

Rockefeller-UDSM Funded Projects

Promotion of Community based Commercial Cultivation of Herbal Medicines and Packaging of Herbal Nutritional Supplements.

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Final Project Report

Introduction

The devastation resulting from immunodeficiency in HIV/AIDS patients predisposes patients to a multitude of opportunistic infections, ranging from bacterial, fungal, viral, and protozoa infections and malignancies such as Kaposi's sarcoma and non-Hodgkin's lymphomas. The availability of antiretroviral drugs (ARVs), which reduce viral load and help to restore the immune system, has given hope to those who can afford them. However, for the majority of people the availability of ARVs is a luxury that they can not afford. The only available option is to deal with the emerging opportunistic infections so as to reduce illness episodes. The availability of easily accessible and cheap drugs for the treatment of opportunistic infections would be of great relief to patients. Another important component in the management of HIV/AIDS patients is availability of adequate nutrition that ensures maintenance of good health and constant repair of the ailing immune system.

The use of herbal medicines could contribute significantly towards the treatment of opportunistic infections and supply of nutritional supplements to cope with the devastation of immunodeficiency. It is generally acknowledged that traditional herbal medicinal preparations provide an easily accessible, and possibly cheap alternative therapy to a number of patients with various disease conditions (1). The search for potential herbal medicines that can be used for the treatment of HIV/AIDS is an option that has been considered by a number of researchers since the onset of the pandemic (2, 3). Apart from directly catering for the needs of the patients the plants could also serve as a means for generating income, and thus alleviate income poverty in line with aspirations of the Tanzania National Strategy for Growth and Reduction of Poverty (NSGRP).

This project aimed to promote local cheap processing, packaging, and developing simple herbal preparations to add value to herbal medicines with therapeutic and nutritional potential, and in so doing enhance marketability of the products thus creating a source of income, and contribute to reduction of income poverty.

This project targeted 3 plants *Hibiscus sabdariffa*, *Moringa oleifera*, and *Aloe vera*.

These three plants are reputed for their medicinal and nutritional properties and are being suggested as valuable plants that can be used as a source for nutritional supplements, particularly for HIV/AIDS patients who would also derive the benefit of protection from opportunistic infections.

Study Objectives

General objective

Promotion of cultivation of specific herbal medicinal plants with nutritional supplements for income generation and support for HIV/AIDS patients

Specific objectives

- (i). Promotion of local cheap processing, packaging, and developing simple herbal preparations to add value to herbal medicines and create a source of income.
- (ii). Promotion of production of value-added standardized herbal medicines of the currently used medicinal plants with therapeutic and nutritional potential.
- (iii). Promotion of use and trade in herbal nutritional supplements

Strategic goal of the project

The main strategic goal of the project is contribution to the National Strategy for Growth and Poverty Reduction through cultivation of herbal medicines as nutritional supplements, and for income generation. Medicinal plants are a viable source of income which can be adopted without demand for a very heavy investment. Many people in Tanzania have experience of growing and processing non-medicinal herbs and spices (drying, milling, packing), an experience which can be translated into the processing of medicinal herbs.

The project implementation

Promotion of local cheap processing, packaging, and developing simple herbal preparations to add value to herbal medicines and create a source of income

A workshop was conducted consisting of 25 small scale food processors to train them on different aspects of processing and packaging of herbal nutritional supplements. The processors were introduced to the use of solar drying techniques to prepare herbal nutritional supplements. They were also introduced to methods for processing and packaging of herbal material, quality control, packaging and labelling:

Promotion of the production of standardized herbal medicines to add value to the currently used medicinal plants with therapeutic potential, or which can be used to meet nutritional deficiencies, particularly among HIV/AIDS patients.

The activities involved:

- Development of formulations from extracts of *Hibiscus subdarifa*, *Moringa oleifera*, and *Aloe vera*, such as capsules, packaged powders, juices, topical preparations and teas.
- Standardization of products using TLC and HPLC including development of product chromatographic finger prints, and possibly achieve the goal of registering these products.
- Purchase of equipment for product development and production, to include Stainless steel solvent extraction tank (100 litres) fitted with an electric stirrer, Solar drying beds, vacuum packing machine for powders/granules, packaging and labelling material, and bottle sealing machine

Promotion of use and trade in herbal nutritional supplements

- This involved participation in exhibitions, involving farmers in cultivations, and collaboration in establishing markets.

Results

The results and achievements that were made are reported in three key results areas.

Key results area I: Promotion of local cheap processing, packaging, and developing simple herbal preparations to add value to herbal medicines and create a source of income

A. Processing and packaging of herbal material.

- Plastic packaging materials was sourced from AMKA and 1000 plastic bags were purchased. These were used to package raw Rosella calyces and powdered Moringa leaves. Two packet sizes, 50 g and

100 g of Rosella calyces, and Moringa leaves were made. These are now being used at the Institute and by some farmers to pack products. Two sizes for packing 50 g and 100 g are now available.

- Labels were designed, and 5000 labels for Rosella calyces were printed which are now being used on packets that are being sold to customers. The Institute has invited one NGO group based in Kilosa which is cultivating rosella to use the labels on their product as one way to bring in community participation.
- One workshop was conducted at Kongowe Kibaha District that involved 25 food processors. Different aspects of food processing, and packaging of herbal nutritional supplements were addressed. They were introduced to the production of different products of Rosella, Moringa and *Aloe vera*. A lot of interest was shown by participants, and some indicated interest to invest in processing export products.
- Three solar dryers were erected close to the farm and used for demonstration.
- 1 plastic bag thermal sealing machine was acquired which is being used to seal bags of rosella calyces and powdered Moringa leaves.



Figure 1: Demonstration solar dryer for drying herbal nutritional Supplements



Figure 2: Packed Rosella calyces representing simple Packaging of nutritional supplements for direct use

B. Acquisition of simple equipment for extraction, drying, formulation, and packaging of medicinal plant products

- The Institute has managed to purchase four machines; a miniature granulator, Vacuum drying machine, Automatic granule packing machine, and a groove type mixer to build capacity for the production of herbal formulations
- One 85 litre water jacket boiler for making juice was fabricated which is already being used to produce the Morizella drink.



Figure 3: A hot water extraction jacket for preparing juice.

Key results area II: Promotion of production of value-added standardized herbal medicines of the currently used medicinal plants with therapeutic and nutritional potential..

