

INNOVATIONS IN HOME SCIENCE

BY
Dr. Annie Ninan

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Published by

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ISBN: 978-93-5717-8587

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First Edition

Printed at Right click Printing Press, Manjeri, PIN 676121, Malappuram (DT), Kerala, India.

FOREWORD

Home Science education is a dynamic and ever growing field with many career opportunities. The institutes of Higher Education offering Home Science as a field of study have a scope of playing a significant role in research and innovation for the progress of the nation.

Innovation is no longer limited to creating value for individuals, business and society. The purpose of innovation is to help shape a smart future where people can enjoy the highest quality of life possible.

This book “Innovations in Home Science” provides a platform for researchers and students to present the most recent innovations, trends, practical challenges encountered and solutions adopted in the verticals of Home Science. I congratulate the authors who have envisaged this book including the various aspects of Home Science.

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EDITOR'S NOTE

Home Science has evolved into a sea of opportunities for entrepreneurs who have been instrumental in spurring social change and improving the way people live and work. The horizons are ever widening in Home Science with the application of technology and the innovation brought in with it. This book "Innovations in Home Science" is a collective effort to explore the viability of innovation opportunities in its multidisciplinary roots, creating an innovation friendly culture within the academic and research environment. It also provides specialised knowledge in the field of entrepreneurship development, innovation and creative ideas. We are happy to present this book which offers stimulating read for all practitioners in the field of Home Science.

The Authors extend their sincere thanks to the Principal, Manager and IQAC for the support and motivation rendered in publishing this book. We are indeed thankful to Mrs. Anitha Begum, Head of the Department for her wholehearted support. We express our gratitude to Mrs. Suhada. K.M., Coordinator of ISBN book. The editor owe her thanks to all her colleagues and students for their timely submission of the articles. We are grateful to Right click printing press and Media X, Manjeri for the designing and binding the book.

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CHAPTER 1

TRANSFORMING OLD JEANS TO VALUE PRODUCTS

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INTRODUCTION

Jeans are in no way eco-friendly. They possess more harm to the environment than good. The production of jeans is highly hazardous. Its manufacturing entails chemical residues, heavy metals, strong bleach, chemical agents and so many hazardous substances that not only pose a threat to the environment but also endanger the lives of people by causing problems such as respiratory illness, loss of hearing, skin cancer as well as brain damage. Jeans is one of the most popular fabrics in the world, so the environmental damage associated with the production of jeans is very dangerous. Huge usage of jeans, makes it waste. So recycling is the best method to reduce the wastage. Recycling is the process of converting waste material into new materials and objects.

Recycled denims are a great and creative way to dress up while giving ones contribution to the environment as well. Recycled products have the lowest carbon footprint. So, it's time to recycle, reuse and reduce carbon footprints

WEALTH FROM WASTE

Waste are basically things that we have consumed and used its primary purpose, then after doing so disposing them accordingly. Examples of this are papers that we have printed for school purposes, tin cans from spams and other preserved foods, even the boxes that our pair shoes came from, and then those leftover foods from our meals that we decided not to eat because either we are full already or not in the mood to eat. There is this idea or thought

that 'There is wealth from waste'. It is quite common idea for most but to shed light to others it is called recycling. Recycling is an efficient way of maximizing the things that we have already used its primary use and then use it again for another purpose, which then continues the cycle of its use and make it not part of the increasing volume of waste. In one way, that there is a wealth in waste is first, if we respond to our waste in terms of recycling, we are getting the benefit of being thrifty, instead of buying other materials we can rely on our creative minds in order to work on things that we have. This kind of thinking, applies on crafty materials like school materials or making some arts and toys, or even inventions that can be found on old electronic things. Ideally, these concept resolves the problem on the continuous growing waste that humans tend to dispose but aside from that there is possible business that came out of it and certainly becomes wealth. One of those business arose, is the biogas power plant which with his kind of power plant is deems the usage of composite waste from human excrete & animal excrete in order to produce the methane gas that then is the raw material that the power plant needs to function generating electricity enough to power a neighborhood or even a small community.

Moreover, in sugar mill they are using the waste cane in order to fire-up their boilers to produce steam that is enough to generate electricity for their power plant. With these kinds of concepts there is an immense money that can be saved, thus can be used on other service or product. Also, recycling on waste like those of in used tetra packs of orange drinks or any fruit drinks have been converted on multi-purpose bags that can be used for shopping or for luggage plus the strength of the material used is capable to withstand great amount of load, roughly around the usual weight of grocery items, this makes the eco-bags or recycled bags economical while being environmentally friendly. In another point, there are business establishments that are called 'junk shop' in some places which buys scrap items ranging from thread of copper wires, any sort of metals may be steel, pipe or piece of aluminium, empty glass of bottles, old boxes, used papers including newspapers and old magazines. Those kind of shop buys them, then sort them up, give them value on certain scale like per weight or per pieces ,then after collecting them those materials are carried to different recycling plant making the materials of those considered waste be useful once more. Recycling, indeed have proven itself to be source of wealth in many various ways that is why we should encourage y people to consider their items before throwing or disposing them.

