

**NATIONAL FOOD AND NUTRITION
COMMISSION**

Report

on

NUTRITION OPERATIONS

January- October 1998

November, 1998

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1.0 INTRODUCTION

This report outlines the activities undertaken by the National Food and Nutrition Commission (NFNC) during the period 1 January to 30 October 1998. It describes the NFNC, its operational set up, perceived vision and mission statement and overall objective, functional arrangement and staff establishment.

This is followed by the progress report based on existing administration arrangement, staff strength, and programme activities based on 1998 Action Plan. It gives a summary of the 1998 Action Plan and its implementation progress; and the unplanned but relevant activities undertaken by the NFNC.

The SWOT analysis of the 1998 operations based on NFNC professional staff's perception has been included from which the strategic planning of the 1999 Action Plan will be based.

1.1 *The National Food and Nutrition Commission*

The National Food and Nutrition Commission (NFNC) of Zambia is a statutory body established by the Government through an Act of Parliament, Act No. 41 of 1967 under the Ministry of Health. It is a promotional and advising organ to the Government with a coordinative role, on matters concerning food and nutrition.

1.1.1 *Organisational Set-up*

The National Food and Nutrition Commission falls under the Ministry of Health (MoH) for administrative and operational purposes. With the inception of the Central Board of Health (CBoH), the executing arm of the MoH, the lines of relationship between the NFNC and CBoH have not been very clear. However, the ideal relationship should be that of collaborative partnership, in the same way NFNC relates with other sector ministries and organisations.

The NFNC (Commission) is composed of the Board comprising of five members including the Chairman, and the office headed by the Executive Director who is supported by Heads of Units, professional and administrative staff.

1.1.2 *Funding*

The NFNC is funded by the Government through monthly grants, released by the MoH. As a Statutory body, it is also free to receive funding from other sources.

1.1.3 Operational Set-up

The NFNC functions through seven (7) Units namely:-

- Public Health and Community Nutrition Unit
- Training and Collaboration Unit
- Research and Planning Unit
- Nutrition Education and Communication Unit
- Food Management Unit
- Administration Unit
- Accounts and Finance Unit.

Each Unit is headed by a head of Unit who reports to the Executive Director.

1.2 The Vision:

The vision of NFNC is “ to achieve optimal nutrition status for the Zambian population”. The MISSION STATEMENT is therefore “ to coordinate , guide, oversee, and regulate all national food and nutrition activities and monitor the policy implementation”.

1.3 Overall Objective

To promote support and facilitate the improvement of the food security and nutritional status of the population of Zambia through sector ministries of health, agriculture, education, community development and Social Services and other Government and non-Governmental, public and private organisations having a bearing on food and nutrition; and through programmes, projects and activities pertaining to food and nutrition.

1.4 Functions Of The Commission

The main functions of the Commission are:

- 1.To facilitate formulation and periodic review of the National Food and Nutrition Policy.
- 2.Advise relevant agencies of Government and other organisations on Food and Nutrition Policy implementation.
3. Monitor and evaluate implementation of Food and Nutrition Policy.
4. Promote, support, facilitate and coordinate implementation of programmes and activities aimed at contributing to the improvement of the food security and nutrition status of the population of Zambia.
5. Establish and maintain a National Food and Nutrition information system and data bank.

6. Mobilize and orient resources according to Government's laid down procedures, for implementation of the food and nutrition programmes.

Note: Since the inception of NFNC in 1967, there has never been a food and nutrition policy, therefore function 2 and 3 have been programme related and not policy related. Function 1 only commenced in 1998.

These functions are carried out through its operational units whose staff establishment is as follows:

1.4.1. The Public and Community Nutrition Unit (PHCNU)

a) Establishment

<i>Chief Nutritionist -Head of Unit</i>	<i>1</i>
<i>Principal Nutritionist</i>	<i>1</i>
<i>Senior Nutritionist</i>	<i>1</i>
<i>Nutritionists</i>	<i>2</i>
<i>Public Health Nurse</i>	<i>1</i>
Sub-total staff establishment	6

b) Functions:

PHCNU main functions are to facilitate coordinate, and support implementation of food and nutrition programmes including:-

- 1. Micronutrient (Iron, Vitamin A, and Iodine) Deficiency Control Programmes.*
- 2. Breastfeeding programme*
- 3. Growth Monitoring and Promotion Programme for Children Under five years.*
- 4. Nutrition in schools programme*
- 5. Household food security and dietary diversification.*
- 6. Supplementary feeding programme.*

1.4.2.. Training and Collaboration Unit

a) Establishment

<i>Chief Nutritionist-Head of Unit</i>	<i>1</i>
<i>Principal Nutritionist</i>	<i>1</i>
<i>Senior Nutritionist (Training)</i>	<i>1</i>
<i>Nutritionist</i>	<i>2</i>
<i>Coordinator of Nutrition Groups</i>	<i>1</i>
Sub-total staff establishment	6

b) Functions:

1. To carry out training needs assessment for various nutrition and nutrition-related service providers
2. To develop nutrition training programmes and modules in line with assessed training needs.
3. Facilitate inclusion and improvement of nutrition concerns in the curricula of schools and training institutions.
4. Conduct update workshop focussing on food and nutrition issues and participate (contribute) in other relevant trains.
5. Monitor and evaluate performance of food and nutrition service providers.

1.4.3. Nutrition Education And Communication Unit

a) establishment

- Chief Communications Officer - Head of Unit	1
- Principal Nutritionist	1
- Senior Nutritionist	1
- Materials Designer	1
- Media Officer	1
- Librarian	1
- Nutritionist	2
- Library Assistants	2
Sub-total staff establishment	10

b) Functions:

The main function is to promote food and nutrition concerns for the improvement of food security and nutritional status of the Zambian Community through various publicity messages and channelled through electronic and print media. Major activities include:-

1. Development and execution of IEC strategy
2. Production of information, education and communication (IEC) materials.
3. Advocacy for food and nutrition programmes, projects and activities.

1.4.4. Research, Planning, Monitoring And Evaluation Unit (RPU)

a) Establishment:

- Chief Research and planning Officer-Head of Unit	1
- Principal Nutritionist	1
- Agricultural Economist	1

- Sociologist	1
- Statistician/computer programmer	1
- Nutritionist	1

Sub-total staff establishment 6

b) Functions:

1. To facilitate development of Nutrition Policies and strategies
2. To facilitate and conduct operational and formative research
3. Monitoring and Evaluation of food and nutrition programmes projects and activities as they relate to food and nutrition policy and strategies.
4. Mobilize and provide technical assistance for food and nutrition research
5. Provide consultancy and technical backstopping
6. Establish and maintain a food and nutrition related resource centre and data bank.

1.4.5. Administration Unit

a) Establishment

- Administrative managers -Head of Unit	1
- Administrative Officer	1
- Personal Secretaries	2
- Secretarial staff	3
- Transport Officer	1
- Mechanic	1
- Drivers	6
- Registry Clerk	2
- Front line Clerk	1
- Day Security Guards	2

Sub-total Staff establishment 20

b) Functions:

1. To manage the Commission transport fleet and vehicle allocations for official assignments.
2. To manage an efficient Communication system internally and externally for the NFNC's efficient operations
3. To manage the secretarial services of the commission
4. To maintain the Commission's estates
5. Personnel administration and management
6. Manage staff welfare.

1.4.6. Accounting And Finance Unit

a) Establishment

- Accountant	1
- Assistant Accountant	1
- Accounts Assistant	2
- Purchasing Officer	1
- Store Clerk	1
Sub-total staff establishment	6

b) Functions:

- 1. Preparation of annual budget estimates for submission to Ministry of Health through which Government grants are received*
- 2. Preparation and maintenance of monthly operating budgets and expenditure to facilitate proper use of funds.*
- 3. Maintain, periodic cash flows*
- 4. To establish, manage and maintain records of all accounting transactions*
- 5 Preparation of periodic financial reports for management, the Board of Directors.*
- 6 Preparation of annual accounts for submission to public accounts for audit.*

Total Staff establishment of NFNC = 56 (FMU exclusive)

ANIMAL PRODUCTION AND HEALTH SUB-PROGRAMME
P.O. BOX 50060
LUSAKA
ZAMBIA

1.0 ROLE OF EACH DEPARTMENT

(a) FIELD SERVICES:

Is responsible for crops extension, land husbandry, irrigation, Crops phyto-sanitary, and advisory function

(b) RESEARCH AND SPECIALIST SERVICES:

Is responsible for disease control, Animal production extension, vector control, livestock research, fisheries research & extension, crops research, phyto-sanitary and advisory function.

(c) POLICY AND MARKETING:

Is responsible for agricultural planning, Agricultural cooperatives & marketing, and coordination role in the Ministry.

(d) HUMAN RESOURCE DEVELOPMENT:

Is responsible for coordinating Training in the Ministry and administrative role in the Ministry.

(3.0) COUNTER MEASURES FOR FOOD POISONING:

FOOD PRODUCTION STAGE: For both crops and animals, farmers are Encouraged to use registered chemicals and observe the residual effect of these Chemicals.

FOOD PROCESSING: Meat inspection is conducted in the abattoirs, processing Plants are regularly inspected and expiry dates are indicated on the label.

FOOD DISTRIBUTION: Food packaging is monitored, re Fridgeration of Perishable products is encouraged.

(3.0) LABORATORY EXAMINATION

University Teaching Hospital has a laboratory which can be used for testing The food. Mount Makulu has a laboratory which can also be used for testing Food.

(4) QUARANTINE: Government officers will be put on all boarder posts to check the in coming products. Permits are issued before products land in Zambia. Products without permits are destroyed. Quarantine stations are available but will quire rehabilitation. All in coming livestock are quarantined before proceeding to the destine.

(5) FOOD SAFETY CONTROL:

This exists under Ministry of Health

(6) FUTURE PLANS: The department is setting up an inspectorate which will be responsible, among other things, food safety.

(7) EATING HABITS.

MEAT : Produced under intensive (feed lot), semi-intensive and extensive systems. Beef animals are slaughtered in the registered abattoirs. Carcasses are sold to butchers on whole sale prices.

Before carcasses are sold, they are inspected and graded and certified fit for human consumption. Those found unfit for consumption are disposed by burning.

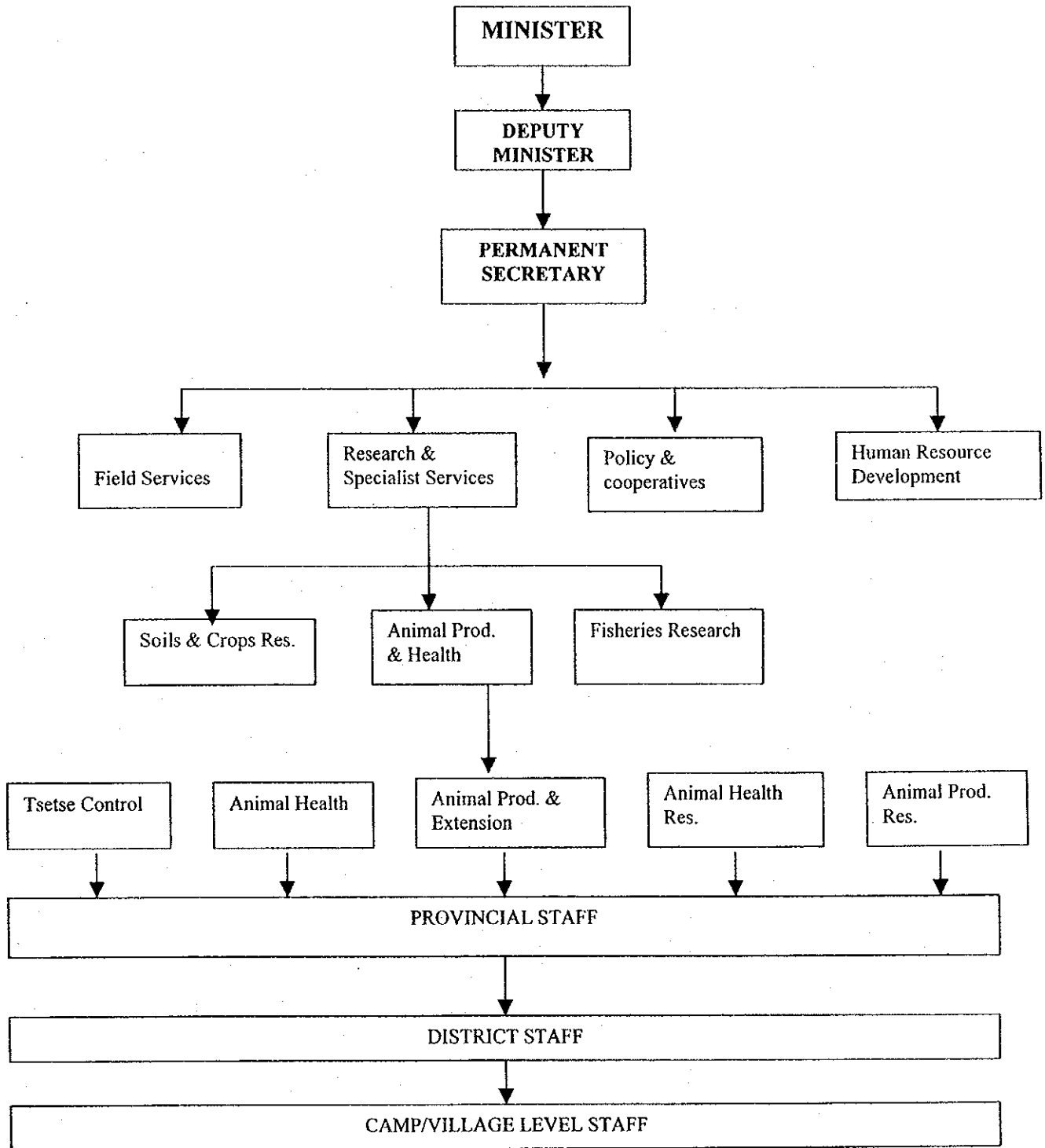
MILK: Produced by commercial and small scale farmers. Milk is tested after purchasing and milk which is unfit for processing is discarded. Milk is processed before consumption and expiry dates are indicated. Dairy animals are vaccinated against zoonotic diseases.

FERMENTED MILK PRODUCTS: Such as sour/lacto and yorghurt are processed before consumption.

The following legislation exist for food safety and quality control: pharmacy and poisons Act, Dairy Act, Cold Storage Board Act, Animal health Act.

(8.0) FISHERY PRODUCTS: These include fish fillet, smoked, salted and sun dried.

2.0 ORGANISATION CHART. MAFF (Fig. 1)





THE UNIVERSITY OF ZAMBIA

**SCHOOL OF AGRICULTURAL SCIENCE
DEPARTMENT OF FOOD SCIENCE AND TECHNOLOGY**

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**JICA QUESTIONNAIRE ON THE TRAINING OF FOOD SAFETY
CONTROL SYSTEMS IN SUB-SAHARAN AFRICAN COUNTRIES.**

1. ORGANISATION CHART

See attachment for organizational charts (administrative and academic)

The major roles of each department and division in the school of Agricultural Sciences are to teach, research and provide public service.

2.0 DEPARTMENT OF FOOD SCIENCE & TECHNOLOGY

VISION

To improve and increase the human productivity and sustainability resource capacity for the food processing industries in Zambia.