- Oil from Moringa seeds and extract of the leaves has been used to prepare a skin ointment that is being used by HIV/AIDS patients to relieve itching and for removal of skin spots.
- A blended Moringa and Rosella drink "Morizella" was developed, which is now being sold for Tshs 500/500 ml bottle, as a nutritional supplement with antioxidant, hypocholesterolemic, memory enhancing, and other health benefits.
- Proximate analysis of Morizella is being done to enable registration and commercialization of the product.
- Two new products, a juice containing extract of rosella alone, and a drink containing *Aloe vera* extract and propolis are still at an early stage of development.



Figure 4: Morizella juice made from Rosella calyces and Moringa leaves for use as a nutritional supplement.

Key results area III: Promotion of use and trade in herbal nutritional supplements

A. Involvement of small scale farmers in production of herbal supplements

- Twenty five (25) food processors and 2 entrepreneurs have joined activities of the project. This group is interested to put up a joint premise for processing herbal nutritional supplements. However, they require start up financing. The Institute contemplates to work jointly with the group to develop this activity.
- The Institute has worked closely with Jipe Moyo, a community based group based in Dodoma which is promoting the use of herbnaal nutritional supplements by HIV/AIDS patients. Two participants from the group participated in a workshop to promote cultivation that was organized by the Institute. The group also held a joint exhibition of herbal supplements with the Institute in the 2006 International Trade Fair Exhibitions.

B. Income generation from sale of herbal nutritional supplements

- Small scale farmers have been invited to grow rosella at Kongowe and sell the crop to the Institute for product formulation. One farmer has been successful in selling rosella calyces to the Institute production unit, and realized an income of Tshs 100,000.
- A Kilosa based NGO which is promoting commercial cultivation of rosella sold to the Institute production unit 300 Kg of rosella calyces at a price of Tshs 6000/kg, thus realizing an income of Tshs 1,800,000. The group has been allowed to use Institute labels for packed rosella calyces to promote income generation.

- The formulations developed by the Institute are already bringing a good income. The Institute is realizing between Tshs 300,000 and 650,000/month from sale of these products. This will directly form a source of income for the farmers who are selling raw materials to the Institute.

Impact of the project

A. Impact to the Institute, College, and University

- Through this project the Institute has been able to develop marketable products that are helping to generate income
- The Institute has had opportunity to contribute to implementation of government policies; namely the National Nutrition Policy and the National Strategy for Growth and Reduction of Poverty.
- The Institute has been facilitated to strengthen research and Development capability for herbal medicines through acquisition of production machines
- The Project has contributed to training of students. Two students have been facilitated to do their undergraduate projects and have been given opportunity to participate in herbal product development.
- The project contributes directly to College efforts to fight HIV/AIDS and improvement of the lives of people living with AIDS.
- At University level the project contributes to the University wide Goal no. 6 which addresses enhancing linkages with the productive sectors and the society.

B. Impact to the nation

- The project directly addresses reduction of income poverty and sustenance of livelihoods by providing nutritional supplementation. Already small scale farmers are generating income from the sale of rosella calyces and Moringa leaves. *Aloe vera* products are also in the offing, which will create another source for income.
- Nutritional supplements are being made available to the people to use. These supplements are good for improving the nutritional status of HIV/AIDS patients, pregnant mothers and malnourished children. This is in line with implementation of the National Strategy for Growth and Reduction of Poverty (NSGRP), and the National Nutrition Policy.
- An industrial component is already becoming a reality as the available juice is likely to pass for industrial scaling up. Once data for proximate analysis becomes available there is possibility to patent

The future of the project

There are a number of activities that need to be done so as to ensure continuity of what has been initiated with the current funding. These activities include:

- Development of architectural drawings for renovation/modification of designated herbal medicines production laboratory
- Renovation and upgrading of the laboratory to a GMP compliant unit
- Installation of 5 machines that have been acquired from China

- Determination of proximate composition and shelf life of Morizella
- Determination of a suitable flavour and proximate composition and microbial content of rosella juice
- Development of juice from *Aloe vera* and Propolis, determination of proximate composition
- Identification of supplier for juice containers and attractive labels for developed products
- Identification of supplier for juice containers and attractive labels for developed products
- Promotional campaigns, registration and identification of interested industrial partner to produce the developed products.

These activities require sustainable funding. Already some income is being realized from the sale of the developed products which are becoming popular to users. This income can be ploughed back to support research and development activities. However, at the present time the income has not reached a threshold to significantly support research and development activities, therefore, additional sources of funding need to be identified.

Appendix 1: INFORMATION ON HIBISCUS SABDARIFFA, MORINGA OLEIFERA AND ALOE VERA.

A. INFORMATION ON *HIBISCUS SABDARIFFA*

Hibiscus sabdariffa L.(Malvaceae), also known as roselle is a native to Old World Tropics, probably in the East Indies; but now it is cultivated throughout the tropics. It is being cultivated in some areas of Moshi, Morogoro, Coast, and Dodoma. The plant is a source of a red beverage known as jamaica in Mexico (said to contain citric acid and salts, serving as a diuretic). In the West Indies and elsewhere the fleshy calyces are used fresh for making roselle wine, jelly, syrup, gelatin, refreshing beverages, pudding, and cakes, and dried roselle is used for tea, jelly, marmalade, ices, ice-cream, sherbets, butter, pies, sauces, tarts, and other desserts. Fruits are edible (5). Perry cites one study showing roselle's usefulness in arteriosclerosis and as an intestinal antiseptic (6). Roselle is cultivated primarily for the fiber obtained from the stems. The fiber strands, up to 1.5 m long, are used for cordage and as a substitute for jute in the manufacture of burlap.