RECYCLING

Recycling is the process of converting waste materials into a new material and object. Recycling is the key component of the modern waste management. There are three R's reduce reuse and recycle.. Reuse is that taking care of our steps. Recycling is the conversion of waste materials into useful materials. Recyclable materials include glass, paper, metal, newspaper, plastic, textiles, clothes etc... Process of recycling includes collection, materials collected in recycling collect in collecting bins then processing which in Boat sorting materials into groups training them and getting them ready for manufacturing. Manufacturing step involved developing products from the already used products. Recycling has many benefits. Mainly the expected one is environmental protection. It reduces the contamination of risk from landfills reduce pollution because we convert a material which probably become waste into a new product of use. Also there is financial benefits, resource conversion, energy savings and community building.

TEXTILE WASTE

Wastage or waste can be defined as such kind of materials that don't come into use after the end of the process or the basic use of a product. It is one kind of worthless or useless or defective material. So, textile wastage can be defined as the material that becomes unusable or worthless after the end of the production process of any textile product. Wastage produces in every stage of the textile manufacturing process such as spinning, weaving, knitting, dyeing, finishing and clothing. Textile wastage is a great threat for any textile industry and the environment as well. When fibre bales are processed through the blow room section in a spinning mill a huge amount of cotton wastage produces. So, it is an economic threat. In a dyeing factory ton of fabric dyed and tons of wastewater is produced which is a great threat to the environment.



TYPES OF TEXTILE WASTE

Textile wastage can come from different textile manufacturing departments like spinning, weaving, dyeing, finishing, garment manufacturing and even from the consumer end.

Spinning Waste

Cotton fibre bale contains a lot of wastage such as foreign particles, dust, seeds, short fibres etc. and so when processed through different sections of a spinning mill then different types of wastage are produced in different sections. The wastage % in blow room is 3% and blow room waste is called lap waste. Carding section wastage % is about 10%. The wastage of carding section is called dropping-1, dropping-2 and sliver waste.

The wastage % in the draw frame section is about 0.5%. The wastage of this section is called sliver waste. The wastage % in the comber section is about 14-15% and the wastage are called noils, lap and vacuum waste. The % of wastage in the simplex section is about 0.5% and the wastage are called roving and sliver wastage. The wastage % of the ring frame is 2-2.5% and the wastage are called pneumatic, hard waste, vacuum waste etc.

Weaving Waste

Like spinning mills, different types of wastage are found in weaving mills also. Residual yarns which are left on the cones after warping are considered wastage. In the warping reel section, it is not possible to empty all the cones and there will always be a little amount of yarn left on the cones. Sizing waste is another kind of waste in a weaving factory. When in the weaver's beam section, a new set of warp yarn is started then it is necessary to eliminate some portions of the yarns to ensure that properly sized yarns are wound on the weaver's beam. After sizing wastage, comes the knotting wastage. Knotting is done to ensure all the warp ends of two beams are available for attaching together. Beam residual wastage is another kind of weaving wastage. When a weaver beam is finished, a small amount of warp yarn remains unused on the weaver's beam and it is not possible to finish yet. Auxiliary selvedge wastage is also a common weaving wastage. Auxiliary selvedge is a fake selvedge used to hold the weft yarn during the loom beat up period.

TEXTILE RECYCLING

The average lifetime of a garment is estimated to be for a period of three years. After the time period, they are thrown away as old clothes. Even useful garments are discarded as they are no longer fashionable, or desirable. A report states that more than one million tons of textiles are condemned every year. Huge quantities of old clothing end up in the landfill instead of being recycled and reused. Of the house hold garbage, textiles make about 3

percent by weight. Textile wastes also arise during the process of yarn and fabric manufacture, garment making, etc. They are called as post-industrial wastes. All thrown clothing has a potential for recycling and reuse. 80 percent of the textiles that are thrown away can be recycled and used again, whereas, currently only 25 percent being recycled. Less than 5 percent of all the garments that is thrown in the bin actually end up as waste.