MISSION:

- To produce adequate number of highly qualified and skilled manpower in a multisectoral modern Food Science and Technology industry.
- To provide multisectoral professional guidance and advisory service through research, consultancy and public service concerning food in general.
- To facilitate collaboration between the Department of Food Science and Technology and the Institutions involved in Food in general

2.1 ACADEMIC PROGRAMMES

B.Sc. degree (5 years)
Extension Courses
Specific demanded training
Public Seminars

UNDERGRADUATE SYLLABUS:

List of Courses for Year II -V

Second year FS&T

1.	General Microbiology	AGF211
2.	Computer Sciences	AGF 221
3.	Organic Chemistry	C 251
4.	Organic Chemistry	C 252
5.	Animal Production for Agricultural Engineers	AGA 351
6.	Applied Physical Chemistry	C262
7.	Crop Production for Agricultural Engineers	AGC 342
8.	Fundamentals of Micro-Economics I	AGE 211
9.	Fundamentals of Macro-Economics II	AGE 222
10.	Biochemistry	C 212

Third year FS&T

1.	Statistical Analysis	AGG 311
2.	Chemical Techniques in Food Analysis	AGF 311
3.	Food Chemistry	AGF 331
4.	Engineering drawing I	ME 209
5.	Technical Thermodynamics	AGF 341
6.	Electricity I	EE 209
7.	Methods in Food Analysis I	AGF 332
8.	Food Microbiology	AGF 352
9.	Food Toxicology	AGF 342
10.	Food Evaluation	AGF 362

Fourth year FS&T

1.	Unit Operations in Food Engineering I	AGF 412
2.	Principles of Food Technology I	AGF 421
3.	Fundamentals of Biochemical Engineering	AGF 431
4.	Water and Food Waste Treatment	AGF 441
5.	Applied statistics	AGF 451
6.	Methods in Food Analysis II	AGF 452
7.	Agribusiness	AGE 411
8.	Food Packaging	AGF 442
9.	Nutrition	AGF 422
10.	Process Control and Instrumentation	AGF 432

Fifth year FS&T

1.	Unit Operations in Food Engineering II	AGF 511
2.	Principles of Food Technology II	AGF 521
3.	Technology of Plant Products I	AGF 531
4.	Technology of Plant Products II	AGF 532
5.	Technology of Meat and Fish	AGF 541
6.	Technology of Dairy and Egg Products	AGF 512
7.	Technology of Fermented Foods	AGF 522

8. Plant Design
9. Research Project

AGF 542
AGG 500

2.2 NO STUDENT HAS GRADUATED YET

The first intake of 22 students, is doing third year this academic year (2000/2001)
The second intake of 12 students, is doing second year this academic year (2000/2001)

2.3 ENVISAGED OR TARGETED COMPANIES FOR OUR GRADUATE INCLUDE:

Large and small Food Processing plants, food related research institution, educational institutions, food packaging and distribution companies, food marketing and sales companies.

The students will have adequate skills to work in manufacturing, process/product research, equipment design, product storage and preservation, plant design and scale-up, quality control, regulation and protection of public health, engineering and technical sales.

2.4 THE EDUCATIONAL SYSTEM FOR FOOD SAFETY CONTROL:

At **primary school** students are taught domestic science, hygiene and environmental science.

Community for mother and children; involves the topics and activities outlined below, which are intensified during periods of food borne and waterborne disease outbreaks such as cholera and dysentery. These periods are particularly in the rain season. The topics and activities include:

- Need for boiling water for consumption
- Disinfecting of water for consumption with chlorine
- Need to avoid eating raw foods and, for eating adequately heated or adequately prepared foods
- Need for adequately covering foods meant for storage to avoid contact with contaminated air, water and insects (especially flies)
- Need for getting rid of pests in peoples homes
- Buying from authorized and established retails and butcheries
- Freezing/drying of foods for storage
- Performance of drama activities concerning above mentioned issues by NGOs, district/municipal councils and district Health management teams

The educational system for food safety control in high schools involves the topics outlined below which are covered in science subjects such as biology, human and social biology and home economics. The topics include:

- Existence and modes of contamination of foods with harmful (pathogenic) bacteria
- Existence of toxic inorganic substances in foods
- Parasites found and transmitted to man through foods such as vegetables, meat and fish
- How to prevent and how to get rid of pathogenic bacteria in foods at home preparation level

- The relevance of health (food) inspection divisions of government in community health

2.5 HUMAN RESOURCES IN DEPT OF FST

The department of Food Science & Technology, is a new department, therefore it is still looking for scholarships to enable it to train its local staff in the following areas:

Scholarships Needed for Training of Core Academic Staff of Zambians in Various Fields of Food Science and Technology

LEVEL OF STUDY	FIELD OF STUDY	NUMBER OF SCHOLARSHIPS
Ph.D	Food Chemistry	1
Ph.D	Food Microbiology/Toxicology	1
Ph.D	Food Technology/Engineering	1
Ph.D	Nutrition	1
Ph.D	Applied Statistics	1
TOTAL Ph.D		5
M.Sc	Food Chemistry	1
M.Sc	Food Microbiology	1
M.Sc	Food Toxicology	1
M.Sc	Food Technology/Engineering	2
M.Sc	Nutrition	2
M.Sc	Post-harvest Technology	1
TOTAL M.Sc		8

2.6 FUTURE PLANS ON FOOD SAFETY CONTROL EDUCATION:

Within the department's syllabus (see 2.1 above), there are courses tackling food safety.

As a department we also intend to handle topics related to food safety targeted at small and large food processors in Zambia. Topics will include but not limited to:

- GMPs, SSOPs
- HACCP
- Public research paper presentations on the research conducted by our department related to food safety in areas such as:
 - Safety of milk and milk products in Zambia
 - Safety of vegetable and vegetable products
 - Evaluating the occurrences of microbiological, chemical and physical food safety hazards at every stage in the food chain for particular foods of economical importance in Zambia.

For example: Raw Material ----- Processing-line ----- Distribution----- Marketing (retail/wholesale)-----Consumer (food handling Practices); the department has already started this study on milk and milk products. Work has

commenced on analysis of raw milk from farms destined for milk processing in 'modern plants' of Zambia. Next, will be evaluation of processed milk and milk products on

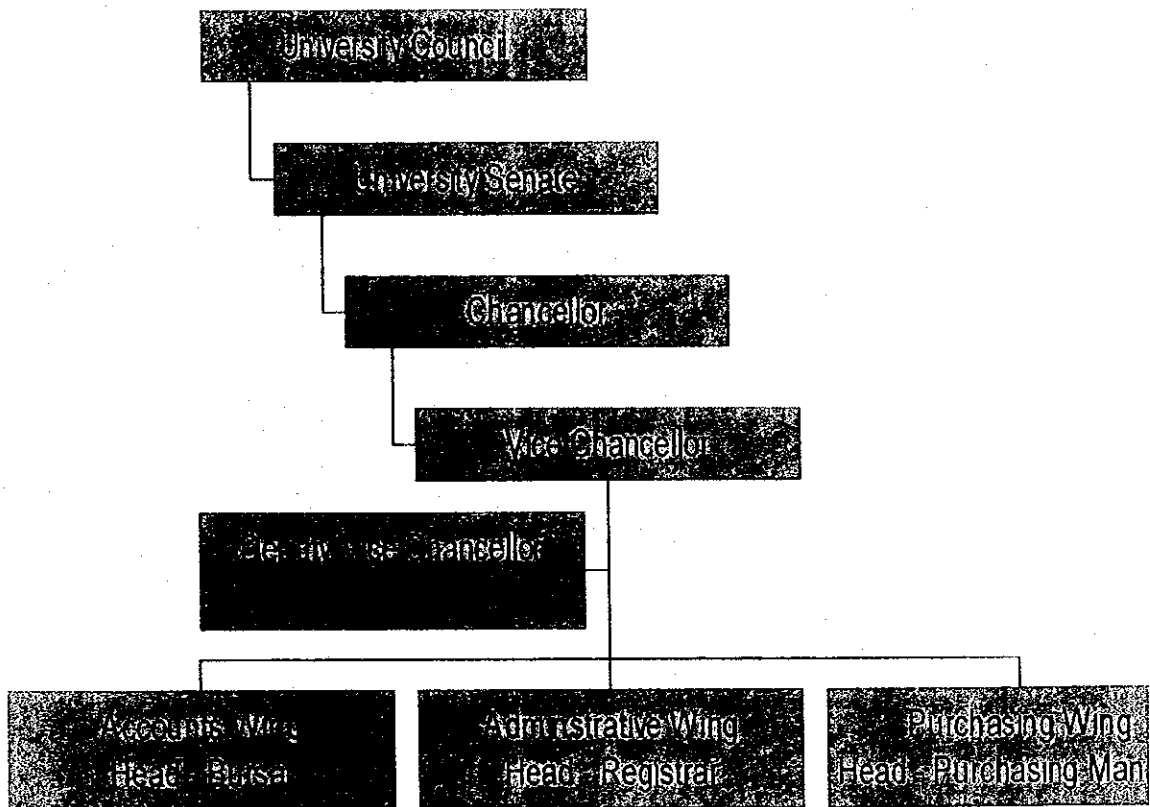
- the process-line
- retail/wholesale outlets
- consumer handling practices of milk and milk products

Department of Food Science and Technology

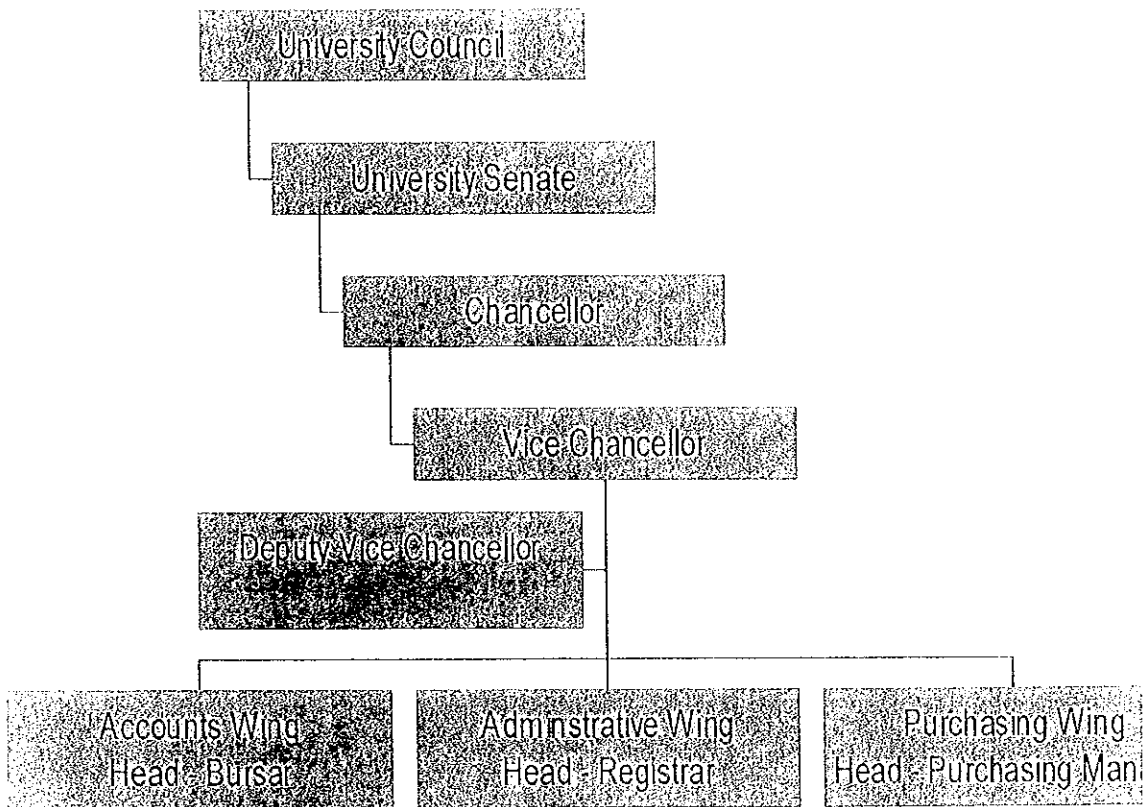
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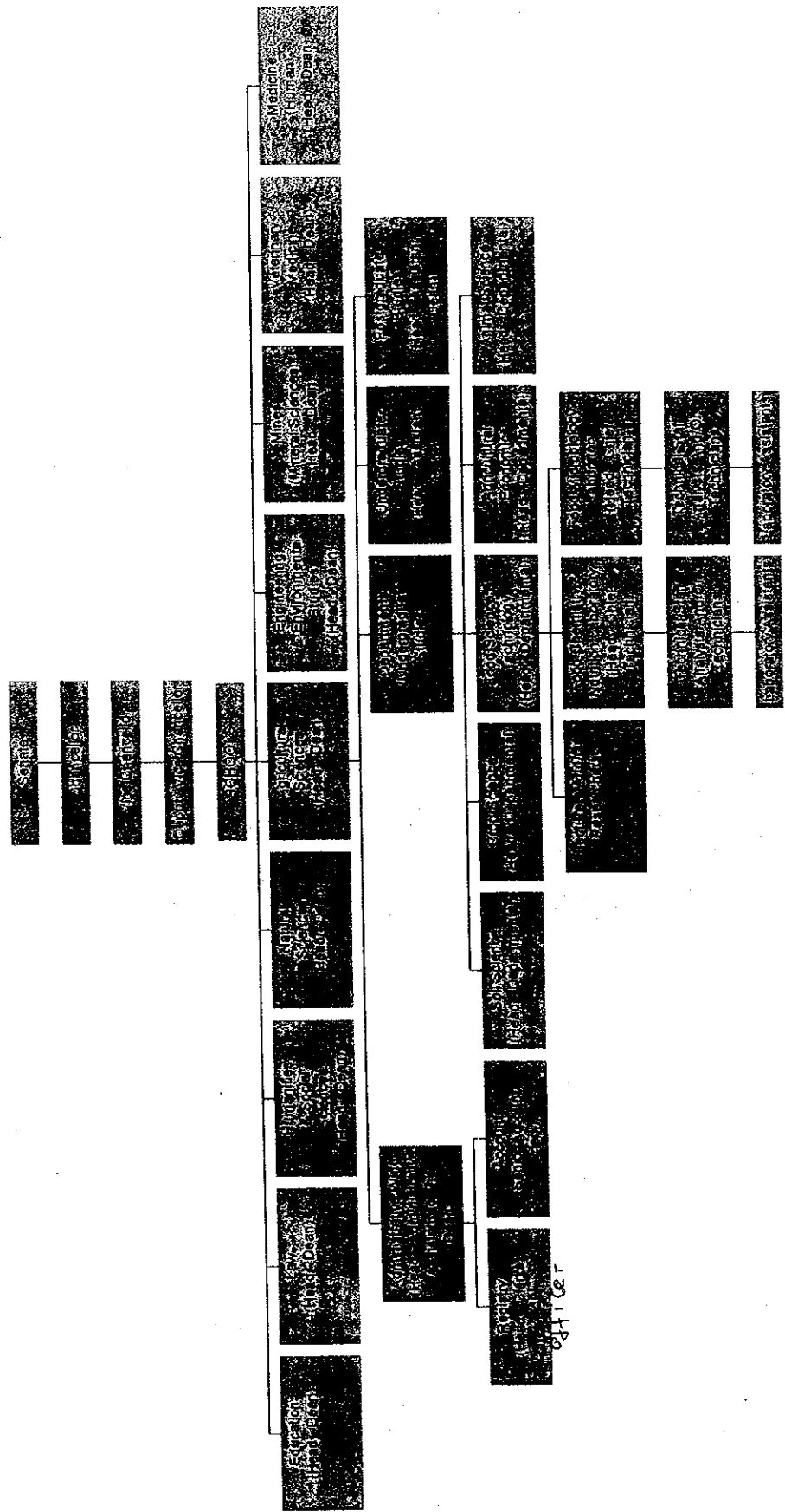
ADMINISTRATIVE ORGANISATION CHART OF THE UNIVERSITY OF ZAMBIA