Folk Medicine

Reported to be antiseptic, aphrodisiac, astringent, cholagogue, demulcent, digestive, diuretic, emollient, purgative, refrigerant, resolvent, sedative, stomachic, and tonic. Roselle is a folk remedy for abscesses, bilious conditions, cancer, cough, debility, dyspepsia, dysuria, fever, hangover, heart ailments, hypertension, neurosis, scurvy, and strangury. The drink made by placing, the calyx in water, is said to be a folk remedy for cancer. Medicinally, leaves are emollient, and are much used in Guinea as a diuretic, refrigerant, and sedative; fruits are antiscorbutic; leaves, seeds, and ripe calyces are diuretic and antiscorbutic; and the succulent calyx, boiled in water, is used as a drink in bilious attacks; flowers contain gossypetin, anthocyanin, and glucoside hibiscin, which may have diuretic and choloretic effects, decreasing the viscosity of the blood, reducing blood pressure and stimulating intestinal peristalsis. In Burma, the seeds are used for debility, the leaves as emollient. Taiwanese regard the seeds as diuretic, laxative, and tonic. Philippines use the bitter root as an aperitif and tonic (6). Angolans use the mucilaginous leaves as an emollient and as a soothing cough remedy. Central Africans poultice the leaves on abscesses. Alcoholics might consider one item: simulated ingestion of the plant extract decreased the rate of absorption of alcohol, lessening the intensity of alcohol effects in chickens (5).

Pharmacology

Extracts of the calyx have *in vivo* and *in vitro* antioxidant activity. The extract exhibited antihypercholesterolemic, antinoriceptive and antipyretic activity (7). The extracts have a strong antihypertensive activity in rats and man and have a very low degree of toxicity (7).

Chemistry

Per 100 g, the fruit contains 49 calories, 84.5% H₂O, 1.9 g protein, 0.1 g fat, 12.3 g total carbohydrate, 2.3 g fiber, 1.2 g ash, 1.72 mg Ca, 57 mg P, 2.9 mg Fe, 300 µg β-carotene equivalent, and 14 mg ascorbic acid. Per 100 g, the leaf is reported to contain 43 calories, 85.6% H₂O, 3.3 g protein, 0.3 g fat, 9.2 g total carbohydrate, 1.6 g fiber, 1.6 g ash, 213 mg Ca, 93 mg P, 4.8 mg Fe, 4135 µg β-carotene equivalent, 0.17 mg thiamine, 0.45 mg riboflavin, 1.2 mg niacin, and 54 mg ascorbic acid. The inflorescence, per 100 g, is reported to contain 44 calories, 86.2% H₂O, 1.6 g protein, 0.1 g fat, 11.1 g total carbohydrate, 2.5 g fiber, 1.0 g ash, 160 mg Ca, 60 mg P, 3.8 mg Fe, 285 µg β-carotene

equivalent, 0.04 mg thiamine, 0.6 mg riboflavin, 0.5 mg niacin, and 14 mg ascorbic acid (8). Seeds contain 7.6% moisture, 24.0% crude protein, 22.3% fat, 15.3% fiber, 23.8% N-free extract, 7.0% ash, 0.3% Ca, 0.6% P, and 0.4% S. Seed extracted with ether contained 0.7% fat, 29.0% protein, and 32.9% N-free extract (9) Component acids of the seed lipids were 2.1% myristic-, 35.2% palmitic-, 2.0% palmitoleic-, 3.4% stearic-, 34.0% oleic-, 14.4% linoleic-, and 3 unusual HBr-reacting fatty acids (cis-12, 13-epoxy-cis-9-octadecenoic (12,13-epoxoleic) 4.5%; sterculic, 2.9%; and malvalic, 1.3%). Two other studies (10, 11) report on the sterols in the seed oil, 61.3% β -sitosterol, 16.5% campesterol, 5.1% cholesterol, and 3.2% ergosterol (said to be rare in vegetable oil but the most common mycosterol in most fungi, including yeast). Seed has properties similar to those of cotton seed oil, and is used as a substitute for crude castor oil. Karkade (dried-flowers minus-ovary) contains 13% of a mixture of citric and malic acid, two anthocyanins gossipetin (hydroxyflavone) and hibiscin, and 0.004–0.005% ascorbic acid. Petals yield the flavonal glucoside hibiscitrin, which yields a crystalline aglycone—hibiscetin ($C_{15}H_{10}O_9$). Flowers contain phytosterols. The dried flower contains ca 15.3% hibiscic acid ($C_6H_6O_7$). Root contains saponins and tartaric acid. Calyces contain 6.7% proteins by fresh weight and 7.9% by dry weight. Aspartic acid is the most common amino acid. Dried fruits also contain vitamin C and Ca oxalate; dry petals contain flavonol glucoside hibiscitrin.

B. INFORMATION ON *ALOE VERA*

Common name: *Aloe vera*

Biological name: *Aloe barbadensis* L. (Alocaceae)

Aloe vera (*Aloe barbadensis* L. (Alocaceae))

is one of the oldest known therapeutic herbs and is renowned worldwide as a healing plant. It originated in the Cape Verde islands off the West African Coast. First mentioned in the Egyptian "Papyrus Ebers" in 1550 B.C. for its medical and embalming value, aloe vera was supposedly used to embalm the body of Christ.

Both the Greek historian Dioscorides and the Roman naturalist Pliny recommended *Aloe vera* about 2,000 years ago as an effective remedy for constipation, burns, wounds, bruises, skin irritations, kidney problems and more.

The plant contains a variety of amino acids, enzymes, vitamins and minerals and it comes closer than any other known plant to the duplication of life's essential substances in the biochemistry of the human body. It has natural healing and detoxifying powers and works gently within the intestinal tract to help break down impacted food residues and thoroughly cleanse the bowel. It can help ease constipation and prevent continuing diarrhoea. *Aloe vera* is a stimulant to the immune system, a powerful anti-inflammatory, and analgesic and is able to speed up cell growth. *Aloe vera* contains a large number of mucopolysaccharides (basic sugars), which are found in every cell in the body and contains large numbers of nutrients including vitamins E, C, B1, 2, 3, and 6 as well as minerals like Fe, Mn, Ca and Zn. Seven essential amino acids and fatty acids are also found in *Aloe vera* (12-16). This plant should be promoted as a nutritional supplement to HIV/AIDS patients, who are likely to realize a lot of benefit from its use.

C. INFORMATION ON *MORINGA OLEIFERA*

Moringa oleifera Cam (Syn. *Moringa pterygosperma* Gaertner), commonly referred to as "drumstick tree" or "horseradish tree", belongs to the monogeneric family *Moringaceae* which grows throughout most of the tropics and is native to sub-Himalayan tracts of North-West India, Pakistan, Bangladesh and Afghanistan. It is a large shrub or small tree well distributed in Africa and Asia. Its leaves and pods have great nutritional value, yield many vitamins and minerals. Parts of the tree can also be used as

animal forage, a domestic cleaning agent, perfume, dye, fertilizer, medicine, water clarifying agent, fiber for rope, and as an agent for tanning hides (17).