Recycling Process

All clothing has a useful second life. The collected garments are sorted and graded as natural, synthetic and blended fabrics. Good quality clothing is sent to charity institutions and is used as second-hand clothing. Unwearable textiles are considered as damaged textiles, and are processed in the factory as rags. Rags are collected and sent to the wiping and flocking industry. Other materials will be sent for fibre reclamation and stuffing. Fibres from the old fabrics are reclaimed and are used for making new garments. Threads from the fabric is pulled out and used for re-weaving new garments or blankets. Both natural and synthetic fibres can be recycled this way. Incoming textiles are graded into type and colour. Initially the material is shredded into fibres called shoddy. Later based on the end use, other fibres are blended with shoddy. The blended mixture is carded, and spun for weaving or knitting. The garment is shredded for fillers in car insulation, roofing felts, loudspeaker cones, furniture padding, panel linings and many other uses. Woollen garments are sent to other firms that make fibre reclamation to make yarn and fabric. Cotton clothes are recycled and used for paper manufacture, automotive, and mining industries and various other uses. Some old clothes are being reused in a creative way by fashion designers to make fashionable garments and bags. Fibres made from recycled PET plastic bottles are used in the active sportswear market.

Advantages of recycling

Textile recycling helps in the protection of environment as well. Recycled clothes reduce the landfill space. Landfill sites pose a threat to the environment and water supplies. When it rains, water drains through the discarded clothes and picks up hazardous chemicals and bleaches. This water turns out to be toxic. Textile made from synthetic fibres will not decompose quickly whereas fabrics like wool releases methane, during decomposition and both fibres ultimately cause global warming. When these fabrics are recycled, this hazard will be reduced to a considerable extent. It saves on consumption of energy, as recycled clothes need not be re-dyed or sourced. Reduced usage of dyes and chemicals minimizes their manufacture and ultimately the adverse effects of their manufacture. Of all the old clothing, 70 % is used as second-hand clothing, 6 % is waste bags and zips, 8% is used for

reclaiming fibres and making recycled products, 7% is used as wiping material and the remaining 9 % is shredded and used as stuffing. It is a surprising fact that over 70 percent of the world's population uses second hand clothing. Raw materials acquired out of recycled fabrics cost less; making it an attractive feature for manufacturers.

Customizing own and old clothes

It is an amazing fact to know, that clothes that are considered as useless can be creatively used to make something new. Old clothes can be reused for making cushions, handbags, quilts etc. Damaged clothing can be used as rags and dusters. Bright coloured fabrics can be used for borders in a lampshade. Head and wrist bands can be made with fabrics with electrifying colours. Old garments can be transformed into works of art; like sewing patches, buttons and beads into old garments, ironing graphics, etc. From the early age of industrial revolution, textile industry is being identified as a major polluter of rivers. Attempts to minimise wastage are now on focus due to increased environmental awareness. Currently, there is an increasing awareness among people regarding waste collection and recycling. Developing a potential market for recycled textiles by buying such recycled products will reduce the wastage going to landfill.

CONCLUSION

Making wealth out of waste by utilizing old jeans and constructing them into value added products give motivation to recycle the resources. Waste are basically things that we have consumed and used its primary purpose, then after doing so dispose them accordingly. There is idea the "Wealth from waste". It is quite common idea for most but to shed light to others it is called Recycling. Jeans is one of the most popular fabrics in the world, so the environmental damage associated with the production of jeans is very dangerous because the number of jeans that consumers produce and use today is huge. Huge usage of jeans, makes it waste. So recycling is the best method for reduce the wastage. There are more benefits through transforming old jeans in to valued products. Reusing and recycling old items like fabrics, denim jeans prevents them from going into the landfill, and is a great way to reduce the use of raw materials and energy and to reduce air pollution, water pollution, and waste.

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CHAPTER 2

HAIR ACCESSORIES FROM OLD CLOTHES

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INTRODUCTION

A textile is a flexible material made by creating an interlocking bundle of yarns or threads, which are produced by spinning raw fibers (from either natural or synthetic sources) into long and twisted length. Textiles are then formed by weaving, knitting, crocheting, knotting, tatting, felting, bonding or braiding these yarns together. A fabric is a material made through weaving, knitting, spreading, felting, stitching, crocheting or bonding that may be used in the production of further products, such as clothing and upholstery, thus requiring a further step of the production cloth.

The textile industry plays a significant role in Indian economy by providing direct employment to an estimated 35 million people, by contributing 4% of GDP and accounting for 35 % of gross export earnings. The textile industry in India covers a wide gamut of activities ranging from production of raw material like cotton, jute, silk and wool to providing high value added products such as fabrics and garments to consumers. The industry uses a wide variety of fibres ranging from natural fibres like cotton, jute, silk & wool to manmade fibres like polyester, viscose, acrylic and multiple blends of such fibres and filament yarn.