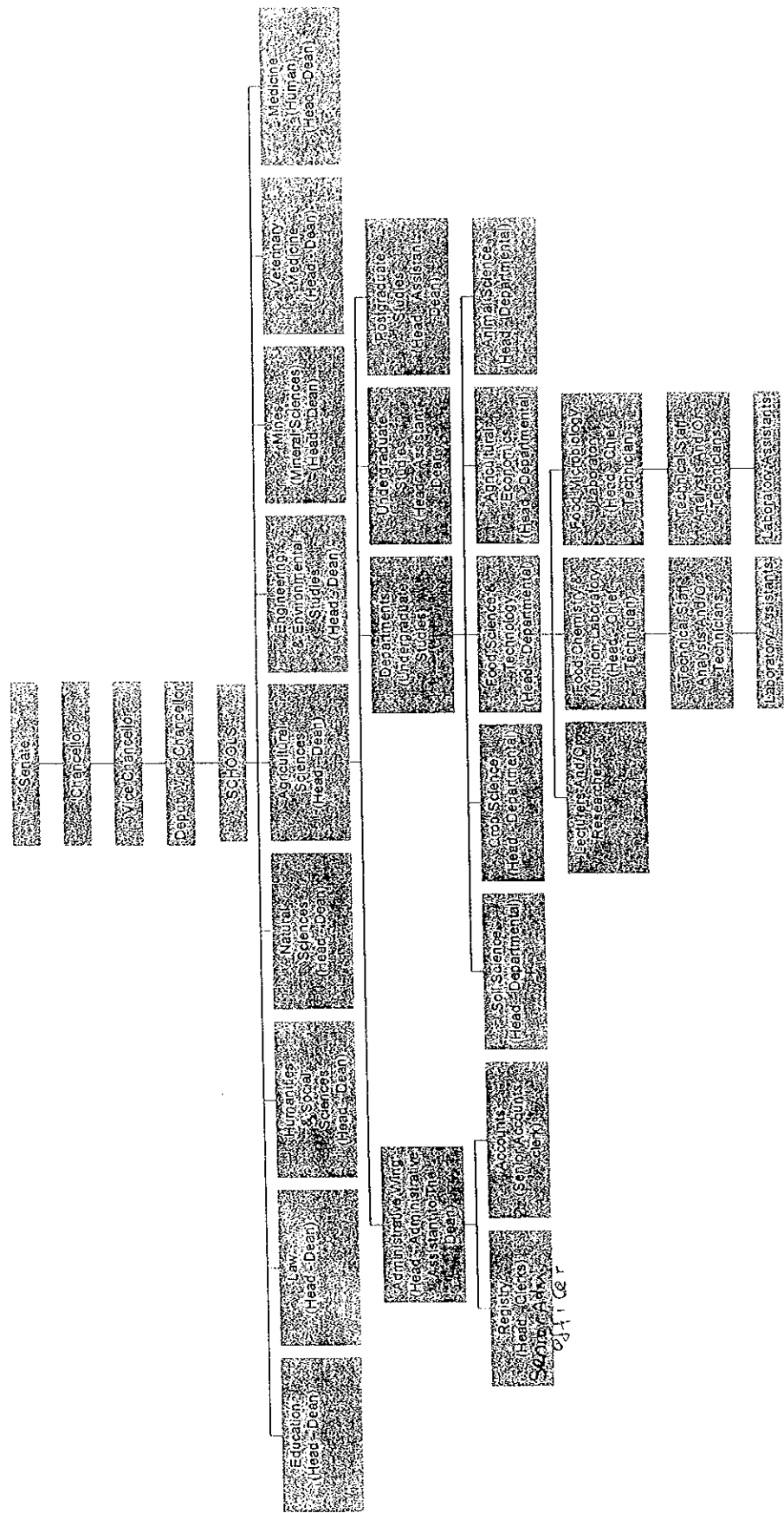
ADMINISTRATIVE ORGANISATION CHART OF THE UNIVERSITY OF ZAMBIA



ACADEMIC ORGANISATION CHART OF THE UNIVERSITY OF ZAMBIA

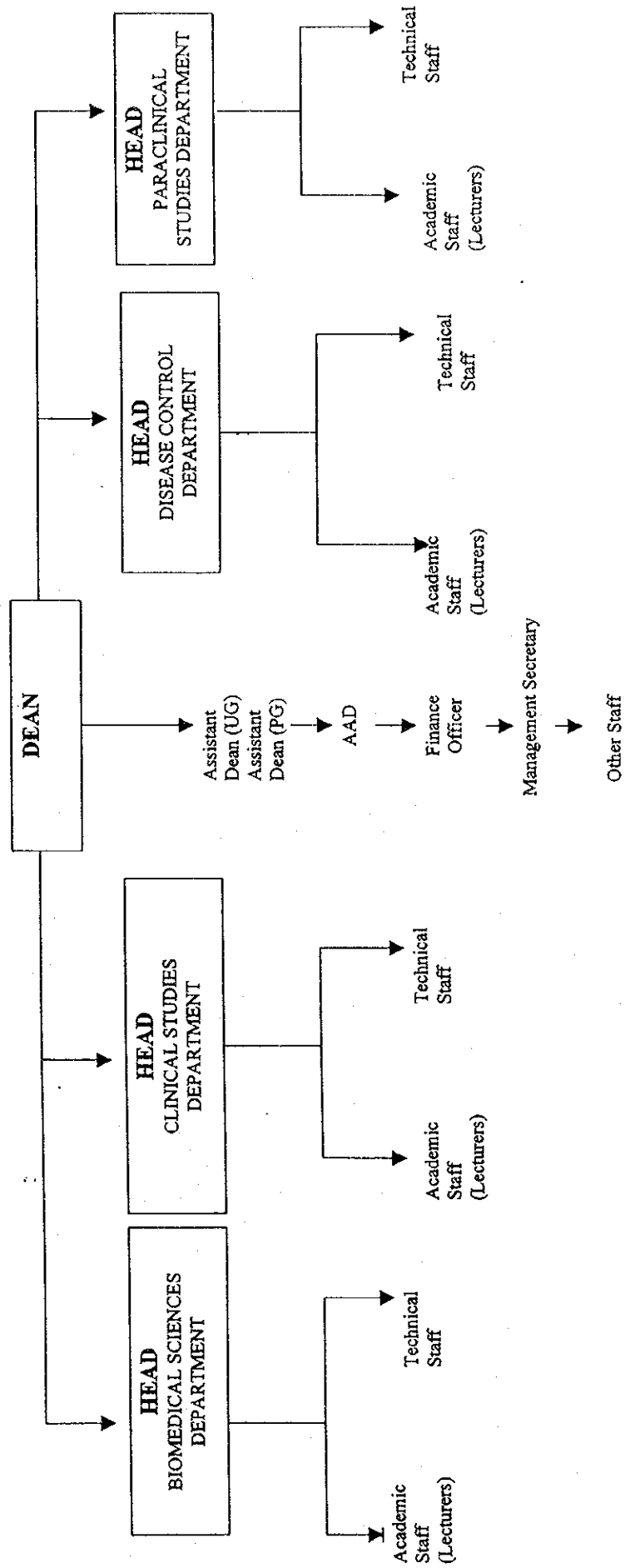


ACADEMIC ORGANISATION CHART OF THE UNIVERSITY OF ZAMBIA



THE UNIVERSITY OF ZAMBIA SCHOOL OF VETERINARY MEDICINE

ORGANISATIONAL CHART



(2) ROLE OF EACH DEPARTMENT AND DIVISION

(a) Dean

The Dean is the Chief Administrator of the school. He exercises general superintendence over the academic and administrative affairs of the school. He is also responsible for the promotion and maintenance of efficient teaching and research.

(b) Assistant Dean - Postgraduate

He assists the Dean in the development and promotion of research through postgraduate studies in the field of veterinary medicine. He also assists in the planning and implementation of the Staff Development Programme of the School.

(c) Assistant Dean – Undergraduate

He assists the Dean in the promotion and implementation of undergraduate programmes by selecting high calibre students who undertake Veterinary education programmes.

(d) Administrative Assistant to the Dean (AAD)

He assists the Dean in such matters as record keeping, general administration, supervision of administrative staff and any such duties as the Dean may assign him from time to time.

(e) Finance Officer

He is under the direction of the Dean, responsible for the financial planning and general administration of all school finances. He maintains the school accounts in the manner determined by the University.

(f) Departmental Heads

They are responsible for the promotion and maintenance of efficient teaching and research in their respective departments. They assist the Dean in the daily running of the School.

2. DATA OF THE ORGANISATION'S ACTIVITIES

2(1) Available subjects for the students

(a) Pre-clinical years (2nd – 4th year)

- Veterinary Anatomy
- Veterinary Physiology

- Veterinary Entropology
- Chemistry for Agriculture and Veterinary students
- Biochemistry
- Statistical analysis
- Genetics
- Forage Crop Production
- Veterinary Histology
- Principles of Animal Nutrition
- Applied Animal Nutrition
- Veterinary Pathology
- Veterinary Immunology and Bacteriology
- Veterinary Virology and Mycology
- Veterinary Parasitology
- Veterinary Pharmacology
- Pig and Poultry Production
- Ruminant Production

Clinical Years (5th – 6th year)

- Veterinary Clinical Pathology
- Infectious Diseases of Livestock
- Veterinary Epidemiology
- Veterinary Economics
- Clinical Veterinary Medicine
- Principles of General Veterinary Surgery and Anaesthesiology
- Veterinary Radiology
- Theriogenology
- Operative Veterinary Surgery
- Preventive Veterinary Medicine
- Veterinary Extension and Jurisprudence
- Veterinary Public Health

2(2) AVERAGE GRADUANDS PER YEAR

An average of 16 graduates are usually recorded per year.

2(3) INSTITUTIONS THE GRADUATES WORK FOR

- Mainly Government
- A small number opt for Private Practice under the Veterinary Privatisation Trust
- Few are employed by Private Companies
- Few are employed by the School as house surgeons under a two year contract.
- A few with the best results are retained by the School under the Staff Development Programme

**2(4) EDUCATION SYSTEM FOR FOOD SAFETY CONTROL AT
PRIMARY, HIGH SCHOOL AND COMMUNITY FOR MOTHER AND
CHILD**

This has not yet been developed. This is mainly due to lack of competitiveness and capacity.

2(5) SUBJECT LACKING QUALIFIED HUMAN RESOURCES

- Environment and water hygiene
- Food Safety Control
- Veterinary Food Safety
- Food Microbiology and Toxicology
-

2(6) FUTURE PLANS RELATED TO FOOD SAFETY CONTROL

The School has in its plans, the development of a Masters Degree Programme in Public Health. It has also plans to participate in the Regional Masters Programme to be launched by SADC Regional Veterinary Schools.

There are also plans by the Ministry of Agriculture Food and Fisheries through the Department of Research and Specialist Services to take over control of all Veterinary Public Health related issues including Meat Hygiene. The School wishes to participate in this by way of training human resources to take over the new role in Veterinary Public Health.

FOOD SAFETY CONTROL SERVICES

DIVISION OF ENVIRONMENTAL HEALTH

MINISTRY OF HEALTH

KENYA

PRESENTED TO JICA

SEPTEMBER 2000

DIVISION OF ENVIRONMENTAL HEALTH

INTRODUCTION

Statistically over 80% of patients' attendance in our Health facilities in Kenya suffer from environmental related and preventable disease such as malaria, diarrhoeal diseases, Food borne infections and acute respiratory infections. To scale down this, there is an overwhelming need to strengthen Environmental Health Services in the country. This move is in line with Kenyan Health Policy Framework (1994) and Health Sector Strategic Plan (1999-2004).

Environmental Health Services are specifically geared towards the control and prevention of all preventable and environmentally related diseases. Promotion of health is another major activity in environmental health services. Specific activities of the Division of Environmental health include:

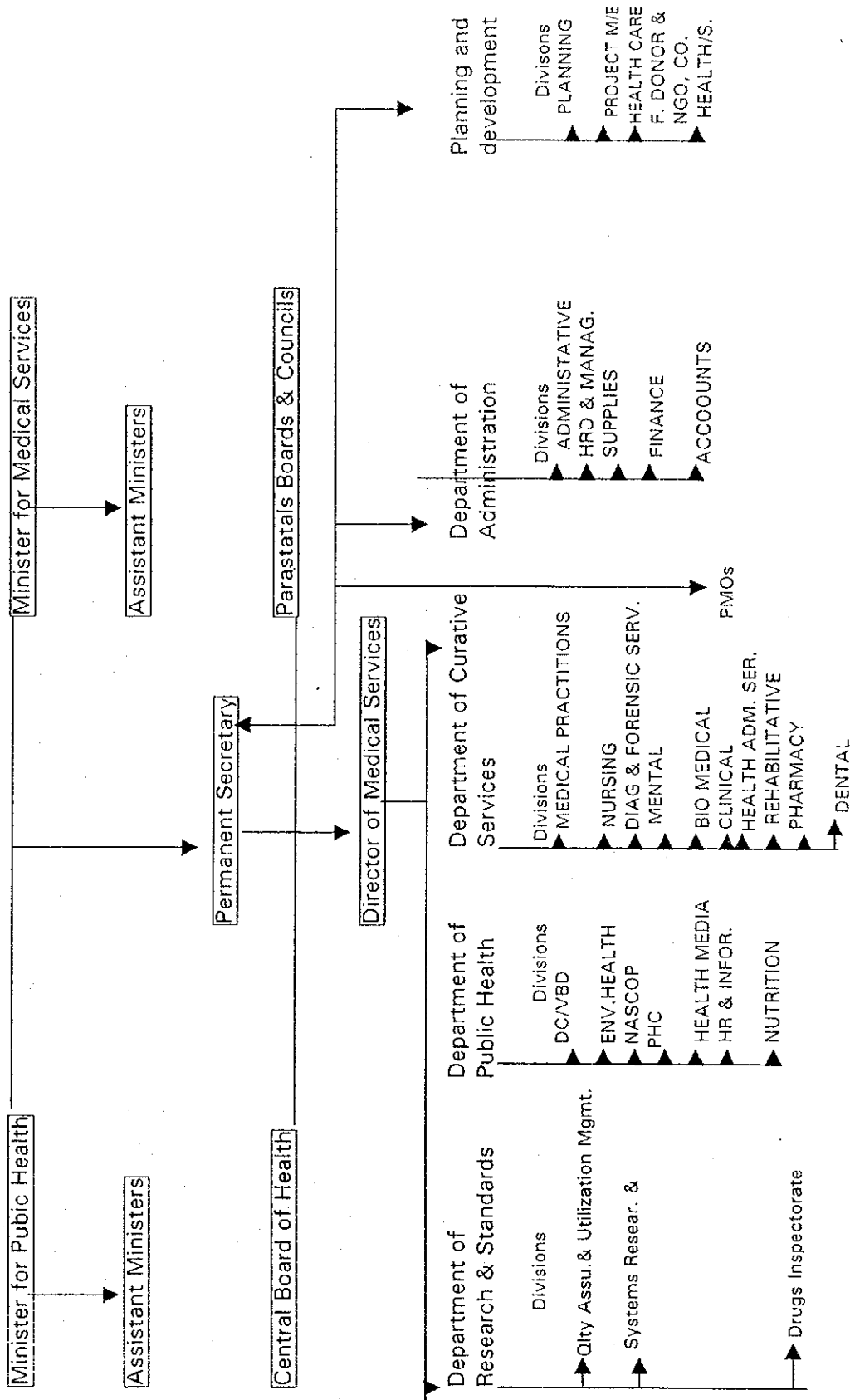
- ◆ Urban and rural sanitation
- ◆ Disease vector and vermin control
- ◆ Food safety and hygiene
- ◆ Solid and liquid wastes management
- ◆ Control of hazardous wastes and insanitary nuisances
- ◆ Surveillance of environmental pollutants and drinking water quality
- ◆ Hygiene education for behavioral change
- ◆ Occupational Health and safety in work places
- ◆ Enforcement of Public Health Legislations (Caps 242, 254, 246) and other related regulations
- ◆ Port Health services and quarantine administration

To execute the above enumerated activities are Public Health Officers who are deployed from National to Divisional administrative units and Public Health Technicians who man locational and sublocational administrative units in the country. In total there are approximately 4,000 Public Health Officers and Technicians in the Ministry of Health's payroll. There is a felt need to develop these officers further through in-service training so as to adequately tackle the rapidly changing environmental health issues.

One area which urgently requires capacity building in the Division of Environmental Health is the Food Safety and Control Services. This has been necessitated by World Trade Liberation which has made possible for food commodities to be shipped from one end of the globe to the other with little hindrance relating to sanitary and phytosanitary requirements. Kenya like any other developing country has some inherent difficulties in optimally enforcing food safety measures.

Major areas to be addressed would include training of Public Health Staff on food safety and updating and equipping Food Laboratories to adequately handle

MINISTRY OF HEALTH ORGANIZATION CHART



microbiological & chemical analyses of both locally produced and imported foodstuffs.

2.1 FOOD SAFETY ROLES OF ENVIRONMENTAL SERVICES DIVISION

2.1.1 Director of Medical Services:

- ◆ Chairs Public Health Standards Board
- ◆ Directs and issues policies on food control activities.

2.1.2 Chief Public Health Officer:

- ◆ Secretary to the board
- ◆ Coordination and supervision of Food Safety activities.
- ◆ Advises the DMS on food safety issues and legislation
- ◆ Monitoring compliance and enforcement of the food legal requirements.

2.1.3 Provincial & District Levels:

- ◆ General sanitary inspection of food staff and premises
- ◆ Advises the stakeholder and community on hygiene production, preparation and handling of food.
- ◆ Collects samples for microbiological and chemical analyses
- ◆ Enforce food laws e.g. food, drugs and chemical substance Act Cap 254.
- ◆ Collaborates with relevant ministries and NGOs in the implementation of food safety control activities.
- ◆ Issuance of food hygiene licenses for food establishments and ensure that food handlers are medically fit.