Leaves and pods of *Moringa oleifera* can be an extremely valuable source of nutrition for people of all ages. For example, for a child aged 1-3, a 100 gram serving of fresh leaves would provide all his daily requirements of calcium, about 75% of his iron and half his protein needs, as well as important supplies of potassium, B complex vitamins, copper and all the essential amino acids. As little as 20 grams of fresh leaves would provide a child with all the vitamins A and C he needs. Twenty (20) grams of fresh leaves will satisfy all the daily requirement of vitamin C of pregnant and lactating mothers. For both infants and mothers, pods can be an important source of fiber, potassium, copper, iron, choline, vitamin C and all the essential amino acids. Six rounded spoonfuls of leaf powder will satisfy nearly all of a woman's daily iron and calcium needs during times of pregnancy and breast-feeding.

The numerous medicinal uses of Moringa are well documented. Moringa is used in the treatment of rheumatism and gout, helps lower high blood pressure and possesses anti-bacterial and anti-cancer properties. All parts of the Moringa plant are of medicinal importance and are used in folk medicine for treatment of numerous ailments. The fruits, seeds and flowers are all considered to be nutritious vegetables. The leaves are extremely rich in essential nutrients such as β -Carotene, Vitamin C (ascorbic acid), iron and free leucine. For example, the β -carotene content of the leaves is three times as high as in carrots, 4 times calcium in milk, 3 times potassium in milk, 2 times the protein in milk and seven times the vitamin C in oranges (18-21).

Moringa seed extracts are also efficient as a primary coagulant for wastewater treatment to remove suspended solids, microorganisms and even some metals. In developing countries, Moringa seed coagulants are a viable alternative to expensive and toxic chemical coagulants such as aluminium sulphate (alum) for purifying drinking water.

Uses of *Moringa oleifera* in Traditional Medicine

Moringa oleifera is already highly esteemed by people in the tropics and sub-tropics for the many ways it is used medicinally by local herbalists. Some of these traditional uses reflect the nutritional content of the various tree parts. The following are but some of the ways the tree is used in Asia, Africa and the Americas. In recent years, laboratory investigation has confirmed the efficacy of some of these applications (22, 23).

Leaves

Juice from leaves have a stabilizing effect on blood pressure and is used to treat anxiety. An infusion of leaf juice is believed to control glucose levels in cases of diabetes. Mixed with honey and followed by a drink of coconut milk 2 or 3 times a day, leaves are used as a remedy for diarrhea, dysentery and colitis (inflammation of the colon). Leaf juice, sometimes with carrot juice added, used as a diuretic (to increase urine flow). Eating leaves is recommended in cases of gonorrhoea on account of the diuretic action. Leaves and young buds are rubbed on the temple for headache. In India and the Philippines, a poultice made from fresh leaves is applied to reduce glandular swelling. It was reported that Malaysians sometimes applied a leaf poultice to the abdomen to expel intestinal worms. Leaf juice is sometimes used as a skin antiseptic. In India, leaves used to treat fevers, bronchitis, eye and ear infections, scurvy and catarrh (inflammation of the mucus membrane). Leaves are considered to be anthelmintic (able to kill intestinal worms). Leaves are used as an irritant and as a purgative. In Nicaragua, Guatemala and

Senegal, leaves are applied as poultice on sores and skin infections. In the Philippines, eating leaves is believed to increase a woman's milk production and is sometimes prescribed for anemia.

Flowers

Flowers are traditionally used as a tonic, diuretic, abortifacient and anthelmintic. Flowers are also used to cure inflammations, muscle diseases, tumors and enlargement of the spleen. In India, juice pressed from the flowers is said to alleviate sore throat and catarrh. In Puerto Rico, an infusion of the flowers is used as an eye-wash and a decoction from the flowers has been used to treat hysteria.

Pods

Pods are believed to be anthelmintic. Pods are used in affections of the liver and spleen, and in treating articular pains (pain in the joints).

Roots

In India, roots are used as a carminative (promotes gas expulsion from the alimentary canal, against intestinal pain or spasms) and as a laxative. Roots are considered useful against intermittent fevers and are sometimes chewed to relieve cold symptoms. Juice from roots is applied externally as a rubefacient (skin tonic), counterirritant or vesicant (agent to induce blistering). Roots are used as an abortifacient, diuretic and a cardiac and circulatory tonic. Roots are used to treat epilepsy, nervous debility and hysteria. In Senegal and India, roots are pounded and mixed with salt to make a poultice for treating rheumatism and articular pains. In Senegal, this poultice is also used to relieve lower back or kidney pain. Roots are used as a purgative. In India, Indo-China, Nicaragua and Nigeria, a root poultice is used to treat inflammations, especially swelling of tissues in the foot (pedal edema). A decoction of roots is used to cleanse sores and ulcers. In India and Indo-China roots are used to treat cases of scurvy. Root juice mixed with milk is considered useful against hiccupping, asthma, gout, lumbago, rheumatism, enlarged spleen or liver, internal and deep-seated inflammations, and calculous affections. Crushed root mixed with rum has been used as a liniment on rheumatism. A snuff made from roots is inhaled to relieve earache and toothache. A juice made from a combination of fresh roots, bark and leaves is inserted into the nostrils to arouse a patient from coma or stupor.

Root bark and Stem bark

In Senegal, root and tree bark are used to treat sores and skin infections. Bark is regarded as useful in treating scurvy. In India, stem and root bark are taken as appetizers and digestives. In Senegal, a decoction of root bark, roots, leaves and flowers is used to treat epilepsy, hysteria, and intestinal spasms. In India, a decoction of the root bark is used as a fermentation to relieve intestinal spasm and is considered useful in calculous affections (mineral buildup/kidney stones). Stem bark is used to cure eye diseases. In India, stem and root bark are believed to be aphrodisiacs and anthelmintic. In India, root bark is said to prevent enlargement of the spleen and formation of tuberculous glands of the neck, to destroy tumors and to heal ulcers. Juice from root bark is put into the ear to relieve earaches and also placed in a toothache cavity as a pain killer. Bark is used as a treatment for delirious patients. In the Philippines it is believed that, roots, chewed and applied to a snakebite, will keep the poison from spreading. Bark is used as a rubefacient and as a vesicant. In India, bark is sometimes mixed with peppercorns and used as an abortifacient (although often with fatal consequences).