Textile product mills convert raw textile into finished products other than apparel. Some of the items made in this sector include house hold items such as carpets and rugs, towels, curtains, and sheets, cord and twin, furniture and automative upholstery, and industrial belts and fire

houses. The apparel manufacturing industry transforms fabric products by textile manufacturers into clothing and accessories.

Hair accessories are functional or ornamental objects wrapped, tied, twisted, inserted, or otherwise attached to the hair. Infinitely varied in shapes, sizes, and materials, examples of hair accessories include: hair rings or bands, ribbons and bows, hairpins, hair combs, barrettes, beads, thread or string, hair spikes and sticks, and other affixed miscellaneous objects (shells, jewels, coins, flowers, feathers) perceived to have aesthetic or social and cultural value. Hair accessories have been worn by people of all ages and by both genders.

Fashionable men also adorned their long tresses with ribbons and bows. A "love lock" was a lock of a man's hair grown longer than the rest, and then accentuated with a ribbon. Hair rings and hair bands are cylindrically shaped hair accessories wound around the hair, designed to hold hair away from the face, or otherwise confine strands of hair. Some of the earliest hair rings were found in Great Britain, France, and Belgium at the end of the Bronze Age. These objects were solid gold or gold-plated clay, bronze, or lead. Ancient Egyptians wore similar rings during the New Kingdom Dynasties 18-20. Examples have been found in Egyptian tombs.

In the twentieth century, the use of rubber and other manufactured elastomeric fibres made hair rings (now called hair bands or ponytail holders) more flexible. They were covered with thread or fibres to make them less likely to break strands of hair. "Scrunchies" were some of the most popular hair bands during the 1980s. These fabric-covered elastic decorative bands were used to create ponytails in the hair of young girls and women. Now a day's hair accessories are worn by women around world and are available in a variety of shapes, sizes, materials, great for keeping hairstyle in place, others are ideal for getting bangs out off your face and then there are decorative pieces that are perfectly well as hair adornments. Now they are a part of youth culture.

FASHION ACCESSORIES

An accessory can be said to be anything you wear or carry other than your clothes. In fashion, an accessory is an item used to contribute, in a secondary manner, to an individual's outfit. Accessories are often chosen to complete an outfit and complement the wearer's look. They have the capacity to further express an individual's identity and personality. Accessories come in different shapes, sizes, hues, etc. Fashion accessories can be loosely categorised into two general areas: those that are carried and those that are worn. Traditionally carried

accessories include purses and handbags, hand fans, parasols and umbrellas, wallets, canes, and ceremonial swords. Accessories that are worn may include jackets, boots and shoes, cravats, ties, hats, bonnets, belts and suspenders, gloves, muffs, necklaces, bracelets, watches, eyewear, sashes, shawls, scarves, lanyards, socks, pins, piercings, rings, and stockings. The type of accessory that an individual chooses to wear or carry to complement their outfit can be determined by several factors, including the specific context of where the individual is going. Similarly, an individual's economical status, religious and cultural background would also be a contributing factor.

Accessories aim to enhance the effect of clothes you wear- whether they succeed or not depend on your sense of style, the trend in fashion at that particular time and the context.

These accessories are just as much a part of fashion history as specific types of apparel. There are classic, timeless accessories that remain in fashion year after year, as well as trendy items that quickly become popular, then fade as new looks are introduced to the scene.

USE OF FASHION ACCESSORIES

Fashion accessories are vital for fashion design in terms of creating total look and presenting a fashion statement. Fashion accessory is an item used to contribute in a secondary manner, to the wearer's outfit often used to complete an outfit. Accessories are important details to complete each appearance. Accessories and cloths are more important than you think. Accessories and clothes are equally important in your outfit, working together to create a harmony that expresses your style and who you are. Accessories offers unlimited opportunities for cloths. Never underestimate the power of accessories. They are touches to an outfit that express individuality and style. Clothing experts predict accessories will be more important as style become more classic and investment dressing a necessity. Wise consumers can no longer afford to purchase clothes having a short fashion life, they are buying fewer clothing items of better quality. Accessories make basic clothing versatile by changing the mood and image of an outfit. Using accessories is an art. By experimenting with belts, shoes, bags, scarves etc, we create a total look. The next step is to plan the clothing presentation, just like an artist plans a picture, we must design and plan your clothing image. Choosing accessories requires the careful blending of elements and principles of design. Each accessories should enhance the features and contribute to the unity and harmony of our clothing.