2.2 Measures for curbing food poisoning and other health hazards caused by food are:

2.2.1 Production (Farmers) Processing (Processors) and Distribution (Retailers)

- ◆ Production quality food stuff
- ◆ Use acceptable fertilizers and pesticides.
- ◆ To harvest mature food products
- ◆ Provision of proper farm storage facilities to avoid spoilage by weevils, vermins and rats.
- ◆ Ensure hygienic requirements of food production, preparation, handling, packaging and transportation are complied with.
- ◆ Use of potable water in the processing line
- ◆ Application of Hazard Analysis and Critical Control Point Concept.

3. FOOD LABORATORY ANALYSIS

Food Samples are analysed for Microbiological and Chemical Contaminants at the following laboratories:

- ◆ National Public Health Laboratory
- ◆ Government Chemist
- ◆ Kenya Bureau of Standards
- ◆ Kenya Plant Health Inspectorate.

Import foods are inspected on arrival by checking the importation documents and health certificates from the country of origin and its compliance with the Food, Drugs and Chemical Substances Act.

Samples are taken for analysis to determine the ingredients

FAO/WHO assisted in setting a food laboratory for testing aflatoxins in food grains in 1978. The project was successful as it helped in the development of Food Hygiene Regulations of 1978. The laboratory is operational but only needs support to rehabilitate some equipments and purchase of reagents, standards solutions. There is also a need to set-up Regional Food Laboratories

Conditions of Sanitary Infrastructures

a) **Water Supply System:**

Water supply system in the urban areas has been fairly adequate except for now due to insufficient rains. The peri-urban and rural areas water supply is not adequate

b) **Sewerage system:**

Urban areas have conventional sewers with sewage treatment works. Some peri-urban and small town oxidation ponds and septic tank systems are in use. Rural area pit latrines are being used.

c) **Solid Waste Management including animal wastes**

Urban area controlled tipping is used while incineration and some extent composting are used in peri-urban and rural areas.

REQUEST FOR JICA SUPPORT

Environmental Health Division will request for support in training of 80 public health officers and 20 analysts in Japan in advanced food courses. Two Public Health Officers have attended a three months course in Japan in Food Sanitation and Administration Course. The officers found the course very useful to their work.

SURVEY MISSION FOR A TRAINING COURSE ON "FOOD CONTROL SYSTEM IN SUB-SAHARAN AFRICA COUNTRIES"

1.0 INTRODUCTION

1.1 COUNTRY BACKGROUND

The Republic of Kenya lies astride the Equator in Eastern Africa. The total country surface area is 569,247 square kilometres. Of the total land area, only 30% is of high and medium potential. The rest 70% is arid and semi-arid lands (ASAL). The current population is 28.5 million people according to the 1999 national census. Pressure on land is great in the high and medium potential areas, with a density of 1,000 per sq. km in certain locations. Approximately 85% of this population is dependent on agriculture. The agriculture sector dominates the Kenya economy and will continue to be the engine for growth into the foreseeable future. The sector accounts for 25% of GDP and 45% of the Government revenue, employs 80% of the labour force, contributes 60% of foreign exchange earnings and provides materials for agro-industries which account for 70% of all industries in Kenya.

1.2 Vision for the Ministry of Agriculture

The strategic vision for the Ministry of Agriculture and Rural Development is to commit the Ministry and to enable /empower the private sector to provide everyone everywhere in Kenya at all times with sufficient and healthy food in an ecologically sustainable way. This vision includes the specific goal of poverty alleviation through employment creation in the rural areas.

1.3 The mission for the Ministry

Given the favourable policy climate of market-led reforms, the Ministry's mission is to effectively and sustainably facilitate private-sector initiatives, with emphasis on providing strengthened adaptive research, relevant extension, quality control, regulatory and other essential services to the entire farming community to ensure sustainability in agricultural production in Kenya.

The agriculture sector in Kenya (i.e. both crops and livestock production sub-sectors) has contributed between 20% and 30% to the country's recorded national income, i.e. gross domestic product (GDP), over the last one decade. The sector is also the major source of livelihood for over 80% of the country's population. The livestock sub-sector accounts for over 50% the contribution of agricultural sector to the Kenya's economy. Dairy production is an important activity within the livestock production sub-sector in Kenya. Available data indicate that dairy production is a source of livelihood for the farm families of about 600,000 small-scale farmers in Kenya

2.0 PROBLEMS IN MILK PRODUCTION, PROCESSING AND DISTRIBUTION

2.10 Problems in milk production.

About 80% of the total milk produced in Kenya come from about 600,000 small-scale dairy farmers. About 60% of that milk is from grade animals, which are at various upgrading levels, 25% from zebu, 11% from camels and 4% from goats. The average milk yield in Kenya from grade animals is 1300 litres per cow per annum, which is relatively low compared to over 3000 litres per lactation in other developed countries.

Milk production in Kenya is constrained by a number of factors, the major ones being;

2.11 Dairy Animals feeding.

- a) Deficiencies in the quality of the available feeds. This is so because of the improper management of pastures/ fodder through, inadequate use of fertilisers and manure, poor control of grazing or paddocking and a lot of succulent feeding (especially in zero grazing systems) so that less dry matter is available to the animal, leading to low production.
- b) Low quality and high cost of concentrate feeds;
- c) Inadequate capacity to monitor feed quality standards;
- d) Inadequate use of concentrates or leguminous plants to bridge the protein gap;
- e) Inadequate conservation and preservation of feeds for dry season feeding; this has resulted to high fluctuation in milk production between dry and wet season. The consequence is idle processing capacity in the dry period and inadequate processing capacity in the rainy season. The country has no capacity to process high quality milk powder and evaporated milks.
- f) Inadequate supply of water, including poor access to clean water.
- g) Poor and Insufficient extension and training on the dairy farming and management, contributing to low production per animal. Much of extension efforts have targeted the wrong client (failure to adequately recognise that gender is an issue in dairy production e.g. 75% of the labour in the rural places is contributed by women)
- h) Inadequate attention given to other milk producing animals like zebu, camels and goats.

2.12 Breeding

- a) Difficulties in accessing AI services, particularly after privatisation of these services, this is because the Government AI services which was highly subsidised, was withdrawn and the private AI services are expensive and not readily accessed. This problem is likely to lead to poor quality cows especially in the smallholder farms
- b) Use of improperly selected bulls for breeding purposes in the face of poor accessibility of AI services

2.13 Disease Control

- a) Inadequate practise in disease control by the dairy farmers. Tick-borne diseases are rampant. Also the control of helminthiasis in the dairy animals is low
- b) High cost of drugs, vaccine and sera.
- c) Uncontrolled movement of cattle leading to spread of animal diseases.

2.14 Handling of Milk Products

- Low hygienic standards in milk handling at farm level resulting in high incidences of mastitis and poor quality of milk
- Problems of non-observance of safety in use/marketing of milk and milk products. There are cases where producers do not observe the withdrawal time period of milk and milk products for consumption and sales for certain drugs used for treatment as advised by the manufacturers.

2.15 Credit

- Lack of appropriate credit for farming activities has greatly affected dairy production.
- The credit for agricultural activities is not readily available from the commercial lending institutions because farming is a risky undertaking. Besides the high interest rate charged discourages borrowers undertaking agricultural activities.

2.2 problems in processing and distribution

- a) Inadequate understanding by both processors and milk collectors/transporters on clean and safe milk handling techniques/procedure.
- b) Inadequate knowledge in management at the factory level. Prior to the decontrol of milk prices and the liberalisation of milk marketing in May 1992, dairy processing and marketing was dominated by Kenya Co-operative Creameries (KCC). Since then, there has been proliferation of new milk processors, who are processing anything from 500 to 100,000

new milk processors, who are processing anything from 500 to 100,000 litres per day. The new entrants had no prior knowledge in milk processing. The poor knowledge in management has led to many factories being closed down.

- c) Expensive loans. The borrowers are not able to repay the principles as stipulated in their agreement.
- d) Unfair competition from itinerant traders (Hawkers) to the up-coming processors. This form of marketing poses a big risk to the quality and safety of milk and milk products to the consumers.
- e) Poor infrastructure; poor roads in the main milk shed areas, inadequate milk cooling facilities in the these regions;

3.0 TRAINING NEEDS, PARTICIPATION AND COURSE CONTENT

3.1 Training needs on dairy production.

It necessary to train trainers who will in turn train the farmers and small-scale feed manufacturers

Broadly the areas where training is required include:

- a) Nutrition of the dairy animal and feed formulation
- b) Conservation and preservation of feeds.
- c) Pasture and fodder production.
- d) Animal breeding.
- e) Dairy animal management.

3.2 Course content

- a) Dairy animal nutrition
- b) Feed formulation at small scale level and ration balancers
- c) Feed conservation and preservation
- d) Dairy animal feeding
- e) Dairy animal management (record keeping, fertility, calf rearing, housing, fodder production, importance of fertiliser and manure in sustainability of land productivity)
- f) Animal breeding
- g) Disease management and control.

3.3 Training needs on Milk processing and distribution.

Milk is highly nutritious and if not handled properly may be contaminated and rendered unfit for consumption.

The people handling milk lack training. There is need therefore to train them in hygienic milk handling and food safety procedures

3.4 Target group:

Supervisors, technicians, operators directly involved, and those to be trained in handling raw milk processed milk and milk products; dairy extension, field advisory staff, and managers in large scale farms and trainers in learning institutions and quality control staff

3.5 Course Content.

- a) Milk, its composition and properties
- b) General dairy microbiology and milk borne diseases;
- c) Basic milk collection and distribution systems;
- d) Source of contamination;
- e) Sampling and testing and record keeping;
- f) Record keeping and production control
- g) Production control and total quality assurance;
- h) Operating principles of basic dairy plant and equipment
- i) Equipment maintenance and how maintenance influences the dairy business
- k) The maintenance system, record keeping system; (spares - ordering and inventory
- l) Entrepreneurship
- m) On farm processing (cottage industries promotion).

4.0 MEAT PRODUCTION, PROCESSING AND DISTRIBUTION

4.1 Introduction

About 75% of Kenya's landmass is arid and semi- arid (ASAL). Although the region cannot support rain fed crop production, it is suitable for livestock rearing especially indigenous cattle and shoats. Livestock production in the ASAL offers livelihood of about 6 million people. The ASAL regions contribute about 67% of the meat consumed in the country while the rest is from culls and bulls from the high potential areas.

It is estimated that 255,000 metric tonnes (MT) of red meat is produced in the country. Beef account for 70% of the red meat while mutton and goat meat account for 30%. There is also an additional contribution of 5400 metric tonnes per annum from camels.

The white meat is mainly from poultry and pigs. The country has a poultry population of 28.9 million of these; the majority is chicken with very few other species such as turkeys and ducks. Commercial birds consisting of both layers and broilers make up to 25% of the poultry population. There are over 300,000 pigs in the country.

4.2 Problems in meat production

- a) Inadequate practise in disease control by the pastrolist. Tick-borne diseases are rampant. Also the control of helminthiasis is inadequate
- b) High cost of drugs, vaccine and sera.
- c) Poor management of cattle movement as a means of controlling the spread of animal diseases.
- d) Inadequate suitable sources of finances and high cost of loans when available
- e) Poor managerial skills on ranches
- f) Low quality and high cost of concentrates for pigs and poultry
- g) Inadequate drought coping mechanism

2.1 Problems in Meat processing and distribution

- a) Inadequate processing capacity especially of red meat
- b) Unacceptable quality standards of meat products for local and international market.

4.3 Training needs, course content and target group.

4.31 Training needs

- a) Quality assurance
- b) Drug residual effect
- c) Laboratory diagnostic techniques
- d) Experimental animals and laboratory
- e) Meat grading
- f) Non conventional animals meat processing facilities

a) Quality Assurance

Course Contents

- | | | | |
|---|-------------|---|--------------------------|
| - | Biologicals | - | Safety tests |
| | | | Potency & efficacy test |
| - | Acaricides | - | Evaluation of acaricides |

b) Drugs and residues

- Detection of residues - foods
- Anti-microbial resistance
- Maximum residue limits
- Good manufacturing

- Animal feeds and quality control

c) Veterinary laboratory services

Training needs

- Quality Assurance
- Biologicals
- Acaricides
- Drugs
- Residues in animal products & by-products

Laboratory diagnostic management

- Current
- Advanced

Laboratory diagnostic techniques course

- Good laboratory practice
- Validation of diagnostic assays
- Biotechnology in diagnostic of infectious disease

- Current diagnostic techniques
- Advanced diagnostic techniques
- Biosafety - diagnostic of diseases
- Standardisation of reagents & biologicals

Laboratory Instruments course

- Servicing maintenance and repair of laboratory equipment

Laboratory/experimental animals management course

- Handling
- Feeding
- Housing
- Production of SPF animals

d) Abattoirs course

Course content

- Slaughtering
- Slaughtering house equipment
- Hygiene
- Hides and skins
- Animals by-products

e) Meat Grading Course

Meat preservation

Meat quality

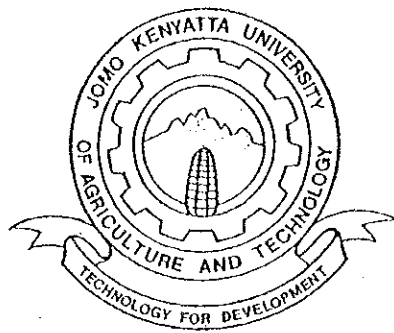
Slaughtering process

Slaughterhouse organisation

Utilisation of animal by-products

4.32 Target

- Both community and high class butchers.
- Meat inspectors in slaughter houses including those dealing with export
- Trainers in training institutions



INTRODUCTION

TO

**THE DEPARTMENT OF FOOD SCIENCE
AND
POSTHARVEST TECHNOLOGY**

2000 – 2002

**FACULTY OF AGRICULTURE
JOMO KENYATTA UNIVERSITY
OF
AGRICULTURE AND TECHNOLOGY**

1. Mission of the Department

Food processing has become a major industry in Kenya, both large and small scale. For this reason, there is need to train personnel in the areas of Food Technology at both technical and managerial levels. Besides, a high percentage of commodities is lost after harvesting, despite high capital investment in production. Therefore, correct postharvest handling of food crops and minimization of postharvest losses can be as important to overall crop production and food supply as are efforts to increase yield through improvements in plant breeding, crop protection and agronomy. For these reasons, the Department of Food Science and Postharvest Technology aims to produce well trained personnel to meet manpower requirements for the food industry and postharvest handling systems. It is, indeed, the only department of any University in the East, Central and Southern Africa regions, offering specialized training in Postharvest Science and Technology. In addition, the department carries out both basic and applied research, geared particularly towards solving local problems. The department also contributes to the development of food related sectors in the country through extension work and consultancy.

2. Chronology of Main Events

MAY 1981	First intake of diploma students into the Department of Food Processing.
APRIL 1984	First graduation of ceremony presided over by H.E. the President of the Republic of Kenya.
MARCH 1984	Department renamed Department of Food Technology
FEBRUARY 1989	Production activities expanded
MAY 1989	First draft of B.Sc. programmes in Food Science and Postharvest Technology submitted.
DECEMBER 1989	Department renamed Department of Food Science and Postharvest Technology.
OCTOBER 1990	First intake of degree students to B.Sc. in Food Science & Postharvest Technology
FEBRUARY 1992	Organization of Seminar on "Quality Control for Food Industry".
MARCH 1992	Organization of Seminar on "Postharvest Management of Food Crops".
FEB-MAR. 1993	Organization of "Inaugural Seminar on Applied Food Analysis" (JICA Regional Group Training Programme).
MARCH 1993	Organization of seminar "Quality Control for Food Industry.
FEB-MARCH 1994	Organization of "2 nd JICA Regional Group Training Programme on Applied Food Analysis".
OCTOBER 1994	First Departmental Open Day.
NOVEMBER 1994	Organization of joint JKUAT-KIFST Conference.
DECEMBER 1994	First batch of 16 students completed B.Sc (8-4-4) programmes.
FEB-MARCH 1995	Organization of "3 rd JICA Regional Group Training Programme on Applied Food Analysis"
OCTOBER 1995	Second Departmental Open Day.
NOVEMBER 1995	Organization of 2 nd joint JKUAT-KIFST Conference.
DECEMBER 1995	Second batch of 20 students completed
FEB.-MARCH 1996	Organization of 3 rd joint JKUAT-KIFST Conference.
DECEMBER 1996	Third batch of 15 students completed B.Sc. (8-4-4) programmes.
FEB.-MARCH 1997	Organization of "5 th JICA Regional Group Training Programme on Applied Food analysis".
NOVEMBER 1997	Organization of 4 th joint JKUAT-KIFST Conference.
DECEMBER 1997	Fourth batch of 21 students completed B.Sc (8-4-4) programmes.