Gum

Gum, mixed with sesame oil, is used to relieve headaches. This is also poured into ears for the relief of earache. In Java, gum is given for intestinal complaints. In India, gum is used for dental caries. Gum is considered to be diuretic. In India and in Senegal, gum is considered useful in treating fevers, dysentery and asthma. Gum is used as an astringent and rubefacient (skin tonics). In India, gum is sometimes used as an abortifacient. In India, gum is used to treat syphilis and rheumatism.

Seeds

Seeds are used against fevers. Flowers, leaves and roots used as remedies for various tumors, and the seed for abdominal tumors. In Aruba, a paste of crushed seeds is spread on warts.

Seed Oil

In India, seed oil is applied externally to relieve pain and swelling in case of gout or rheumatism, and to treat skin diseases. Oil is used to treat hysteria and scurvy. Oil is applied to treat prostrate and bladder troubles. Oil is considered to be a tonic and a purgative. Some of the above traditional remedies have been supported by recent laboratory studies (22, 23).

Chemistry

Per 100 g, the pod is reported to contain 86.9 g H₂O, 2.5 g protein, 0.1 g fat, 8.5 g total carbohydrate, 4.8 g fiber, 2.0 g ash, 30 mg Ca, 110 mg P, 5.3 mg Fe, 184 IU vit. A, 0.2 mg niacin, and 120 mg ascorbic acid, 310 µg Cu, 1.8 µg I. Leaves contain 7.5 g H₂O, 6.7 g protein, 1.7 g fat, 14.3 g total carbohydrate, 0.9 g fiber, 2.3 g ash, 440 mg Ca, 70 mg P, 7 mg Fe, 110 µg Cu, 5.1 µg I, 11,300 IU vit. A, 120 µg vit. B, 0.8 mg nicotinic acid, 220 mg ascorbic acid, and 7.4 mg tocopherol per 100 g. Estrogenic substances, including the anti-tumor compound, β-sitosterol, and a pectinesterase are also reported. Leaf amino acids include 6.0 g arginine/16 g N, 2.1 histidine, 4.3 lysine, 1.9 tryptophane, 6.4 phenylalanine, 2.0 methionine, 4.9 threonine, 9.3 leucine, 6.3 isoleucine, and 7.1 valine. Pod amino acids include 3.6 g arginine/16 g N, 1.1 g histidine, 1.5 g lysine, 0.8 g tryptophane, 4.3 g phenylalanine, 1.4 g methionine, 3.9 g threonine, 6.5 g leucine, 4.4 g isoleucine, and 5.4 valine. Seed kernel (70–74% of seed) contains 4.08 H₂O, 38.4 g crude protein, 34.7% fatty oil, 16.4 g N free extract, 3.5 g fiber, and 3.2 g ash. The seed oil contains 9.3% palmitic, 7.4% stearic, 8.6% behenic, and 65.7% oleic acids among the fatty acids. Myristic and lignoceric acids have also been reported. The cake left after oil extraction contains 58.9% crude protein, 0.4% CaO, 1.1% P₂O₅ and 0.8% K₂O. Pterygospermin, a bactericidal and fungicidal compound, isolated from *Moringa* has an LD₅₀ subcutaneously injected in mice and rats of 350 to 400 mg/kg body weight. Root-bark yields two alkaloids: moringine and moringinine. Moringinine acts as cardiac stimulant, produces rise of blood-pressure, acts on sympathetic nerve-endings as well as smooth muscles all over the body, and depresses the sympathetic motor fibers of vessels (24).

Pharmacology

Moringa leaf extract has been shown to be effective in lowering blood sugar levels within a space of 3 hours, albeit less effectively than the standard hypoglycaemic drug, glibenclamide. Effects increased with larger doses (25).

An extract taken from dried leaves showed an impressive ability to heal ulcers in laboratory animals. Administration of daily doses by injection caused a very significant improvement in the healing rate in induced gastric ulcers (26).

An extract made from dried powdered leaves was shown to have a very potent depressive effect on the central nervous system, resulting in significant muscle relaxation, decreased body temperatures and increased sleep time among laboratory mice. Subjects receiving the highest dosages spent twice as much time asleep as the control group (27).

An extract from dried roots, applied orally to laboratory mice, demonstrated clearly that the roots possess antiinflammatory properties. In another study, infusion of seeds, roots and flowers significantly inhibited the formation of pedal edema, although the authors concluded that the seed infusion may be the only one worthy of further investigation (28, 29).

An infusion made from seeds demonstrated an ability to inhibit intestinal spasms, as well as some diuretic activity.

An *in vitro* study showed that an aqueous extract made from seeds is effective against *Pseudomonas aeruginosa*, *Staphylococcus aureus* and *Escherichia coli*. This study showed the seed extract to be equally effective as Neomycin against *S. aureus*. Similar results were obtained with aqueous extracts from the roots (30). Fresh leaf juice has showed some positive inhibition of *Pseudomonas aeruginosa* and an extract from leaves was found to be effective at inhibiting the growth of the fungi *Basidiobolus haptosporus* and *B. ranarum*. The *in vitro* anti-fungal effects of the extract compared favorably with the effects of some conventional drugs used to treat zygomycotic infections (31).

Aqueous extract from stem bark were shown to increase the rate of heart contractions at low concentrations and decrease the rate at high concentrations, with the effect of lowering blood pressure. Moringinine (32), from root bark, acts on the sympathetic nervous system and acts as a cardiac stimulant, relaxes bronchioles (bronchial tube inflammation) and inhibits involuntary intestinal tract movement. Anthonine, also found in root bark, is highly toxic to the cholera bacterium (32).

Spirochin, found in the roots, is anti-gram+ bacteria, analgesic, antipyretic, affects the circulatory system (by raising or lowering heart beat, depending on dose), and affects the nervous system. In high doses it can paralyze the vagus nerve. Also found in roots and seeds, benzylisothiocyanate (which works against fungi and bacteria) may be even better than medicinally utilized benzylisothiocyanate and other isothiocyanates (32).