Majority of the accessories are used daily as per types of the dress. Footwear are the most preferred fashion change accessories followed by wrist watches and earrings. People change their handbags-as per types of their dress and are influenced about-the use of fashion accessories by their friends and media. Accessories are as important as clothing, offering a whole new opportunity to express yourself .Accessories can create a fluent style waves up from head to toe. Accessories are your best friends. Eye-catching accessories can also create a strong style statement.

HAIR ACCESSORIES

Hair accessories are functional or ornamental objects wrapped, tied, twisted, inserted, or otherwise attached to the hair. Throughout the history types of ornamentation and the materials from which they were made indicated religious significance, social class, age group, and level of fashion awareness. Infinitely varied in shapes, sizes, and materials, examples of hair accessories include: hair rings or bands, ribbons and bows, hairpins, hair combs, barrettes, beads, thread or string, hair spikes and sticks, and there affixed miscellaneous objects (shells, jewels, coins, flowers, feathers) perceived to have aesthetic or social and cultural value. Hair accessories have been worn by people of all ages and by both genders. Hair rings and hair bands are cylindrically shaped hair accessories wound around the hair, designed to hold hair away from the face, or otherwise confine strands of hair. Some of the earliest hair rings were found in Great Britain, France, and Belgium at the end of the Bronze Age. In North America, hair binders were made of pliable materials such as silk or cotton covering lead wire (Cox 1966). In the twentieth century, the use of rubber and In other manufactured elastomeric fibers made hair rings (now called hair bands or ponytail holders) more flexible. They were covered with thread or fibers to make them less likely to break strands of hair.

TYPES OF HAIR ACCESSORIES

1. Pearl hairband

They're one of those sophisticated gemstones that add charm to your personality much like these pearl hairbands. A fine addition to a woman's hair accessory collection, pearl hairbands can be put to test when you need to pretty up your party-fit or a fancy dinner look. Wear these with laced dresses, tops and more especially with a jewelled neckline.

2. Knot hairband

Do not underestimate the power of fashionable hair accessories for women. Particularly the versatile ones. They're refined but with an added sass. Style it with your messy buns and middle-part hairstyles for a look on the go. They are great for amping up a simple brunch look.

3. Braided hairband

A step further to knot hairbands, braided hairbands is the latest fad in the hair accessory for the girls' department. They're super stylish and extremely gorgeous. These can be used to jack up an otherwise plain outfit. It's a lovely hair accessory mostly worn with bland work wear clothes or a very basic t-shirt/shirt dress. With these crowning your head, no extra jazz is needed.

TIARA-STYLE HAIRBAND

Tiara-style hairbands have been amongst us for a long time now, and they have managed to steadily get better with time. They're artful, elegant and super cute. It's a hair accessory for women befitting all sorts of party/wedding outfits. Furthermore, these hairbands for women go with any length and quality of hair.

JEWELLED FANCY HAIRBANDS

More of a rager, jewelled fancy hairbands are a top-of-the-line hair accessory for women who like to set trends. These are big, chunky and frankly tricky to style. However, one certain thing about owning these fancy hairbands is that they'd look best with loose, slightly wavy hair.

BOW HAIRBANDS

An occasion is made brighter and happier with bows. The whimsy is true for bow hairbands. It's a part of a hair accessory for girls that are adorable.



PRINTED HEAD-WRAPS FOR LADIES

Head-wraps are a great hair accessory for spring and summer! They look super-chic with t-shirt dresses, maxis and long shrugs. And it is one of the best outfits for the hot days. Styled in a myriad of ways, head-wraps are fun to experiment with and are very comfy. Mostly coupled with long, messy hair to create a boho-chic look perfect for brunch dates, a day-out with girlfriends or for a fun visit to the beach. A cute bow-knot at the top will keep the ensemble cool and classy all through the day.

SHAPE CLIPS

Shape clips are also a part of the latest hair accessory for womens' trends. A minimalistic accessory every lady should have at her disposal all the time. These are quite handy and adorable to wear. Pick a shape you love, pair it with your buns, loose or half-tied hair, and make heads turn!

PEARL-WHITE BEADED HAIR CLIPS

The charismatic grandeur of pearl is known to all and they go interestingly well with chic and classy ensembles. These hair clips for girls offers a rich, classy look with a pinch of elegance. Use these to complete your first-date look or a super-cute party outfit

STONE STUDED LETTER HAIRPINS

Stone studded letter hairpins are a glam jam for the hoarder of stunning hair accessories for women. These letter hairpins are just a few years old and they don't fail to show off the sassy, OTT side of you. A single pin or maybe two with words so wise that they describe you are enough to make a fashion statement. These work out best with a fancy outfit specially made for rocking parties.