FEB.-MARCH 1998 Organization of "1st JICA Regional Group training Programme in Applied Food Analysis" of the second 5 year phase.
 DECEMBER 1998 Fifth batch of 23 students completed B.Sc. (8-4-4) programmes.

3. Main teaching Areas

The Department offers courses leading to the award of a University Diploma in Food Technology and B.Sc. degree in Food Science with options in Food Technology and Postharvest Technology. The courses are designed to contain at least 50% practicals of total contact hours.

Besides the basic sciences namely Mathematics, Physics, Chemistry, Biochemistry, Botany etc, the major subjects taught are:-

Food Chemistry, Food Analysis, Food Engineering, Food Microbiology, Food Processing and Preservation, Food Biotechnology, Food Quality Assurance, Human Nutrition, Packaging, Food Toxicology, Food Product Development and Marketing, Food Industry Management, Processing Technologies for Meat, Dairy, Beverage, Cereals, Sugar and Starch, Fats and Oils and Fruits and Vegetables Processing, Postharvest Technologies for Grains and Perishable Food Crops, Postharvest Entomology and Pest Control and Postharvest Handling Systems.

Students are attached in the Departmental Food Processing Workshops and food and beverage industries or related research institutions in the country. They are also required to undertake their own research projects and at the end of the projects, they are expected to present and submit their research findings.

4. Staff

Professors

R. Oniang'o (Ph.D., Nairobi), Food Nutrition/ Food Science

Associate Professors

Vacant

Senior Lecturers

F.M. Mathooko (Ph.D., Okayama),

L.E. Wongo (Ph.D., Kansas State),

P.M. Kutima, (Ph.D., North Carolina)

G.M. Kenji (Ph.D., Okayama)

C. Kiiyukia (Ph.D., Hiroshima)

S.N. Muhoho (Ph.D., Ehime)

M.A. Mwasaru (Ph.D., Putra)

C.K. Njoroge (Ph.D., Illinois)

Food Chemistry / Postharvest Physiology/ Postharvest Technology – **Chairman of Department**

Postharvest Grains Technology/ Postharvest Entomology Microbiology/ Biotechnology

Food Chemistry/ Natural Products Chemistry

Food Microbiology/ Postharvest Pathology

Food Chemistry/ Flavor Chemistry

Cereal Technology/ Food Chemistry

Postharvest Physiology/ Postharvest Technology

Lecturers

C.A. Onyango (Ph.D., JKUAT)

N.K.O. Olang'o (Ph.D., Tsukuba)

A.O. Makokha (M.Sc., Cambridge)

Food Chemistry / Meat Technology

Food Technology / Food Engineering

Cereal Technology./ Human Nutrition)

Assistant Lecturers

P.M. Kinyanjui (M.Sc., S. Gujurat)	Food Microbiology (on study leave)
T.K. Tunje (M.Sc., Minsk)	Hydrolysis Technology/ Industrial Microbiology
C.A. Omumasaba (M.Sc., Mizayaki)	Food Microbiology (on study leave)

Tutorial Fellows

J.M. Mathaara, (M.Sc., (Nairobi)	Food Microbiology / Dairy Technology
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Teaching Assistants

A.N. Oyango, (B.Sc., JKUAT)	Food Science & Postharvest Technology (on study leave)
W.O. Owino, (B.Sc., JKUAT)	Food Science & Postharvest Technology (on study leave)

Chief Technician

T.W. Wandati (Mrs.) (B.Sc., Nairobi)	Food Science and Technology
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5. Facilities

The department possesses the following main physical facilities.

1. Food Chemistry Laboratory

Equipment for basic chemistry, practicals and proximate analysis of food components, etc.

2. Food Microbiology Laboratories

Equipment for analysis in General Microbiology, Food Microbiology and Biotechnology

3. Food Engineering Laboratory

Equipment for unit operation experiments, grain dryer, sprayer dryer etc.

4. Instrumental Analysis Laboratory

Spectrophotometer, GLC, HPLC, AA/FE spectrophotometers etc.

5. Food Biochemistry Laboratory

Equipment for advanced studies on foods, HPLC, UV spectrophotometer, Fluorescent spectrophotometer, ultra-centrifuges, densitometer, automatic titrators etc.

6. Postharvest Technology Laboratories

Color difference meter, spectrophotometer, rheometer, moisture meters, storage chambers etc.

7. Baking Workshop

Facility for producing 500 loaves of bread per batch, Brabender equipment etc.

8. Fruits & Vegetable Processing Workshop

Vacuum juice evaporator, canning machine, retort, oil extractor etc.

9. Meat & Dairy Processing Workshop

Smoking chamber, silent cutter, mixer, pasteurizer, cheese Vat, fermentation tank etc.

10. Pilot Plant for Market milk Processing

Facilities including HTST pasteurizer, homogenizer, CIP and carton packaging machine etc.

11. Students and staff Computer Rooms

IBM and Macintosh computers and printers. Common application softwares have been installed.

12. Departmental Library

Technical journals, textbooks, laboratory and workshops manuals and other reference materials.

6. Production

In addition to teaching and research, the facilities in the workshops are used for production of various food products. The products include yoghurt, cheese, sausages, ham, bacon, fruit juices, jams, sauces, bread, biscuits, cakes, doughnuts among others.

7. Research

In addition to supervising students projects, the staff members conduct their own research. Such research activities include the following areas and aims:-

1. Food Processing Technology

- to increase shelf-life of foods and their acceptability.
- to assess the suitability of processing conditions.
- to evaluate the utilization of new raw materials.

2. Postharvest Technology

- to reduce substantial losses of grain and perishable food crops.
- to investigate and adopt appropriate storage conditions suitable for local environment.
- to establish maturity and harvest indices for fruits and vegetables grown in Kenya.
- establish quality standards for harvested horticultural produce.
- to identify common postharvest pathogens of perishable commodities.

3. Fermentation/Biotechnology

- to apply biological and engineering processes to the production of foods and their byproducts.
- isolation and study of microorganisms from traditionally fermented food products.

4. Product Development & Quality Assurance

- to promote the utilization of local raw materials and traditional technology for commercialization purposes.
- to ensure the production to wholesome and nutritive foods and their by-products.

8. Possible Areas of Employment for Graduates

On completion of the course, the graduates are expected to have knowledge and practical skills to enable them to work either in formal employment or self-employment.

The possible employers in Kenya are:-

Fruit and vegetable processors, fats and oils industries, meat processing factories, brewing industries, dairy industries, bakeries, packaging industries, sugar industries, flour milling plants, tea and coffee processing factories, perishable food exporters, food storage stations, institutions of higher learning, government ministries and research institutes.

9. Future Outlook

The Department has set the following goals for further development and expansion:

1. Expansion of training capacity.
2. Establishment of postgraduate courses and studies.
3. Initiation of technical innovation and product development.
4. Establishment of advisory consultancy units for up-coming entrepreneurs and industries.
5. Involvement in the establishment of food standards and Government projects.
6. Establishment of short-courses and workshops.
7. Establishment of outreach programmes.
8. Collaborative research activities with industries and other research institutions.
9. Excel as a regional centre for Postharvest Technology.

(2) Role of the Department of Food Science and Postharvest Technology, JKUAT

The role of the Department is to train students in Food Science and Technology at both technical and managerial levels. The Department, therefore, aims at producing well trained graduates, equipped with the knowledge and skills, to meet the manpower requirements of the food industry and postharvest handling systems. The Department offers specialized training in Postharvest Science and Technology. The Department carries out both basic and applied research, geared particularly towards solving local problems. It also contributes to the development of food-related sectors in the country and the region through training, extension and consultancy services.

2. Data of your organization's activities

(1) What is the syllabus (i.e. what kind of subjects are offered to the students)?

(a) Undergraduate programmes

The Department of Food Science and Postharvest Technology offers courses leading to the award of a University Diploma in Food Technology and a B.Sc. degree in Food Science and Postharvest Technology. The courses are designed in such a way that, at least 60% and 40% of the total contact hours are devoted to practicals in the Diploma and the B.Sc. Programmes, respectively.

Besides the basic sciences, such as Mathematics, Chemistry, Biochemistry, Physics, Botany, Zoology, Statistics, Computer science, e.t.c, the core subjects taught include Food Chemistry, Food Analysis, Food Engineering, Food Microbiology, Food Processing and Preservation, Food Biotechnology, Food Quality Assurance, Sensory Evaluation, Human Nutrition, Packaging Technology, Food Hygiene and Sanitation, Food Product Development and Marketing, Food Industry Management and Postharvest Technology. In addition, the students are taught Processing Technologies of Meat products, Dairy products, Beverages, Cereals, Sugar, Starch, Fats, Oils, Fruits and Vegetables.

An important aspect of both the Diploma and B.Sc. Programmes is the requirement for field attachment in food industries within the country for a whole semester. Final year students are required to conduct individual research projects under the supervision of academic staff and, at the end, undergo oral examination and submit a written research report.

Postgraduate programme

The major objective of the Postgraduate Programme in Food Science and Postharvest Technology is to provide the candidate with advanced knowledge of the principles, techniques and skills in Food Chemistry, Postharvest Physiology, Food Microbiology, Food Toxicology, Food Engineering, Research, Food Biotechnology, Human Nutrition, e.t.c. The course focuses on the applications of the knowledge to Food Science and Postharvest Technology in order to meet the manpower requirements of the food processing industries, research institutions and institutions of higher learning. Department has also initiated Ph.D programmes.

(2) How many students graduate annually?

The number of graduates from the department per year are:

Between 20 and 25 for B.Sc in Food Science and Postharvest Technology

Between 18 and 24 for Diploma in Food Technology.

We expect to have graduands from the postgraduate Programme soon.

(3) What type of organizations employ your graduates?

The graduates from the department find employment in Food industries (breweries, dairy industry, meat processing, fats and oils processing, sugar factories, tea factories, coffee processing, fruits and vegetables processing, mineral water bottling companies etc), Research institutes, Universities, Non-Governmental Organizations, National Polytechnics, Statutory bodies like Kenya Bureau of Standards.

(4) Please describe the education system for food safety control at primary school, high school, or community for mother and children.

Limited education is offered at primary and high school levels in Kenya regarding food safety control. However, there are courses like Home Economics, Foods and Dietetics, Consumer Studies covering various aspects of food and are offered at higher levels of education. Community Nutrition education is given by the Ministry of Health, Ministry of Agriculture and some Non-governmental organizations.

(5) Is there any subject in the field of sanitary control system which lacks in qualified and well trained human resources e.g. lecturers?

Yes. Food microbiologists and Food Chemists and Water Engineers at all education levels.

(6) Please describe your future plans for education related to food safety control.

Apart from the regular academic Programmes where Food Hygiene and Toxicology courses are taught, the department is in the process of developing short-term training courses on food handling, safety and hygiene for personnel in the local food industry and informal sector. There are also plans to initiate collaborative research and training activities within the Eastern, Central and Southern African regions on food security and safety.

PROBLEMS RELATED TO FOOD SAFETY CONTROL IN SUB-SAHARA AFRICA

By

S. Muhoho Njoroge, G. M. Kenji, C. A. Onyango, F. M. Mathooko, C. K. Njoroge and C. Kiiyukia.

Department of Food Science and Postharvest Technology, JKUAT

Introduction

Food safety is an important subject which is closely related to diseases and human health.

In sub-Saharan African countries there has been several reported cases of food-related illnesses which in some instances result in permanent disabilities and eventual death of the affected individuals. Food quality and safety concerns are increasingly affecting regional and inter-state trade. The main contributory factors to the food safety problems in sub-Saharan Africa are lack of facilities and knowledge required for the detection and regulation of these problems.

A) Common types of food safety problems (chemical) in sub-Saharan African countries

Chemical hazards in food may result in long-term health problems in form of carcinogenicity, neurotoxicity, hematotoxicity, allergenicity, mutagenicity and teratogenic effects in the affected individuals. Once these problems expose themselves they are usually difficult to alleviate.

The main causative agents of food safety problems in sub-Saharan African countries are:

a) Mycotoxins

Mycotoxins are produced as metabolites by moulds growing in dry foods stored in hot and humid environments which are prevalent in most of the sub-Saharan Africa countries.

The common types of mycotoxins important to food safety problems in the region are :

- i) Aflatoxins. These mycotoxins may be present in dry cereal grains, cereal flours, nuts and malted products such as sorghum.

Aflatoxins may also be found in milk and dairy products.

Research work carried out on aflatoxin contamination of Kenyan maize flour and malted Kenyan and Malawian maize and millet grains, which are the staple foods in most of the countries. Recent research in this department (Kenji *et al.*, 2000) has shown high levels of aflatoxin contamination, of up to 1020 p.p.b in the grains. This high concentration of aflatoxins in the food resources is a great health hazard, especially because these grains are the staple food in almost all the countries.

ii) **Ochratoxins**

Low levels of ochratoxins have been reported in dry processed low quality coffee beans originating from the region. These mycotoxins are currently causing great concern among coffee consumers and producers.

b) Pesticide residues in food

Various types of agrochemicals such as fertilizers, pesticides and growth regulators are used widely in food production. Some of these chemical substances or their degradation products persist in the food materials and the environment for a long period of time. Prolonged ingestion of these chemical substances into the human body may cause health problems.

Developed countries have set rigid regulations for maximum residue levels which have to be adhered to by exporting countries.

The countries in sub-Sahara African region need to have the capacity to assess and control the levels of the residue substances in food.

c) Pesticide residues and heavy metals in water

Polluted water when used in food processing activities and cleaning of processing equipment can be a major source of food safety problems. Due to the poor drainage systems and environmental pollution in many sub-Sahara African countries, the water resources are usually contaminated with high levels of pesticide residues and toxic heavy metals, such as tin, lead, mercury, arsenic and cadmium.

This pollution of the environment and water resources has great impact on the quality of fish and other sea-foods. This type of food safety problem has negatively affected the fishing industry in Kenya, Uganda and Tanzania such that the fish originating from these countries has been rejected in the European markets.

Currently, in the sub-Saharan region, there is lack of adequate capacity in terms of trained human resource and facilities to adequately evaluate pesticide residues and heavy metals in water and seafoods.

d) Food additives

There has been a rapid increase in the use of food additives in food processing and preservation in the newly liberalized economies of the sub-Sahara African countries. The safety of the food additives and their levels of usage have not been adequately regulated. The various types of food additives of much concern in this respect are colourings, preservatives, flavourings, nitrites and nitroso- compounds (in meats), sulphites and benzoates.

Food safety problems arising from excessive usage of food additives is likely to increase in sub-Sahara African countries due to the upsurge in numbers of untrained food processors who are penetrating the industry after retrenchment and retirement from formal employment.

Conclusion

There is need for training on the safety control of the chemical substances that may cause hazards in foods and the environment. The training should provide the practical capabilities for monitoring and control of these harmful chemical substances.

B) Microbial food safety problems in Kenya (an overview)

According to the Tokyo based UN University and UNEP, 80% of the diseases in the developing countries are caused by the consumption of contaminated water. Half of the people living in these countries suffer from water related diseases at any time. Each second child dies in the world from infectious diseases. The UN puts 1.4 billion as the number of people who do not have access to clean and safe water world-wide. The number is bound to increase by one billion by the year 2025. Water is life and if that water is contaminated, then the food and the utensils washed with that water will be contaminated. In most of these developing countries including Kenya, a big part of the population does not have enough water. This makes the safety aspects even more precarious. The microbial infection incidences may be even higher than the UN estimates.

The climatic conditions in Kenya are ideal for microbial growth and food gets spoilt very fast. However, very few food poisoning incidences are reported unless they occur at a restaurant or at a party involving many people and where the death due to the infection occurs. Kenya as a model developing country, is replete with bacterial, viral and parasitic gastro-enteritis incidences. All the indicators of healthy living in Kenya are very disappointing when the following indicators are considered:

- Access to clean and safe water
- Literacy rate
- Sanitation in urban centres
- Availability of basic commodities e.g. food, clothes and shelter
- National medical assurance
- Spread of AIDS

No wonder, the life expectancy in Kenya has been falling gradually while the child mortality rate is increasing.

In Kenya, consumption of canned foods is not popular because it is expensive and people prefer cooking at their homes.

However, the food service industries especially for tourists is very good compared to other developing countries. The food processing companies e.g. dairy, meat, fruit and vegetables employ qualified food technologists and their products are safe.

Recently, there has been problems of hygienic handling and processing of raw fish meant for European markets which led to closing of that lucrative market until proper handling is achieved. Meat and milk form a traditional diet of a large population in Kenya.

Since hawking of unprocessed milk is done by people without the basic knowledge of hygiene, incidences of infectious diseases transmitted through milk are bound to increase.