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**WARSHA YA MAFUNZO YA WASINDIKAJI WA BIDHAA MBALI
MBALI ZA MLONGE, ROSELLA, NA ALOE VERA ILIYOFANYIKA
KONGOWE, KIBAHA TAREHE 14-9-2006**

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Moringa oleifera



Warsha hii ilifunguliwa na Dr. Mainen Moshi, Mkurugenzi wa Taasisi ya Madawa Asili ya Chuo Kikuu Kishiriki cha Sayansi za Tiba, Muhimbili. Aliwataarifu wanasemina kuwa asilimia 80 ya wananchi wa Tanzania ni wakulima wa mazao mbalimbali, lakini kuna tatizo kubwa la usindikaji na hivyo karibu asilimia 30 ya mazao mengi huharibika. Lengo la warsha hii ni kujaribu kujenga tabaki la usindikaji wa hapa Tanzania kwa kuanzia na mkoa wa pwani. Kwa nini warsha hii inalenga kwenye usindikaji?

- a) ni njia ya utunzaji bora wa vyakula na hasa vinavyoharibika mapema kama matunda, mboga za majani, matunda na kadhalika.
- b) Kuongeza thamani ya mazao na kuweza kuyauza kirahisi katika sehemu mbalimbali za nchi na duniani kote
- c) Kuhifadhi virutubisho vya mazao hayo kwa matumizi ya binadamu
- d) Ni njia ya kuongeza kipato kwa wanachi wenye kipato cha chini na hivyo kuondoa umaskini

Alikazia kwa kusema ili kuboresha shughuli za uzalisha wa mazao ya wakulima na hivyo kuongeza pato la taifa ni vyema kuwepo na makundi mawili; wakulima wa mazao, na wanaosindika mazao hayo. Kwa hiyo Taasisi ya Madawa asilia leo hii inataka kujenga tabaka la wasindikaji ambalo ndiyo ninyi kwa kuanzia. Ninyi mtanunua mazao kutoka kwa wakulima na kuyasindika mazao hayo kwa ubora zaidi. Kufuatana na utambulisho wenu imefahamika kuwa tayari mmeshaanza kusindika vyakula. Lakini vina ubora unaotakiwa na kuweza kupewa hati ya viwango ili viuzwe kwenye masoko ya ndani na ya nje? Ni bidhaa zilizosindikwa vizuri na kupewa hati ya viwango vya ubora zitakazo ongeza pato kubwa katika familia, kikundi, wilaya na mkoa na mwisho taifa nzima?

Taasisi imeanza kutengeneza juisi kutoka katika mchanganyiko wa Rosella na Mlonge. Pia inatengeneza vidonge vya lishe. Lengo la juisi na vidonge vya lishe ni kuwasaidia waathirika wa UKIMWI kubosesha afya zao na kupunguza magonjwa nyemelezi. Mwelekeo ni mzuri. Alihitimisha hotuba yake kwa kuwatakiwa washiriki wa semina hiyo mafanikio mema na kuweza kutengeneza bidhaa bora zaidi zenye kupata hati viwango bora.

Washiriki wanategemea nini katika warsha hii?

Baada ya kupata taarifa ya ni nani na wanafanya nini katika usindikaji wa vyakula Dr. Nduguru, mmoja wa wawezeshaji, aliwauliza wakurufunzi wanategemea nini katika warsha iliyoandaliwa na Taasisi ya Madawa Asilia. Wakurufunzi walikuwa na mategemeo yafuatayo katika mafunzo haya:-

1. Kubadilishana uzoefu kuhusu usindikaji, utumiaji na masoko ya mazao ya mlonge, rosella na *Aloe vera*
2. Kupata teknolojia ya kusindika mazao hayo
3. Kutafutiwa njia ya kupata mikopo kuhusu bidhaa zao.

Katika kuyajadili yale waliyotegemea katika warsha hii, mjumbe mmoja anayetengeneza jam aliwaambia washiriki kuwa soko la ndani ni kubwa. Katika shughuli zake za kutengeneza jam amegundua kuwa soko ni kubwa mno na hawezi kukidhi soko hilo kwa sasa. Mjumbe mwingine alisema mkazo wa lishe ni kwa watoto, akina mama wajawazito na siku hizi kwa waathirika wa UKIMWI, bila kuwasahau wengine.

Mshiriki mwingine alishauri viwe vinatayarishwa vijarida kwa ajili ya kuelimisha wananchi kuhusu usindikaji wa vyakula, umuhimu wake na namna ya kutumia ili kuboresha afya za familia zao. Pia wananchi wapate nafasi ya kutoa maoni yao katika harakati za kuboresha usindikaji wa mazao na masoko ya mazao yanayosindikwa na hivyo kujenga mtandao wa wasindikaji.

Misingi ya usindikaji wa Mazao

Na Dr. G. Ndunguru

1. Maana ya usindikaji

Ni shughuli za kubadilisha malighafi na kuwa bidhaa bora, zenye thamani na za kudumu.

2. Sababu za kusindika mazao

- Kupunguza upotevu wa mazao
- Kuongeza maisha ya bidhaa
- Kuongeza au kubadili ladha
- Kuondoa sumu
- Kuboresha virutubisho
- Kurahisisha usafirishaji
- Kuongeza thamani
- Kurahisisha shughuli za soko