BOW CLIPS

Bows were one of the quintessential hair accessories for women that never go out of style. They still possess the old-world charm we never get bored of. It's a fashion commitment you don't move on from. They're super cute, too adorable and mostly go with sundresses and casual brunch-date outfits.

PRINTED SCRUNCHIE

They are soft on our tresses but hold three times more volume which, technically is pretty impressive. More than that, scrunchies are an important part of the hair accessories for women list because you can't go living a life without at least a bunch of these in your drawer. However, to make a style statement, remember to pick the cute, printed ones.

HISTORY OF HAIR ACCESSORIES

Architectural findings and historical evidence indicate that hair accessories date back to prehistoric times. Hair accessories have been found in ancient cultures around the world. The Ancient Greeks and Romans used crowns made from twigs, foliage and flowers. In Ancient Africa shells and beads were the materials of choice for making hair accessories. Even to this day shells and beads made from natural materials are used to make various jewelleries and head pieces in various African tribes. For the Native Americans headdresses were made using animal bones and feathers. A lot of materials they used held symbolic meanings and power.

Hair ties are one of the oldest and most commonly used hair accessories. Hair ties are said to date back to between 10,000 and 8,000 BC. Elastic bands did not exist yet back then, but in Ancient Europe, hair rings were made using precious metals such as gold and silver. In Ancient Egypt, hair rings were made using pottery, alabaster or jasper.

One of the earliest known examples of a hair accessory is that of a diadem worn by the Priest King of the Indus Valley Civilization circa 2200-2600 BC. Since then, hair accessories of all shapes and sizes have been used for fashion, function and symbolic purposes all throughout history and up to the present. In the UK, horseshoe-shaped headbands are sometimes called "Alice bands" after the headbands that Alice is often depicted wearing in through the looking glass.

Things changed around 20th century, when rubber and elastic fibers began to be commercially produced. Soon after, elastic bands and scrunchies became popular, making inflexible hair rings obsolete and hair ties we know today to flood to markets.

CONCLUSION

Hair accessories have stayed throughout history and made it into the modern day because they are not only ornamental and decorative, but they are also functional. Two of the biggest differences between the hair accessories of the ancient world and today are the materials that they are made of, and the purpose other than functional usage. Today, most hair accessories such as hair clips are made using plastic and spring. Back then some hair clips were deemed to be status symbol especially the ones made of gold, silver and other precious metals and gems. Today hair clips are mainly made used for functional, decorative and styling purposes. From the humble beginnings to the everyday objects that most people have in their dressers today, knowing about the history of the favourite hair accessories will give a whole new appreciation for them.

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CHAPTER 3

HEALTH BENEFITS OF CHAYA MANSA

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INTRODUCTION

Chaya (*Cnidoscolous chayamansa*), also known as spinach tree, is a common leafy vegetable domesticated in pre-Columbian times. This crop has been used mainly for food and medicine purposes by Mayan civilization and other Mesoamerican cultures. Chaya Mansa is also known as the *king of green leafy vegetables*. Chaya mansa is a very popular green leafy shrub from Mexico. It belongs to *Cnidoscolous Chayamansa* family. It is also called as Mayan Spinach because this plant was most popular among Mayan tribes.



Figure 1. *Cnidoscolous chayamansa*

(Source: <https://www.ebay.com/itm/264792266104>)

Chaya is an easy to grow plant. It grows up to 12” which grows well in all climate and soil type. It is advisable to start harvesting Chaya after one year of planting. This shrub does not need constant attention and it grows fast. Its usage in south eastern México and Central

America for the preparation of food has been documented, especially in Yucatán, Chiapas, Belize, and Guatemala, where Chaya has been considered part of the daily diet. Young Chaya leaves and the thick, tender stem tips are cut and boiled as a spinach. (Kuti & Torres, 1996)

NUTRITIONAL FACTS

Chaya excels more than other leafy vegetables like spinach or lettuce nutritionally. The chaya leaves are highly rich in calcium, iron, carotene, and vitamins. The amino acids are also balanced which plays an important role and mandatory in a diet. During preparation Vitamin C drains out into the water so if one could drink the broth in extra to the leaves, then from 25gms of chaya leaves an adult can meet the daily requirements for Vitamin C. The following Table I shows the nutrient composition of Chaya Mansa as stated by Kuti & Torres (1996) and Mohan (2021).