Handling of meat during and after slaughter is also done in unhygienic manner. However, meat sold in the approved markets is inspected and therefore safe for consumption. Outbreaks of infectious diseases transmitted by either water or food sporadically occur, especially cholera. Cholera is pandemic along the coast and at the shores of L. Victoria although sporadic cases are reported in other parts of the country. Transmission is mainly through contaminated water and or food. Typhoid, bacillary and amoebic dysentery continue to kill young children mainly due to lack of proper sanitation. It is regrettable that there are no reliable statistics on the causative agents of food poisoning incidences in Kenya apart from the scanty reports from the local newspapers. Some of these reports are as below:

1. "A man, a cat and a dog died in Sigor division, Bomet, after eating uninspected meat. The three had eaten the meat after the animal had died. Investigations showed that the animal had died of anthrax." *Daily nation, 4th Dec. 1995.*
2. "Four people have died in the past week of a disease suspected to be typhoid, in Kithitu village, Tharaka Nithi district. Two of them a man and his son died at the Chuka District Hospital where they had been admitted. Two more members of the family were buried two weeks ago while a third is admitted in the hospital with similar symptoms. The victim complained of severe diarrhoea, stomach pains and headaches. Eight other people from the same village are admitted in the hospital with similar problems." *Daily Nation 1st May 1997.*
3. "Marble Arc Hotel in Nairobi, yesterday denied serving poisoned food to seminar participants late last month (July 30th). On that day they served more than 150 customers and non of them has complained so far. Three people are said to have died after eating at the hotel on that day. The food was served as a lunch buffet of chicken, beef, rice and fish fillet. The food poisoning symptoms included severe vomiting and diarrhoea." *Daily Nation 11th Dec. 1999.*

The above three incidences show that food poisoning cases in Kenya are common and most of it is not even reported unless it occurs at schools, wedding and funeral parties or somebody has died as a result of it. Lack of public awareness on food poisoning makes them ignorant of the dangers of drinking untreated water and eating uninspected meat and at unhygienic restaurants. The common causative agents suspected of causing food poisoning in Kenya include *Salmonella sp.*, *Escherichia coli*

(enteropathogenic and enterotoxigenic types), *Staphylococcus aureus*, *Vibrio parahaemolyticus*, *Bacillus cereus*

Other common intestinal infections are caused by infectious bacteria, viruses and parasites transmitted through contaminated water or food and includes; *Vibrio cholera* O1, *Salmonella typhi*, *Bacillus anthracis*, *Shigella sonnei*, *Enteroviruses* and *Entamoeba histolytica*

The above diseases thrive where there is poor hygiene and sanitation.

Lack of basic education also plays an important part since an illiterate population will remain ignorant.

C. Problems related to production, processing and distribution of dairy products in Kenya

1. Background information

Before the liberalisation of the dairy industry in Kenya, the dairy sector was characterised by government interventions at every level namely; the price review procedure, the artificial insemination (AI), extension and veterinary services, and various forms of financial support to Kenya Co-operative Creameries (KCC), like school milk program among others. This government intervention resulted in guaranteed market for raw milk as KCC operated as a monopoly and its existence was guaranteed, and also AI and animal health services resulted in successful upgrading of national herd and continued increase in milk production.

Since the liberalisation of the Kenyan dairy industry in 1992, many aspects of it are in steady decline or have virtually collapsed. Among them is the marketing of raw milk, which has deteriorated tremendously following the near collapse of KCC and therefore, its disappearance from the Kenyan dairy scene. The processors that came up as a result of the liberalisation of the dairy industry, were unable to process the quantity of raw milk KCC used to handle, hence the decline in formal raw milk marketing outlets. KCC used to handle about 50% of the total raw milk, which was produced by about 400,000 small-scale farmers, and it also handled 80% of the processed milk. The collection and sale of raw milk to processors was being done by some 100 dairy co-operatives but there were large-scale farmers who sold milk directly to the processors. Some 60 cooling centres were in operation, most of them owned by KCC, while others were owned by the co-operatives, both of which have since collapsed (DANIDA Report, 1995).

At liberalization, about 20 milk processors came up (DANIDA Report, 1995). The new processors were all from private sector, and all the significant ones (except one), were/are based on large farms or other businesses. Only two co-operatives were involved in the establishment of milk marketing facilities in Kenya. As most of these processors did/do not have the farmers interest at heart, the scenario that has arisen is that of taking least cost, most reliable, best access and highest quality milk. The milk that remains is the high cost, remote, inaccessible, low quality, which unfortunately is from small-scale poor farmers. When KCC was operational, this milk would end up at KCC, but after its collapse, the milk goes nowhere.

Arising from this surplus milk scenario and the need for jobs for the unemployed rural population, the informal market, popularly known as hawking has come up in a big way. This has also been enhanced by the reduced control in milk marketing by the Kenya Dairy Board (KDB), probably due to lack of

financial resources. It would not be an understatement to claim that more than 60% of the marketed milk in Kenya is marketed unprocessed and by hawkers. To some farmers, hawkers are the only market outlet for their milk. The quantity of milk available to hawkers is more than they can handle, hence due to supply outstripping demand, they pay very low prices to the farmer. It is important to note that hawking is only possible in those areas close to the urban centres. In areas further from urban centres which are not accessible to formal processors, the milk just goes to waste.

One of the problems experienced in the Kenyan dairy industry is that the quality of the milk sold by hawkers which is about 60% of all the milk marketed is of suspect quality. However, this cannot be ignored because it forms quite a significant segment of the total milk market. Milk is a good substrate for the growth of animal, human and microbial populations alike and is able to support the growth of both spoilage and pathogenic micro-organisms. Due to its suitability as a growth medium for these micro-organisms, their numbers increase rapidly, posing dangers to the consumers and rendering the milk unusable for the intended purposes.

Milk is prone to adulteration with no obvious detection unless it is subjected to appropriate tests, which are not available to the consumers prior to the purchase of raw milk. Some of these manipulations of milk quality could be injurious to the consumers.

From the foregoing, it is therefore, necessary to ensure that the milk is handled hygienically to exclude as many micro-organisms as possible. It is also necessary to ensure that the milk physical and chemical quality is not interfered with before consumption. It is therefore important to ensure that the milk sold by hawkers is of sound quality and safe for consumption. This is important because depressed economic performance has resulted in most people buying raw milk for their house-hold use.

2. Status of dairy processing facilities in Kenya

By 1998 Kenya Dairy Board had licenced 40 processors, 257 milk bars, 37 milk cottage industries and 45 co-operatives/self-help groups to market milk formally. All combined, they had a processing capacity of 200,000 litres per day besides KCC, whose milk processing capacity was about 300,000 per day (Lenaronkoito, 1998). Using these figures, this translates to 109,500,000 litres per year. Currently, this could have doubled at best.

In 1996, the milk production in Kenya was estimated to be 2.4 billion litres a year. According to a study on milk marketing channels (1998), about 31% of the milk produced in Kenya is consumed at home while the rest is marketed. This would translate to about 1.68 billion litres per year to process and market. This clearly demonstrates that our production capacity outstrips our processing capacity, thus a big portion of our milk goes to waste.

Since then KCC has lost its capacity to process and has almost no impact on the dairy industry today, this has drastically reduced the processing to levels lower than what it was in 1998. Subsequently, a lot of farmers have no formal market for their milk and this has led to drastically reduced milk production levels and subsequently, unimaginable economic hardships.

3. Effect of liberalization of milk marketing to the Kenyan dairy industry

Liberalization was meant to spur the development of private dairy processors by creating a more competitive market that could develop the small holder dairy production thus increasing the price of raw milk. Before liberalization of milk marketing (1990/1991), about 50%, 92% and 71% of the dairy co-operative societies' raw milk in Kiambu, Muranga and Thika districts respectively were sold through the KCC. However, after liberalization (1994/1995), over 50% of the raw milk in the aforementioned Districts was retailed by the same co-operative societies directly as raw milk. The liberalization of milk marketing, therefore expanded the raw milk market.

Liberalization as a policy is attractive and should have resulted in improved dairy industry. However, it came in the backdrop of depressed national economic growth, hence it would be difficult to fairly assess its effect.

Liberalization ushered in many new milk processors but coincidentally, KCC faded out of the milk processing scene. This resulted in a net decrease in the national milk processing capacity and therefore reduced milk market for the producer. Most of the milk producers have therefore not benefited from the liberalization in the dairy industry. On liberalization, it was expected that milk prices would be market driven and due to competition among processors, the prices would be maintained low. However this has not been the case. Except for increased variety of processed milk, it would be fair to state that the consumers have not benefited a great deal from liberalization of the dairy industry as the prices of dairy products have continued to increase.

4. Distribution of processed dairy products

Distribution of dairy products has been a problem due to lack of a continuous cold chain. Some of the perishable products like pasteurized and fermented milk, are displayed on shelves at room temperature, which results in spoilage hence loss to the retailers and processors. Poor road network is also a problem.

D) Livestock production and utilization: constraints to growth and development in Kenya

Introduction

The backbone of Kenya's economy is agriculture and is divided into small scale, large scale and pastoral subsectors. About 85 – 90% of Kenya's people live in and derive their employment and income from the country's rural areas. Agriculture thus contributes to economic growth, employment creation and foreign exchange earnings.

Traditionally, the keeping of livestock in Kenya was valued more for its social significance than for any economic advantage. Hence large numbers of livestock were kept without regard to their quality as this was considered a sign of great wealth. Cattle, sheep and goats were used for bride price, settlement of disputes and other ceremonial and ritual occasions. Feasting on the same took place at major social events such as weddings and funerals. Although, all the different ethnic communities kept livestock, currently, pastoralism, as was previously practiced remains the domain of various nomadic communities found mainly in the arid and semi arid lands which comprise 70% of the total land area.

Although, large tracts of land in the ASAL region are devoted to livestock activities and maintain approximately 50% of the total animal numbers, commercial activities are practiced more in large and small-scale farms of the rich agricultural highland areas. These comprise roughly 30% of the total land area. Small holder livestock production is significant in that most farmers have about 2 ha and they maintain almost 50% of the remaining livestock in the country.

The bulk of agricultural land in Kenya is devoted to crop production, which is easier and cheaper to undertake and has greater yields. However, livestock activities contribute 7 – 10% of total agricultural output and although commercial production is still underdeveloped, it is believed to have a high potential for growth and hence contribute to food security and poverty alleviation. The main constraints are limitations associated with intensive animal rearing, environmental degradation and lack of good quality, non-expensive feeds.

Production

Cattle are the dominant species of livestock kept by all groups of farmers and pastoralists with small holders having about 1 million of them. The second largest group is the sheep and goats. The sheep are kept mainly in the temperate highland zones while goats are found on the drier lowlands and ASAL zones. Also of importance are poultry, pigs rabbits and camels.

Table: Livestock numbers (Tropical livestock Units (TLU)) in '000 by type of farming.

Ruminants	Type of farming					
	Small scale		Large scale		Pastoralists	
	No.	TLU	No.	TLU	No.	TLU
Zebu cattle	3900	2730	1500	1050	2500	1750
Grade cattle	1200	1200	270	270	-	-
Grade beef	90	90	400	400	-	-
Meat goats	4200	420	100	10	3400	340
Hair sheep	2300	230	100	10	3100	310
Wool sheep	400	60	200	30	-	-
Camels	-	-	-	-	640	640
Non ruminants						
Poultry	10,900	109	1000	10	12,000	120
Pigs	57	11	18	4	-	-
Rabbits	70	1	-	-	-	-
Donkeys	70	35	-	-	-	-

1. Cattle

These include improved African breeds such as the East African Zebu and introduced breeds from Europe and India that have been adapted for local conditions. They may be divided into three (3) types:

- Beef type: These are used entirely for meat and include Hereford, Shorthorn and Aberdeen - Angus
- Milk type: These, such as Friesian, Ayrshire and Channel Islands are used only for milk production;
- Dual-purpose type: Includes those, which produce more meat than the dairy type and more milk than the beef type for example Dairy Shorthorn, Redpoll and South Devon. Several Indian types are also available for beef or as dual purpose such as the Sahiwal. The Zebu, though now recognized as a breed, are not classed as the introduced types, but through improvement are able to produce more meat and milk of higher quality for example the Kenya Boran and long horned cattle. The types of production systems are:

Production Systems

Type of farm	Type of animals	Type of feeding	Constraints
Large scale	mixed herds (good quality)	mixed feeding	expensive (high inputs)
Small scale	mixed herds (good quality)	intensive feeding	expensive (high inputs)
Pastoral	indigenous herds (poor quality)	free range	environmental degradation, overgrazing, etc.

2. Sheep and goats

Table 2: Sheep and goat distribution by type of farm and animal ('000)

	Hair sheep	Wool sheep	Meat goats	Milk goats
Large scale	200	300	300	-
Small scale	5,700	500	13,000	12
Pastoralists	7,100	-	3,500	-

As with cattle, both indigenous and introduced breeds are now well established. Exotic breeds which are kept for both meat and wool are kept in the cool, highland areas in the Rift Valley and Central Provinces while the local breeds are well adapted and are found all over the country including the arid and semi-arid regions. Indigenous breeds are mainly Maasai sheep (Kikuyu Red) and exotic are mainly Corriedale and Hampshire.

Goats are very well adapted in all regions of the country. Both indigenous types (East African goat) and exotic breeds (Saanen and Toggenburg) are kept. Previously condemned because of the damage they do to young trees, and hence the environment, they are now viewed as a valuable source of meat and are also kept for traditional wealth as the local cattle breeds, Apart from this they are hardy and suffer little from disease or worms. They also require minimum attention, do well in adverse environment and serve as a source of milk.

Three systems are used for their production:

	<u>System I</u>	<u>System II</u>	<u>System III</u>
Sheep	Small holder (indigenous, 25-30kg)	Cross breeds (improved mgt, increased meat production)	Intensive (mainly wool sheep)
Goats	Small holder (15kg)	Dual purpose; increased meat, milk production	Intensive (exotic types increased production)

4. Pigs

Compared with cattle, sheep and goats, pigs are a relatively recent introduction and few are kept in Kenya. Current estimates put their numbers at 150,000 animals, 75% of which are kept by small holders in areas close to or in Nairobi and other big towns. All breeds are imported and improved for adaptability to local conditions. They include Large White and crosses between Large White and Landrace. Production is solely geared towards the pig processing industry and farmers concentrate on production of three classes to satisfy this demand. These classes are Baconers, Porkers and Sausage pigs. Several problems are associated with pig rearing and production. These include:

- periodic feed shortages
- high feed costs
- high capital investment costs
- absence of attractive marketing outlets in both rural and urban areas
- management problems

Three types of production systems:

1. System I: involves both breeding and fattening of pigs and is mostly carried out by small holders.
2. System II and III: Both are advanced commercial systems with long term development possibilities. System II breeds and sells weaners to farmers who specialize in production of baconers etc. These become System III where profitability of pig fattening is largely influenced by feed conversion rate.

5. Poultry

As with the pig industry, poultry rearing, for meat and eggs is relatively recent in Kenya. The native fowls are a common feature of every homestead in rural Kenya and constitute 70% of total poultry numbers. Their main problem is low productivity with regard to meat and eggs. Ducks and turkeys are also kept by a few farmers, especially for the food service and processing industries. Small holders produce 90% of all poultry. Of the exotic breeds, 75% are broilers reared intensively and close to the large towns.

Four types of production systems are in use:

1. Traditional system: mainly subsistence oriented, least intensive system.
2. Semi-commercial systems: Dual-purpose operation for production of both meat and eggs for both home consumption and sales.
3. Commercial egg production.
4. Commercial broiler production: capital intensive and least farm integrated.

The government, in an effort to encourage and enhance livestock production, has put in place several policies to facilitate the development of this important subsector. These include:

Stocking Policy, Price Policy, Marketing policy, Breeding Policy, Animal Health Policy, Feeding Policy, Research Policy, Education Policy.

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Goats	Small holder (15kg)	Dual purpose; increased meat, milk production	Intensive (exotic types increased production)

The main constraints to livestock development are:

- Animal breeds and breeding
- Animal nutrition and feeding
- Animal health
- Extension services
- Processing and storage facilities
- Lack of adequate quality standards for production, processing and handling
- Education, training and consumer awareness

UTILIZATION

1. Slaughter

Licensed abattoirs found throughout the country carry out slaughtering of cattle, sheep and goats. Large commercial slaughterhouses such as the Kenya Meat Commission previously played an important role in providing hygienic meat and meat products both for local as well as import markets. These have suffered some management problems and are now not operational. Commercial slaughter is still carried out by private slaughterhouses whose products are aimed at the processing industry or export particularly to the Arab Gulf States. Sheep and goats are also sold live to individuals who slaughter them at home, but the government does not encourage this practice.