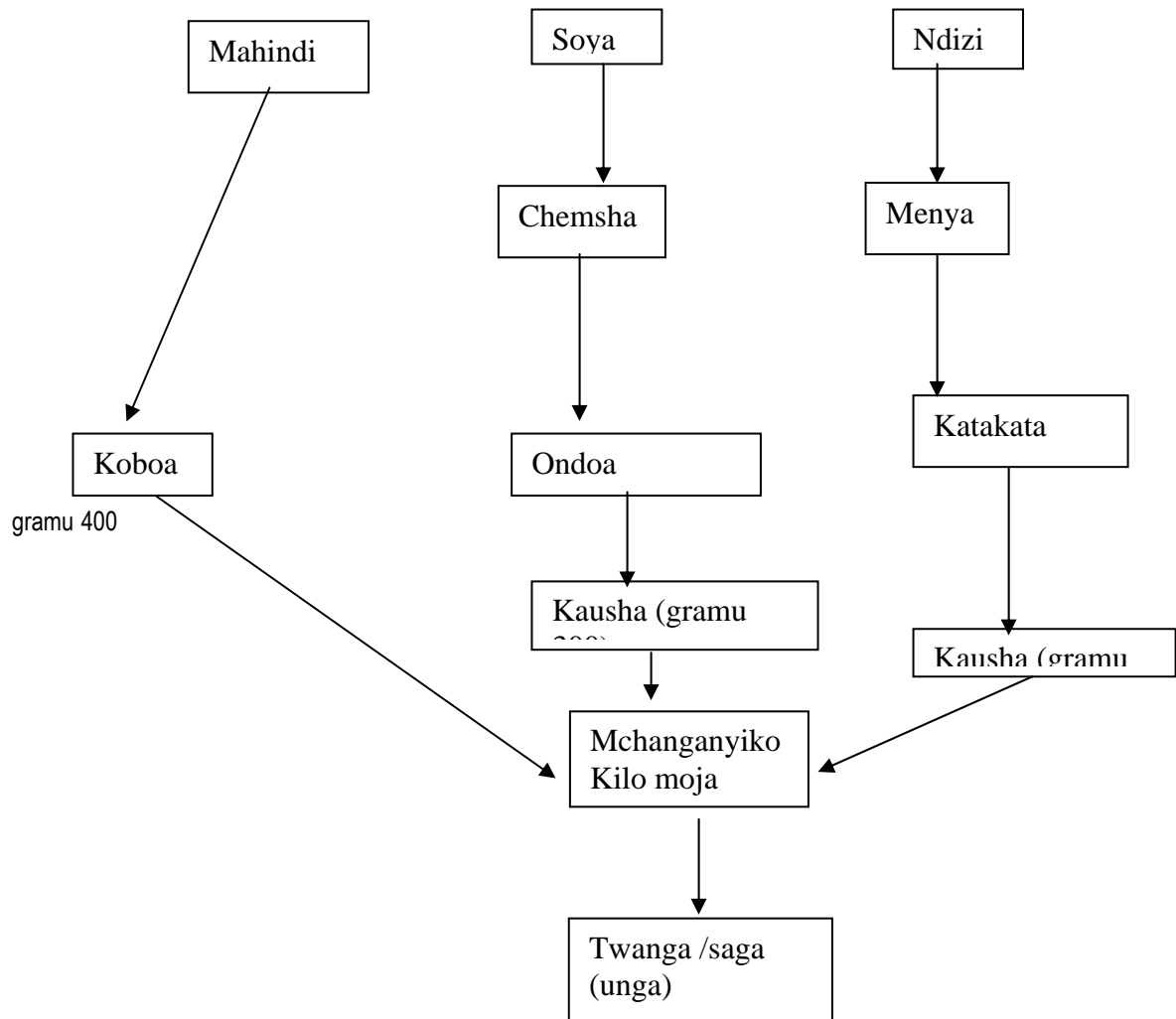
3. Bidhaa mbalimbali kutokana na mazao ya Mlonge, Rosella na Aloe vera

- Juisi
- Unga
- Majani yaliyofukutwa
- Jam
- Mvinyo
- Chakula (unga wa lishe)
- Dawa za aina mbalimbali

- Vipodozi
 - Sabuni
 - Rangi
4. Mambo ya Kuzingatia katika Usindikaji
- Mazingira ya sehemu ya kusindikia
 - Sehemu isiyojaa maji
 - Sehemu isiyo na vichaka
 - Sehemu inayofikika
 - Mambo ya kuzingatia
 - usafi – majengo , eneo la viwanda
 - wasindikaji
 - Vifungashio – bora na sahihi
 - Nembo
5. Umuhimu wa mazao husika (Mlonge, Rosella na Aloe vera)
1. Uwingu wa viini lishe vya aina mbalimbali
 2. Ni dawa
 - Hutibu maumivu ya mgongo
 - Hushusha shinikizo la damu
 - Hutibu ugonjwa wa goti
 - Huzuia saratani
 - Huondoa minyoo
 - Husaidia kutibu ugonjwa wa ngozi
 - Husaidia kulainisha tumbo
 - Hupunguza homa
 - Huondoa kikohozi
 - hupunguza rehamu
 - huongeza damu

Utengenezaji wa unga wa lishe

Na Dr. G. Ndunguru



Mtiririko Wa Utengenezaji wa Juisi na Mvinyo

Na Florence Lyimo

Hatua	Maelezo
1. Nunua/vuna	Chukua Rosella kiasi kinachotakiwa
2. Chagua	Chagua Rosella ili kuondoa takataka mawe n.k.
3. Loweka	Loweka Rosella kwenye maji ya moto yaliyochemka kwa muda wa dakika 10-15
4. Chuja	Chuja kwa kutumia chujio kubwa
5. Loweka	Weka tena maji , loweka na chuja , endelea kuongeza maji, hadi juisi /rangi yote itoke na upate kiasi cha juisi unayotaka kuchachua
6. Chujaa	Chuja juisi
7. Poza	Acha juisi ipoe hadi kufikia nyuzi joto 22–30C, sawa na joto la kuwaida la chumba (Room temperature)
8. Tayarisha	Andaa hamira ya kuchachulia. Weka hamira kwenye (kikombe) yenye joto la kawaida (25-30) weka sukari vijiko viwili vya chai na changanya. Acha kwa dakika 5-10 hadi ianze kuumuka
9. Changanya	Weka sukari kwenye juisi. Changanya vizuri hadi sukari yote iyeyuke
10. Pimaa	<ul style="list-style-type: none"> - Pima kiasi cha sukari kwa kutumia refractometer au hydrometer. Mfano kiasi cha sukari kikiwa nyuzi 90 hukupatia mvinyo wenye kileo cha kiasi 12-13% kwa ujazo - Pima kiasi cha tindikali kwa kutumia pH mita. Kiasi cha tindikali kinachotakiwa kuwepo kwenye juisi wakati wa kuchachua inatakiwa kuwa kati ya 3.1-3.5 pH - Pima joto la juisi, hakikisha halizidi joto la kawaida la chumba (22-30c)
11. Chachua	- Weka hamira kwenye mchanganyiko wa juisi na sukari, koroga, funika vizuri unaweza kutoa hewa moja kwa moja kwa kutumia mrija au kutumia dumu la kuchachulia lenye sehemu za kutolea hewa(air lock). Au chachua kwenye ndoo kwa siku tano hadi saba halafu chuja. Hamisha kwenye dumu la kutolea hewa. Kama dumu la kutolea hewa . Kama ni nyingi (zaidi ya 30C) unaweza kufunika dumu na kitambaa chenye maji baridi. Baada ya siku 10-14 pima kiasi cha sukari (Mvinyo unatakiwa uwe na sukari 0-10)
12.	Chuja mvinyo ili kuondoa makapi weka kwenye chombo safi chenye mfuniko imara usioruhusu hewa kuingia ndani. Acha kwa muda wa wiki 1-2 chuja tena na fanya hivyo mara kwa mara ili

	kuhakikisha unapata mvinyo mwepesi uliojichuja vizuri; inaweza kuchukua siku 21-90. Kama unachokifaa maalumu cha kuchujia (filter) unaweza kutumia na hivyo kupunguza muda wa kusubiri.
13. Kujaza /kufunga	Jaza mvinyo kwenye chupa safi funika /seal na weka lebo.
14. Hifadhi	Hifadhi mvinyo sehemu yenye joto la kawaida (room temperature)