Table 1

NUTRIENT COMPOSITION OF CHAYA MANSA

COMPONENTS	PER 100 GRAM WEIGHT
Water	85.3
Protein	5.7
Fat%	0.4
Crude fibre	1.4
Carbohydrates	4.2
Calcium mg/100g	199.4
Potassium mg/100g	217.2
Iron mg/100 g	11.4
Vitamin C mg/100 g:	164.7
Carotenoids mg/100g	0.085

Iwuji et al. (2018) stated that the energy yield of the Chaya leaves as 258 ± 4.5 kcal/100 mg. Chaya leaves were found to contain substantially greater amounts of nutrients than the spinach leaves. The chaya leaf is especially high in protein (5.7%), crude fiber (1.9%), calcium (199.4 mg/100 g), potassium (217.2 mg/100 g), iron (11.4 mg/100 g), vitamin C (164.7 mg/100 g), and carotene (0.085 mg/100 g). The levels of chaya leaf nutrients, in this study, agree with published reports (Martin and Ruberte, 1978; Munsell et al., 1949; Booth et al., 1992) and are two to threefold greater than most edible leafy green vegetables. In terms of the average nutritive value, chaya leaves [14.9] is by far superior to other leafy green vegetables such as spinach [6.4], amaranth [11.3], Chinese cabbage [7.0], and lettuce [5.4] (Grubben, 1978).

While some edible leafy green vegetables are usually good sources of mineral macronutrients chaya leaf furnishes appreciable quantities of several of the essential mineral macronutrients necessary for human health maintenance. For example, potassium has been shown to be an important mineral nutrient in the control of hypertension and in the reduction of risks of stroke, calcium is important for ossification and iron is necessary for normal hematopoiesis. Brise and Hallberg (1962) reported that vegetables, such as chaya, with high vitamin C content may enhance absorption of non heme iron.

Analysis of raw and cooked samples of chaya leaves revealed that cooking may increase the relative composition of carbohydrate and fat and decrease relative composition of crude fiber and protein. On the other hand, cooked samples of chaya leaves were considerably higher in calcium, phosphorus and iron while the potassium content was relatively lower than in the raw samples. The increase in some of the mineral nutrients may be due to the cooking process, which allows extraction of the nutrients from the tissues, therefore increasing the percentage of mineral elements while decreasing moisture content (Booth et al., 1992).

LEAF PROTEIN CONCENTRATES

Recently, plant-based proteins have been studied for partial or total substitution of animal proteins from both nutritional and techno-functional point of view. The use of green leaves for leaf protein concentrates (LPC) has been suggested, not only because this protein is one of the most plentiful on earth but also because of its high biological value. Currently, LPCs are produced for animal feed, commonly manufactured from by-products from alfalfa, beet-root, and tobacco leaves. Some green proteins from Moringa leaves are being commercialized for human consumption due to its nutritional value. RuBisCO enzyme (Ribulose 1,5-Bisphosphate Carboxylase/Oxygenase) is one of the main proteins in leaves and has

demonstrated to be a high biological value protein for its content profile of essential amino acids (Edelman & Colt, 2016).

Although this crop has been studied for its biological activity and toxicity, Chaya LPC has been used mainly for animal feeding. The knowledge regarding Chaya leaves may be widened by exploring the potential applicability of protein and polyphenol nutritional compounds to encourage the development of functional food products. Thus, Chaya leaves are appreciated for their nutritional properties, especially their protein content and bioactive compounds, mainly polyphenols. Chaya polyphenols have a growing interest due to their antioxidant capacity and their potential to prevent diseases due to bioactivities such as hepatoprotective, anti-inflammatory, and biological activity against cancer and liver problems (Haque et al., 2016).

MEDICINAL PROPERTIES

Many people believe that this plant can cure almost 100 diseases due to its numerous health benefits to the body. Chaya can dissolve cyst, cancer, and numerous types of diseases, that's why it is called a "gift of God". It can treat asthma, anaemia, sore throat, infections, headaches, kidney and liver diseases. It can prevent haemorrhoids, varicose veins, anaemia, osteoporosis, and other serious diseases due to ageing and environmental effect. It can also regulate cholesterol levels, uric acid, blood sugar levels, balance metabolic system, and helps children growth. Chaya leaves can also enhance the health of the eye, cognitive ability, boost the immune system and other health benefits (Jay Nelz, 2016)

A wide variety of claims have been made as to the medical efficacy of chaya as a treatment for numerous ailments, ranging from the ability to strengthen fingernails and darken greying hair to its use as a cure for alcoholism, insomnia, venereal disease, gout, scorpion stings, and as an improvement of brain function and memory.

