable and 36% do not know.

For cooking preference 65.3% preferred boiled and 34.7 in pan cooked.

For egg preference by season 29.4% for autumn 26% winter , 12% for summer and 30.4% for all the years round.

Patil et al, (2005) and Bejaei et al, (2011) noted that consumer, preferences and perceptions varied, the main factor being lack of information of the importance of egg as a source for human diet and health and perception of the nutritional value influences consumer egg selection. Consumer's belief is important as many consider that free range, free run and organic eggs are of higher nutritional value and that brown eggs are of higher nutritional value than white eggs. In Sudan consumers prefer white eggs to brown eggs, mainly colour preference than for any other reason.

Atsobayel and Albadry (2010) stated white shelled eggs had significantly higher weight surface area, lower shape index and blood spots than the brown. Aida (2011) stated that the main objective of the marketing functions is a transfer of the product to the consumer within certain grades specifications and standards different from one community and the other according to regulations and legislations. This study showed lack of sticking to or application of any regulations or legislation.

Moula et al, (2013) assessing quality of marked eggs in Algeria according to the marketing chain found that egg weight differed significantly between marketing chains.

Shell strength was similar for the chain and damaged eggs were higher in public markets, intermediate in food shops and lower in supermarkets, Yolk albumen ratio was significantly higher for supermarkets, intermediate in food shops and lower in public markets. Generally egg quality differed significantly in the marketing chain but was of higher quality in supermarkets. This agrees with the finding of this study as most customers buy table eggs from groceries and super markets.

Bell et al, (2001) in the United States of America found significant age, (HU) weights and cracks between the States.

Brown and white, eggs differed relative to age but (HU), egg weight, shell weight and cracks were all statistically the same in all states studied.

Omer et al, (2013) in Bangladesh found different marketing margins between egg marketing chain and seasonal variation due differences in supply and demand. This also agrees with the finding of this study.

The African Development Bank and the United Nations (2015) stated that a market system is composed of interconnected value chains that have common producers, materials and / or inputs (2) inter- connected systems that include the market and other systems such as the

environment (Linkages to climate changes) health (Linkage to nutrition, the public sector) (Linkage to the business enabling environment) and (3) households and communities which are also systems that connect to markets as producers concluded that supermarkets showed better results than central markets which agrees with some studies in other countries and this study.

Egg handling, transportation, display and presentation and storage systems in the marketing chain present potential hazard to egg quality up - keep and protection from damage.

Consumer perception and attitude indicated lack of information and limited or no knowledge on egg quality and nutritional value and depended on personal judgment rather than accepted recognized standards or to legislations to be applied.

Ruxton et al, (2010) stressed that more research on food value of eggs is needed as a greater stimulus to consumption. This note is the main recommendation of this study. This is in addition to more elaborate diffusion of information on egg quality standards specialty by SSMO and the related institutions and extension departments related to.

For the effect of marketing activities in the marketing chain on egg cracks and methods of disposal of cracked eggs the main study findings were:

Egg storage in the farm units was in the pens which marks the first point of possible egg breakage. This in addition to floor eggs (by observation) which agrees with Gupta (2008) and with Hinke (2000) who stated that egg breakage or cracks remain to be a problem inspite of improvement in nutrition, environment and genetic factors.

Packing starting from the farm and all through the marketing chain flow (agree with Meretens et. al. , (2006).

Marketing activities as egg display methods in Varendra and ground and selling by dozen to most grocery consumers and transport in open cars on rough roads and long distances add-up to egg breakage. Some 18.9% of grocery owners stated high breakage numbers – sizeable economic loss as was stated by Gupta (2008), Meretenset. al.,(2006) and Bell (2007).

For ways of disposal of cracked eggs 32.2% by away from the farm and 13.3% by garbage cars (45.5%) which poses a sizeable environmental and disease transmission hazard for both the industry and humans.

The study show no relationship or correlation with the methods of disposal of cracked eggs and the respondents educational level and for with SSMO information publications.

Inspite of all the above most of the respondents states that they encourage other to come into the business.

Chapter SIX

6- Conclusions and Recommendations

Chapter Six

6 - Conclusions and Recommendations

- A study was conducted on egg handling, transportation, display and presentation and storage systems in the marketing chain that present potential hazard to egg quality up - keep and protection from damage.
- Consumer perception and attitude indicated lack of information and limited or no knowledge on egg quality and nutritional value and depended on personal judgment rather than accepted recognized standards on to legislations to be applied.
- The study showed that many factors are involved, act and interact in the marketing chain flow including marketing activities, knowledge on quality and merchandising.
- The main findings were price assessment by supply and demand and not quality. Purchase depended mainly on external appearance consumers buy by dozen, source of purchase almost equal between companies and farm units, long storing period, harsh transport on rough roads, display in verandas and ground most of which predispose eggs to damages and or breakage.
- Rate of eggs breakage was considerable and the main disposal method was away-from the farm and by garbage cars. The study indicated no relationship or correlation between the disposal method and either the educational level or SSMO type of information.

- The study noted absence of extension programs or any guiding or controlling regulation on cracked egg disposal from any official body or institution.
- The study also concludes that both housing system and season have direct effect on egg quality. The study recommends more drive to the closed system for better egg quality specially egg size as at present more than 80 % of table eggs marketed in the Sudan come from open housing farming system. This is in addition to that the international trend is marketing eggs by quality and not just by numbers as is practiced now in the Sudan which strengthens the move to better egg quality production .
- The study concludes that many factors act and interact on the marketing channel flow of table egg quality, product sustainability and egg cracks. The study then stresses on the importance of the institution and official presence in guiding and controlling table egg marketing in Khartoum state.

Recommendations:

- More in depth studies are needed specially on economics.
- Formation of egg marketing board or organization is a necessity.
- More involvement of the government institutions in the marketing chain.
- Egg surface bacterial test for pollution is needed.
- More economic analysis studies.

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Appendices

Equipments and tools used in the study

External quality:



Picture (1)

Shape index measured by verniar



Picture (2)

Egg Shell Thickness Measured byMicrometer

Internal Quality:



Picture (3)

Albumen height Measured by slide ruler



Picture (4)

Yolk index measured by verniar



Picture (5)

Yolk colour measured by colour fan