Mvinyo wa Rosella

1. Rosella ni maua jamii ya haibiskasi ambayo yana rangi ya damu ya mzee au wekundu ulioiva.
2. Matumizi ya Rosella
 - a) kutengeneza biddhaa mbalimbali kama vile juisi, jamu na mvinyo
3. Rosella inaweza kutumika ikiwa
 - i) kavu
 - ii) mbichi
4. Rosella ina tindikali ya kutosha

Mvinyo lita 25

Viamba uppishi

1. Rosella kavu gramu 250 au robo $\frac{1}{4}$ kilo
2. Sukari kilo 6 au $6\frac{1}{2}$
3. Hamira (yeast) vijiko vya chai 8 au gramu 40

Vifaa

1. Mizani
2. Ndoo au galoni kubwa
3. Kipima joto
4. Kijiko cha chai
5. Mwiko
6. Sufuria kubwa
7. Beseni au bakuli kubwa
8. Mrija wa kutolea hewa
9. Chujio
10. Jiko (Mkaa au kuni)
11. Hydrometer / refractometer

Baada ya masomo ya vitendo wawezeshaji walidadisi jinsi ya utengenezaji wa bidhaa zilizotajwa wakati wa utambulisho. Bidhaa mbili zilitolewa maelezo jinsi zinavyo tengenezwa

1. Mango Peaco

Mahitaji

- Embe zilizokomaa na ambazo hazijaiva
- Chumvi
- Pilipili
- Haladani
- Uwatu
- Vinaga (siki)
- Sukari
- Mafuta

Namna ya kutengeneza Mango peaco**Hatua ya kwanza**

- osha embe kwa maji safi na salama , menya na kukatakata katika vipande vidogo
- Chachua embe kwa wiki 4
- Weka chumvi juu katika embe zilizomenywa (tazama kila wiki kuona kwamba chumvi iliyowekwa imeyeyuka)
- Baada ya wiki nne emba zitakuwa zimeshachushwa na tayari kwa kutengeneza mango peaco

Hatua ya pili

- chukua embe iliyochachushwa
- osha mara nne
- Acha zivuje maji
- Weka mchanganyiko wa pilipili, haladani, uwatu, siki, sukari kidogo, chumvi na mafuta
- Weka kwenye chupa safi na kuifunika- tayari kwa kuuza.

2. Kipodozi kwa ajili ya magonjwa ya ngozi*Utengenezaji wake*

Kundi hili lilitoa utangulizi kipodozi kinachotengenezwa, kwamba mara nyingi watu wanaosumbuliwa na chunusi au harahara kavu usoni au mgongoni au sehemu yeyote mwilini.

Mahitaji

- Aloe vera
- Ndimu
- Mafuta ya parachichi
- Maji safi

Namna ya kutumia mahitaji yaliyotajwa hapo juu kama kipodozi.

- Osha uso au sehemu iliyoathirika kwa sabuni yeyote ile.
- Kausha sehemu iliyooshwa
- Paka maji ya ndimu kwa kutumia pamba
- Osha tena uso bila sabuni kwa maji baridi
- Paka Aloe vera kwa kutumia pamba
- Baada ya dakika 10-15 paka mafuta ya parachichi
- Fanya hivyo mara mbili kwa siku kwa siku 21.

Mtizamo wa baadaye katika usindikaji wa vyakula

Wawezeshaji waliwagawa washiriki katika makundi matatu kujadili mtizamo wa baadaye baada ya mafunzo ya usindikaji wa vyakula. Yafuatayo yalipendekezwa:

1. Kuanza kutengeneza jamu na mvinyo wa Rosella na unga wa lishe.
2. Taasisi ya Madawa Asilia na Idara ya misitu Kibaha Kongowe wa wasaidie wasindikaji mazao eneo la kusindika vyakula (Processing Unit) ili vifikiwe viwango vinavyotakiwa
3. Taasisi ya Madawa Asilia iwasaidie wasindikaji vifungashio bora kwa bidhaa zilizosindikwa
4. Lishe bora isiwe tu kwa watoto, mama wajawazito na sasa kwa walioathirika na UKIMWI, bali iwe kwa wote ili kuboresha afya za familia na kuinga maradhi mbalimbali yanayotokana na ukosefu wa vyakula mbalimbali mwilini.
5. Kuwepo kwa semina mara kwa mara ili kuboresha viwango vya uelewa kuhusu usindikaji wa vyakula na pia kubadirishana mawazo.
6. Kutafuta masoko kwa bidhaa zinazo sindikwa

Washiriki wa warsha iliyofanyika katika ukumbi wa Mama Maria Nyerere Kongowe- Kibaha
Tarehe 14/09/2006

Namba	Jina	simu
1	Asha Jumapili	0784950797
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6	Conjesta Japhet	
7	Ruth Kaaly	
8	Joyce L.A. Kishombe	0787083977
9	Constancia Solomon	0754810804
10	Salafina Joseph	0754318639
11	Cleophamary Edwin	0754665986
12	Michael Ntoga	0755524265
13	Kessia Kilongozi	0752659989
14	Tunu Mazora	071347420
15	Hawa W. Mneka	0755392496
16	Fauzia Rauf	0784388999
17	Rauf Dawood	084388577
18	Nourmhamed Abdul Seliman	0784233280
19	Queen L. Msonde	
20	Christa Msemo	0744452413
21	Remmy Sheiza	
22	Iddi Yasin	
23	Famila Adam	
24	Raila Kinemo	
25	Mary Shaka	0745073984