The main slaughtering plant for pigs is the Farmer's Choice Company, which is also a pork processing plant and supplies both fresh pork and its products to local and overseas markets. Others include NAS Meat Products, though they purchase most of the carcasses from Farmer's Choice. Commercially produced broiler chickens are slaughtered at the Kenchic Factory, which is the only factory of its kind in Kenya. The native chickens are sold live to consumers at local markets, which may also provide slaughtering services on demand.

2. Processing and consumption

On average, beef, lamb, pork mutton or goat yield approximately 14% bone, 20% fat and 60% lean. These are sold as whole carcasses or sides and butchers then fabricate them into bone-in or boneless cuts with varying quantities of fat. Fresh meat is the most widely consumed. Offal, blood and other edible portions are also consumed and demand depends on location.

Fresh poultry meat is also popular, particularly the tougher one from indigenous birds. However, most of the population view chicken as a celebration meal to be consumed only at Christmas, Easter and other cultural and religious highlights of the year. There is a growing market for chicken parts, processed chicken products and giblets especially in urban areas where demand for convenience foods is high. Eggs are also widely consumed and contribute to about 15 of the total food supply. They can

however, if prices are controlled, contribute to increased consumption of animal proteins, which are lacking.

Table: Class, amount and percentage of different meat products in Kenya.

Class of products	Amount (kg)	Percent of total (%)
Fresh meat – All	41,219,331	69.7
Cured meats (not smoked or cooked)	4,598,367	7.8
Smoked, dried and cooked meats	4,593,795	7.8
Sausages – All	5,036,381	8.6
Canned meats	2,213,450	3.7
Convenience meat items (burgers, pizza, meat pies, etc)	1,447,280	2.4
Total (Processed meats)	<u>17,889,813</u>	<u>30.3</u>
Total (all meats)	<u>59,109,144</u>	<u>100.0</u>

CONSTRAINTS TO LIVESTOCK DEVELOPMENT

- Proper policy development and implementation
- Animal breeding, nutrition and health
- Education, training and consumer awareness
- Environmental degradation
- Alternative sources of animal feeds apart from maize, which is the main staple, and therefore expensive if used as animal feed.
- Inadequate meat processing plants and meat storage facilities.
- Lack of strict implementation of legislation for consumer protection and safety.
- Poor meat and meat products quality standards.
- Poor marketing and management therefore lack of demand by consumers, especially for good quality products.
- Poor economic performance of the country.

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CONSUMPTION PATTERNS OF DAIRY PRODUCTS IN
KENYA,
(KARI/MoA/ILRI)



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FINAL REPORT

12/6/2000

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Executive Summary

This report presents the results of a Consumer Characterisation study carried out collaboratively in 1998 and 1999 by ILRI, MoA, KARI and CBS (Central Bureau of Statistics) in Nairobi and Nakuru districts of Nairobi and Rift Valley provinces. The aim of the study is to assess the dairy consumption patterns of rural and urban households in comparison to other goods and services, to identify the sources of consumed milk and to assess the milk handling practices of consumers. The changes that have taken place in the Kenyan dairy sub-sector since the liberalisation of the milk markets in 1992 have also influenced the households' dairy consumption patterns, hence the study aims at capturing this change. The households' awareness of public health hazards associated with consumption of informally marketed milk is also sought.

Study findings

The rural households consume higher quantities of dairy products than their urban counterparts. On average they consume about 29 Kg of dairy products, in comparison to 25 Kg by Nakuru and 22 Kg by Nairobi urban households per month. 93 % of the Nakuru households buy raw milk in comparison to 29 % in Nairobi district. In Nairobi, the proportions of households consuming raw milk appear to increase with higher levels of income class, although the effect is seasonal. This is in contrast to Nakuru where the percentage of households consuming raw milk decrease with an increase in income level. The households rank raw fresh milk "Best", in terms of taste, price and butter fat content. However, in Nairobi Pasteurised is more available than the raw milk. Few households in both districts consume the more processed milk products, citing them as being very expensive.

The mean price of raw milk per Kg in Nakuru is Ksh 20.8, while in Nairobi it is Ksh 31.9, being almost 35 % higher than Nakuru. There is no significant difference in milk price between the two seasons partly because there was no unique identification of seasons.

The main purchase points of raw fresh milk in Nakuru is the producer gate (66 %) and milk bars/shops (29 %), while in Nairobi, it is the street vendors ("hawkers") (40 %) and milk bars/shops (59 %). This suggests lower chances of milk contamination in Nakuru than Nairobi because of the shorter market channel directly from producers to consumers. However, when split by income categories, the higher income earners in both Nakuru and Nairobi obtain milk directly from producers.

The main form of raw milk treatment prior to consumption is boiling, with 100 % and 96 % of the households boiling in Nairobi and Nakuru districts respectively, those not boiling mainly take it in ingredient such as tea or porridge.

The main constraining factors to Nairobi households, for not consuming raw milk is its' unavailability, bad quality and health risks. The more highly processed products are not commonly consumed because of their high prices thus making them unaffordable.

There's low bovine related disease incidences reported by the households, 2 % in Nairobi, 5 % in Nakuru rural and 1 % in Nakuru urban.

The common processors in Nairobi from which the households report purchasing their product brands include KCC, Limuru Dairies, Brookside, Aberdare and Spinknit dairies. In Nakuru they include KCC, Ilara, Spinknit, Delamere and Premiere. However, the number of households purchasing the different brands fluctuated across the seasons implying expansion and collapse of certain processors.

Conclusions

The results clearly show that there are various factors that influence consumption of certain dairy products. Tastes and preferences play a key role in the consumption of raw milk among the high - income earners of Nairobi district, while the product price of the more processed dairy products influences consumption in both districts. However, availability of the product overrules the rest of the factors in terms of importance.

Consumption is mainly of liquid milk in both districts. Consumption of raw milk is higher in the rural than urban areas. Informal milk market channels play a major role in milk marketing in addition to providing services such as delivery functions (especially hawkers), making it convenient to the consumer. Many private processors have come up and some have been expanding overtime. However their operations tend to be area specific though some like Spinknit have expanded to both districts.

Large consumer price differentials exist in the two locations, mainly because the rural areas are milk-producing points, hence they can be termed as milk surplus areas in comparison to urban areas.

Introduction

The study has been conducted using as a guideline, ILRI's Conceptual Framework for Dairy Research, which is multi-disciplinary in design and takes a production-to-consumption approach to the analysis of a dairy system. In the context of the conceptual framework it comprises the production, processing, marketing and consumption sub-systems (Rey et. al, 1993). Research and development of research activities is phased. Phase 2 of the conceptual framework entails the "detailed characterisation of dairy systems which include quantification of their sub-systems, components and sub-components, at the household level for consumption, and at the firm or individual level for production, processing and marketing" (Rey et. al, 1994)

The objectives of this research phase are to:

- Provide baseline data on the status of consumption system
- Identify factors influencing dairy production with constraint and opportunity for increased consumption
- Identify and prioritise researchable issues
- Understand the linkages between production, processing, marketing and consumption
- Analyse the dairy products' demand
- Assess households' awareness of the public health hazards associated with consumption of informally marketed milk

Sampling Methodology

The study was carried out in two districts in Kenya, Nairobi and Nakuru representing both urban and rural populations. Thirty representative clusters were selected out of the available 120 Central Bureau of Statistics determined clusters in each district. Seven households were then randomly selected from each of the thirty clusters, making a total of about two hundred and ten households in each district.

A household level questionnaire (annex 1) was designed to cover various aspects of consumption, such as:

- Factors influencing dairy products demand
- Levels of consumption of dairy products as well as other goods and services and the seasonality aspects,
- Dairy product preferences,
- Constraints for increased dairy product consumption,

- Households' practices in relation to public health hazards associated with consumption of raw milk, and
- Total household income, which assesses the households' purchasing power

Milk samples were also picked from the households surveyed for purposes of testing for the presence of milk-borne zoonoses as well as the milk quality of consumed milk.

Results and Discussion

Households' classification

Table 1: Households surveyed in Nairobi and Nakuru districts

	Nairobi	Nakuru
<i>Household Category</i>		
Rural		260 (64 %)
Urban	413 (100 %)	149 (36 %)
Total	413	409

A total of 408 households were surveyed in both districts between October – November 1998, the same households were visited again between May and June 1999 to assess for seasonality differences in consumption. A total of 822 households were surveyed during both seasons. The households were classified by geographical location, i. e. rural or urban. 64 % and 36 % of the households surveyed in Nakuru belonged to the rural and urban clusters respectively.

Consumption of Dairy Products

Levels of Consumption

Table 2: Total amount of dairy products consumed per household per month, in LME (Liquid Milk Equivalent) by district and location

	October – November 98 (Season 1)			May – June 99 (Season 2)		
	Nairobi	Nakuru urban	Nakuru rural	Nairobi	Nakuru urban	Nakuru rural
Mean lt./Month	19.5	21.8	33.2	24.3	27.7	24.5
Per capita consumption per month (lt.)	3.9	3.6	5.5	4.9	4.6	4.1
Standard Deviation	16.4	16.5	43.6	27.1	27.5	25.0
Median value	15.0	16.7	21.7	15.0	21.0	21.0

During both periods Nairobi households dairy products' consumption was lowest compared to the Nakuru rural and urban households. The Nairobi and Nakuru urban households in comparison to the October – November period, report higher consumption in May – June period. The per capita consumption of dairy products is much lower than recorded in the Kenya Dairy Master Plan of 1991 (64 Lt. for rural households and 125 Lt. for urban households). However, the quantities consumed increase as the income increases, refer to Figure 1 below:

Figure 1: Average Amount of Dairy Products Consumed per Household, per Month, by income groups

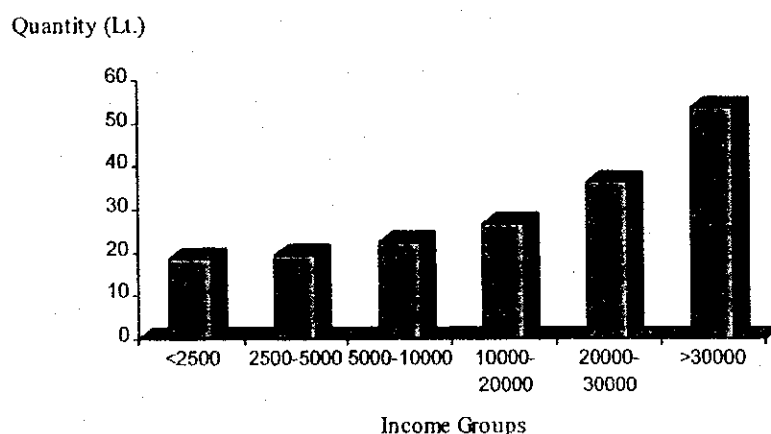


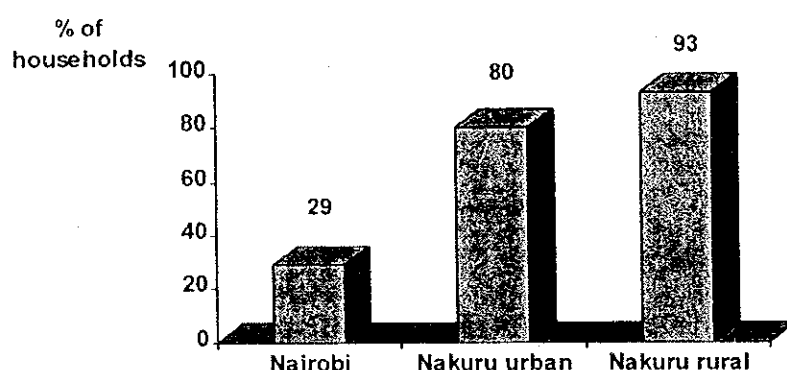
Table 3: Amounts of various milk products consumed per household per month, in LME¹ (Liquid Milk Equivalent) for the surveyed districts by household class (Lt.)

	Nairobi urban (n = 413)		Nakuru urban (n = 149)		Nakuru rural (n = 259)	
	Mean	S. D.	Mean	S. D.	Mean	S. D.
Raw milk	5.1	11.6	19.7	22.1	28.3	35.7
Pasteurized milk	14.0	16.7	3.2	9.0	0.2	1.2
Mala	1.6	5.8	1.1	3.0	0.2	1.2
Other processed product	1.27	7.6	0.6	3.3	0.1	1.3
Total	21.9		24.6		28.8	

Consumption is mainly of liquid milk, raw and pasteurized milk. 29 % of households in Nairobi bought raw fresh milk (average 5.1 litres/hh/month) in comparison to 93 % of households in both Nakuru urban (average = 19.7 litres/hh/month) and rural (average = 28.7 litres/hh/month) refer to Figure 2 below. The rural households, some of whom are producers as well, mainly consume raw fresh milk, with an average of approximately 1litre per household per day.

The quantity of dairy products consumed decreases as degree of processing increases as is evident in the quantities of butter, cheese and milk powder consumed. The main reason to this is attributed to the high cost of these products, as well as the different frequencies at which these products are consumed and this may vary considerably in a month.

Figure 2: Consumption of Un - processed (Raw) Milk



Over 80 % of the households surveyed in Nakuru consume raw milk in comparison to 29 % in Nairobi. However, in Nairobi, the proportion of households consuming raw milk appeared to increase with higher levels of income class, although this effect was seasonal, implying that preferences play a major role in the consumption of raw milk. This is in contrast to Nakuru where the percentage of households consuming raw milk decreased with an increase in income level. This may be attributed to the fact that high-income classes have a choice of what milk type to consume, in comparison to the medium and low-income earners who have income as a constraining factor. Most of the households consuming raw milk actually boil it prior to consumption. 100 % of households in Nairobi, 100% in Nakuru urban and 96 % in Nakuru rural reported boiling milk prior to consumption. Pasteurised milk is also frequently boiled indicating that boiling is mainly to lengthen shelf life. Those "not boiling" consume it in foods such as tea and porridge.

Points of Purchase of Dairy Products

¹ Conversion factors of various milk products to liquid milk equivalent (LME) (Source FAO,1978)

Liquid milk: Butter = 1: 6.6

Liquid milk: Yoghurt = 1:1

Liquid milk: Ghee = 1: 8

Liquid milk: Ice cream = 1: 0.75

Liquid milk: Cheese = 1: 4.4

Liquid milk: Milk powder = 1:7.6

The points of purchase of the dairy products consumed depend on the type of product. The Un-processed raw milk is purchased mainly from producer's gate, shops or street vendors. However the processed products are mainly sourced from shops and supermarkets.

Figure 3: Point of Purchase of Raw Milk in Nairobi

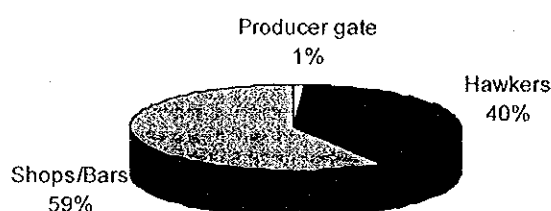
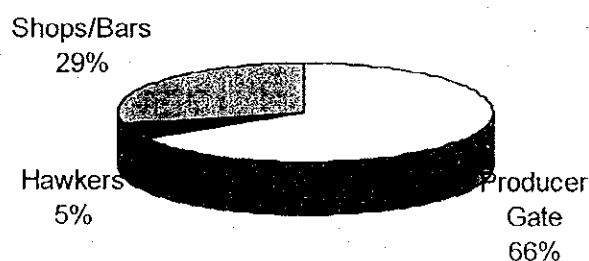


Figure 4: Points of Purchase of Raw milk in Nakuru district



The main point of purchase of raw fresh milk in Nakuru is the producer's gate (66 %) and the milk bars/shops (29%) while in Nairobi it is mainly shops/milk bars (59 %) and street vendors (40 %). However, the higher income categories (monthly income > 30,000) in both districts mainly purchase from the producer's gate.

Milk Price

Prices of Common Dairy Products

Table 4: Milk consumer prices

Milk and Milk products	Mean Price per Litre			
	Nairobi		Nakuru	
	Season 1	Season 2	Season 1	Season 2
Raw Fresh milk	31.9	31.4	20.8	20.8
Packed fresh milk	40.0	41.0	40.0	43.3

There is no much seasonal variation in milk prices across the two districts. However, the price of raw fresh milk is 35% higher in Nairobi in comparison to Nakuru, which is attributed to costs associated with the long marketing channel as opposed to purchase from the producer gate, which is common in Nakuru. The price of packed pasteurized milk is almost the same in the two districts.

Dairy product preferences

Preferences between raw fresh milk, packed fresh milk and UHT milk was asked, based on the outlined criteria below, and the results were as follows:

Table 5: Summary of the scores of the milk types by criterion of preference

<i>Criteria of Preference</i>	Scores		
	Best	Medium	Least
Taste	Raw milk	Pasteurised milk	UHT milk
Price	Raw milk	Pasteurised milk	UHT milk
Shelf life	UHT milk	Pasteurised milk	UHT milk
Butterfat	Raw milk	UHT milk	Pasteurised milk
Availability	Raw milk *	Pasteurised milk	UHT milk
Overall	Raw milk*	Pasteurised milk	UHT milk

Raw fresh milk is ranked best in terms of taste, price, and high butterfat content. In Nakuru it also ranked best in terms of availability, however in Nairobi it ranked second, with pasteurised milk ranking highest in terms of availability. Overall, raw milk is ranked best then pasteurised milk and least preferred is UHT milk by the Nakuru households, while in Nairobi pasteurised milk is ranked best then raw milk and finally UHT milk.

Comparing consumer preferences and consumer behaviour reveals that there is a discrepancy between the two in Nairobi, because the consumers are not consuming what they prefer, though this is influenced by the product availability. In Nairobi pasteurised milk is more readily available and hence highly consumed.

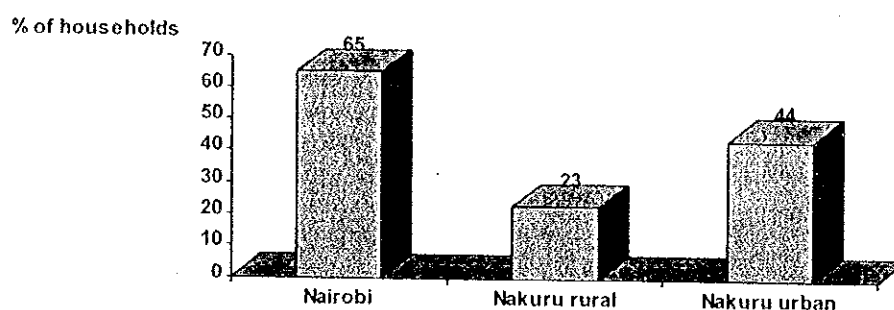
Table 6: Preferences between Home made fermented milk and Mala (cultured milk)

<i>Criteria of Preference</i>	Nairobi		Nakuru	
	Best	Least	Best	Least
1. Taste	Mala	Home made	Home made	Mala
2. Price	Home made	Mala	Home made	Mala
3. Shelf life	Mala	Home made	Mala	Home made
5. Availability	Mala	Home made	Home made	Mala
OVERALL	Mala	Home made	Home made	Mala

In Nairobi, cultured milk (Mala) ranks best overall and in terms of taste, shelf life and availability while home-made fermented milk ranks best in terms of price. In Nakuru, home made fermented milk is ranked best overall and in terms of taste, price and availability.

Awareness of public health hazards resulting from raw milk consumption

Figure 5: Households aware of the public health hazards associated with raw milk consumption



More consumers in Nairobi (65 %) seem to be aware of the public health risks associated with raw milk consumption compared to Nakuru rural (23 %) and Nakuru urban (44 %). This can partly explain the reason why many households (over 80 %) in both Nakuru and Nairobi boil milk prior to consumption.

Table 7: Disease Incidences related to Consumption of Raw Milk

	Nairobi		Nakuru Rural		Nakuru Urban	
	n	%	n	%	n	%
Brucellosis	1	0.2	8	3	0	0
Tuberculosis	6	1.5	5	1.9	2	1.3
Total	7	1.7	13	4.9	2	1.3

There are low disease incidences related to raw milk consumption. However tuberculosis is a bit common in comparison to brucellosis however it has not been established yet it is bovine related.

Materials used for Milk Purchase

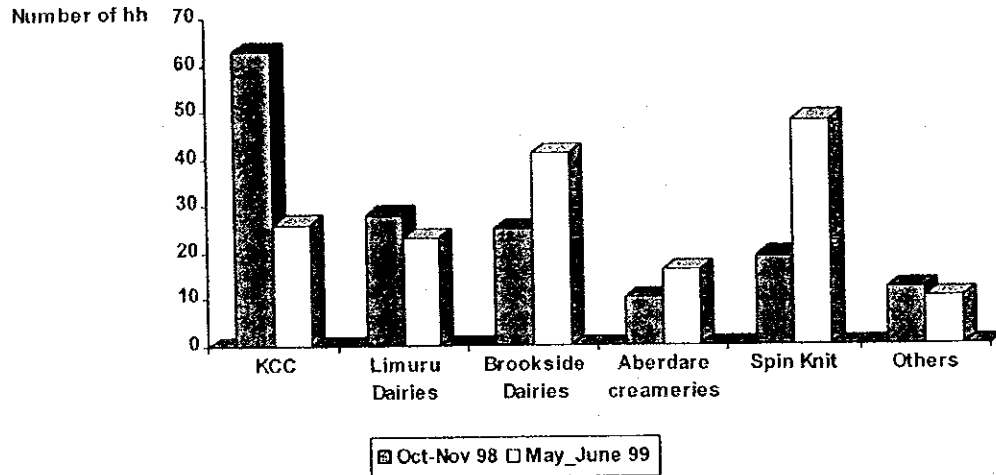
Table 8: Type of material used for purchasing raw milk

Material	Nairobi		Nakuru	
	n	%	n	%
Plastic	22	20	170	47
Polythene paper bags	76	69	71	20
Glass	4	4	47	13
Metallic	7	6	73	20

The most common container used for purchasing raw milk by consumers is polythene paper bags and plastic containers in Nairobi and Nakuru districts respectively. In Nakuru, few households report using metallic containers.

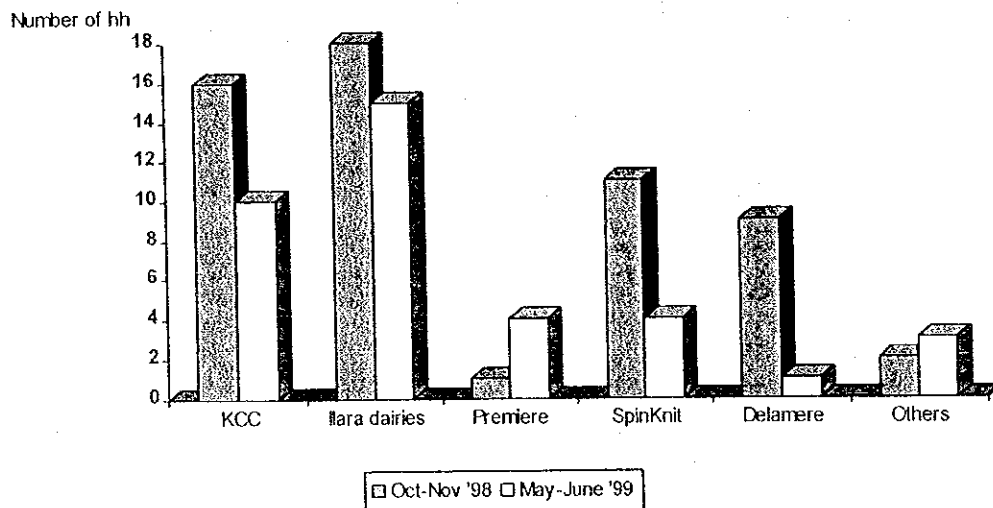
Brands of consumed dairy products

Figure 6: Brands of Dairy Products consumed in Nairobi



The most common processors in Nairobi include the KCC, Limuru dairies, Brookside, Aberdare and Spinknit. However the number of households purchasing the KCC dairy products brand declined by almost half during the second season (May – June '99) attributable to the collapse of KCC, while more households purchased the brands from Brookside, Spinknit and Aberdare processors which have continued to expand overtime.

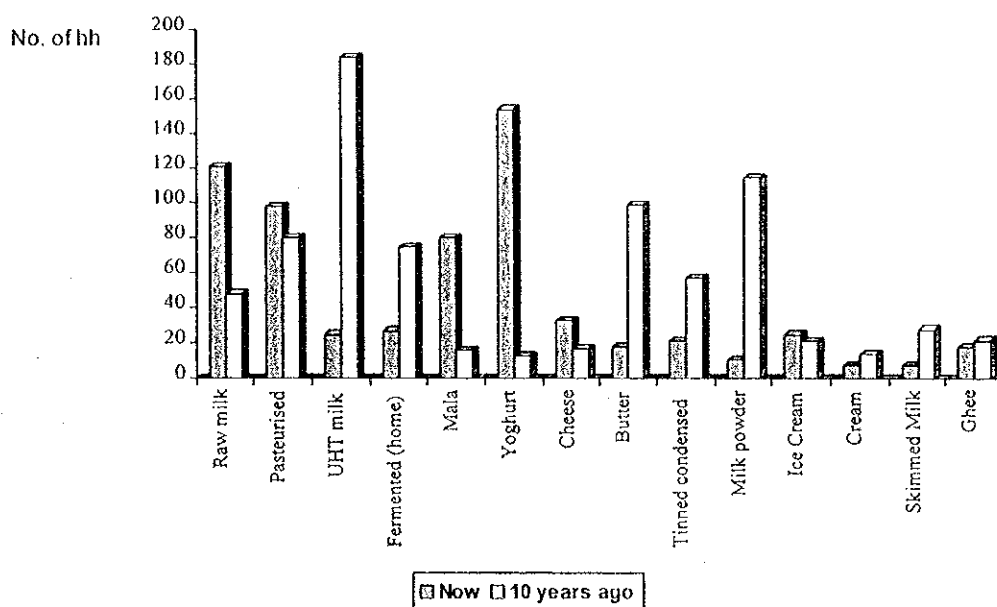
Figure 7: Brands of Dairy Products consumed in Nakuru district



The common processors in Nakuru include KCC, Ilara, Spinknit, Delamere and Premiere. Others include Egerton and Aberdare creameries. Fewer households report purchasing the different brands during the second season of the survey in comparison to the first, with the exception of purchases from Premiere which increased.

Comparison of Dairy Products Consumption Patterns

Figure 8: Comparison of Dairy products consumed now and 10 ears ago



A higher percentage of households report consuming raw fresh milk, pasteurised milk, yoghurt and Mala now than 10 years ago. On the other hand more households report consuming home made fermented milk, butter, milk powder UHT milk, tinned condensed milk and skimmed milk before than now. Some of the products such as milk powder and UHT milk were more readily available before than now. Yoghurt is consumed more now than before because it is more available as a result of the increase in the number of processors.

Dairy consumption constraints

Table 9: Consumption constraints among Nairobi households

Raw milk

	n	%
Not available at purchase point	35	10
Bad quality	89	27
Health risks	137	42

The stated constraints were based on households' response and constitute problems that need to be overcome. 42 % and 27 % of the households reported not consuming raw milk because of the health risks involved and bad quality respectively. This can be overcome at both the producer as well as the market level, through non-adulteration of milk and observation of high standards of hygiene while handling milk. 10 % of the households reported it not being available at the purchase points. The other processed milk products such as butter and ghee are very expensive and thus not affordable to most households. The Nakuru households' record not consuming pasteurized milk because it's not available at the purchase point and its too expensive.

Expenditures on food and non - food items among Nairobi and Nakuru households

Table 10: Expenditure on food and non-food Items per month

Item	Total expenditure per household per month Nairobi		Total expenditure per household per month Nakuru	
	Season 1	Season 2	Season 1	Season 2
	Food items			

Total food expenditure (% of food expenditure)	4959.4 (30.6)	6083.04 (27.3)	3112.0 (37.8)	3007.5 (40.9)
<i>Non - food items</i>				
Services	6176.5	7989.51	2083.8	2142.9
Cloth	1350.8	1031.08	839.5	550.4
Fuel	761.9	875.8	481.6	410.5
Durables	217.0	2601.1	193.5	85.4
Others	2736.1	3714.4	1528.5	1149.0
<i>Total non - food expenditure</i>	<i>11242.3</i>	<i>16211.89</i>	<i>5126.9</i>	<i>4338.2</i>
<i>(% non - food expenditure)</i>	<i>(69.4)</i>	<i>(72.7)</i>	<i>(62.2)</i>	<i>(59.1)</i>
<i>Total food and non food expenditure</i>	<i>16201.7</i>	<i>22294.93</i>	<i>8238.9</i>	<i>7345.7</i>

According to the table above, Nakuru households' food expenditure constitute a higher proportion of the total household expenditure in comparison to the Nairobi households. This is because of the higher expenditure on non - food items such as rent and transport by the latter. The non - food expenditure forms a larger proportion of the households' expenditure in both districts.

Table 11: Expenditure on milk and milk products, per household per month

	Nairobi		Nakuru	
	Season 1	Season 2	Season 1	Season 2
Expenditure on dairy products	790.47	1173.4	571.77	609.9
Expenditure on food	4959.4	6083.04	3112.0	3007.5
% of dairy products expenditure	(15.9)	(19.3)	(18.4)	(20.3)

Expenditure on dairy products seems lower in Nakuru than Nairobi, however this is as a result of lower milk price, though quantities consumed per household is higher than Nairobi. The proportion of dairy products over the total food expenditures is lower in season 1 than season 2 in both districts, attributable to higher quantities consumed during the second than the first season since. Table 4 indicates no significant difference in the milk prices between the two seasons. Overall, the share of dairy products expenditure ranges between 0.16 - 0.20.

Annex 1: Preference between raw fresh milk, Pasteurised milk and UHT milk

<i>Criteria of preference</i>	Nairobi Mean score			Nakuru Mean score		
	Raw fresh milk	Packed fresh milk	UHT milk	Raw fresh milk	Packed fresh milk	UHT' milk
Taste	1.67	2.04	2.26	1.28	1.95	2.59
Price	1.3	1.82	2.88	1.02	2.01	2.96
Shelf life	2.8	1.98	1.14	2.43	2.17	1.22
Butterfat	1.5	2.34	2.07	1.33	2.28	2.24
Availability	2.07	1.15	2.72	1.07	2.03	2.87
Overall	2.17	1.38	2.42	1.14	2.04	2.8

Key: 1 = Best 2 = Medium 3 = Least preferred

Annex 2: Preference between cultured packed milk (Mala) and home made fermented milk

<i>Criteria of Preference</i>	Nairobi		Nakuru	
	Home made fermented milk	Packed cultured milk (Mala)	Home made fermented milk	Packed cultured milk (Mala)
1. Taste	1.58	1.42	1.44	1.53
2. Price	1.19	1.81	1.03	1.96
3. Shelf life	1.85	1.16	1.78	1.18
4. Butterfat	1.33	1.67	1.17	1.80
5. Availability	1.76	1.24	1.19	1.77
OVERALL	1.67	1.31	1.29	1.67

Annex 3: Preference between raw fresh milk, Pasteurised milk and UHT milk, by income categories

Income groupings:

High: > Ksh 20000 per month

Medium: Ksh 5,000 - 20000

Low: < Ksh 5,000

Criteria of Preference	Nairobi					
	High income group		Medium income group		Low income group	
Taste	Best	Medium	Least	Best	Medium	Least
Price	Raw milk	Pasteurised	UHT milk	Pasteurised	Raw milk	UHT milk
Shelf life	Raw milk	Pasteurised	UHT milk	Raw milk	Pasteurised	UHT milk
Butter fat content	UHT milk	Pasteurised	UHT milk	UHT milk	Pasteurised	Raw milk
Availability	Raw milk	Pasteurised	UHT milk	Raw milk	UHT milk	Pasteurised
Overall	Pasteurised	Pasteurised	UHT milk	Pasteurised	Raw milk	UHT milk

Criteria of Preference	Nakuru					
	High income group		Medium income group		Low income group	
Taste	Best	Medium	Least	Best	Medium	Least
Price	Pasteurised	Raw milk	UHT milk	Raw milk	Pasteurised	UHT milk
Shelf life	Raw milk	Pasteurised	UHT milk	Raw milk	Pasteurised	UHT milk
Butter fat content	UHT milk	Pasteurised	Raw milk	UHT milk	Pasteurised	Raw milk
Availability	Raw milk	Pasteurised	UHT milk	Raw milk	Pasteurised	UHT milk
Overall	Pasteurised	Pasteurised	UHT milk	Raw milk	Pasteurised	UHT milk