Medicinally, Chaya leaves are prepared and used often in a manner similar to when normally eaten. It is quite commonly advised to prepare the leaves simply by boiling, and the method of administration is usually cited as "oral". Apart from merely eating cooked leaves, infusions or teas are occasionally made from the leaves, and to treat diabetes and kidney problems the ground or blended leaves are often made into a shake, many times with other. Sometimes the roots of wild or cultivated Chaya are to be crushed and poultice or taken orally (pers. obs.) to treat kidney disorders and back pain.

In the case of gum disease and skin disorders, the sap of the plant is sometimes applied directly to the affected part, though other authors prescribe the use of the leaves locally. Simply eating the leaves is claimed to improve vision, but Anderson (unpubl. data) notes that the water in which the leaves were boiled is used directly as an eyewash to treat vision disorders or discomfort. Roys (1976) recommended the administration of “grated *Jatropha aconitifolia* Mill. (Chaya) with horse-dung and honey and *Capsicum annum* L.” to new mothers in the case of a retarded afterbirth, adding that the concoction “be drunk warm”. Another use of chaya is to treat muscle disorders, fatigue, and even rheumatism or arthritis, for which it is often prescribed to rub or beat the affected part with the stems or leaves of the plant; the painful stinging caused by the trichomes or spines supposedly revives disabled muscles or joints.

In the treatment of kidney disorders, treatment of kidney stones is overwhelmingly the most commonly cited medicinal use of Chaya. The only published study on its antidiabetic properties indeed found a significant drop in blood sugar levels in diabetic rabbits fed increasingly higher quantities of Chaya (Kuti and Torres, 1996).

In a recent study of the use of Chaya leaf meal as a potential feed source for broiler chicks, chicks fed diets high in Chaya leaf meal, though significantly lower in overall mass, experienced a significant increase in absolute heart mass, liver mass, red blood cell count, and a significant reduction in mortality. Though this cannot be directly extended to medicinal effects in humans, it certainly merits further investigation. These two studies, unfortunately, are the only of their kind with respect to chaya, though a few other species of *Cnidocolus* have been evaluated for potentially bioactive compounds to no avail.

CHAYA CAPSULES

In addition to pure plant material, chaya is occasionally sold in nutrition and health food stores as part of various herbal remedies. In such stores, one can even purchase capsules of “purified” Chaya extract—evidence enough that the medicinal use of Chaya continues to be popular even today. Most of its medicinal properties have never been experimentally tested, and it is unknown what the actual efficacy of Chaya is in curing many ailments.

CHAYA TOXICITY

Like most food plants such as lima beans, cassava, and many leafy vegetables, the Chaya leaves contain hydrocyanic glycosides, a toxic compound easily destroyed by cooking. Even though some people tend to eat raw chaya leaves, it is risky to do so. These leaves can be both added to salads, soups, or used as a tea. Chaya can be only consumed cooked or boiled but never consume it raw. To be eaten safely, the required cooking time is 5–15 minutes, with 20 minutes being recommended most often in recipes, and it should not be cooked in aluminium cookware as it causes diarrhoea (Grubben, 2004).

Chaya leaves showed a HCN concentration of 2.37 mg/100 g of dry sample by the acidic titration method and 4.25 mg/100 g by the alkaline titration method. These values are very far from the normal level (200–300 mg/100 g) reported in plant foods such as lima beans, cassava and other green leafy species; they are below the maximum (20 mg/100 g) allowed by the FDA in foods. This might confer some trust for consuming the plant in salads or as a raw vegetable. However, hydrolysis of cyanogenic glycosides and elimination of HCN is easily achieved by boiling leaves in water for at least 5 min; after which there is no detectable presence of the undesirable components. Other heat treatments such as sun drying during four days, soaking in water at 20 °C (60 min) or 70 °C (30 min) were negative in removing and degrading cyanogenic derivatives (Gonzalez-Laredo et al., 2003).

The leaves and root bark extracts have low toxicity than other plant parts. The total cyanogen content in fresh leaf tissue is lower when compared to frozen tree spinach. The increased cyanogenic content in freeze product may be due to the freeze induced damage. Freezing can impact on the changes in lipid membrane, intercellular concentration of carbohydrate and even the protein synthesis in plant cell. High temperature usually lower the cyanogenic content of the leaves of tree spinach.

Research is being conducted on genetic improvement, propagation, field production, potential for processing and marketing of chaya and its products in south Texas (Kutti and Torres, 1996).

CONCLUSION

The potential of Chayamansa for human food and health has a significant implication for the plant as a drought resistant horticultural crop. Although the exposure to medicinal effects of Chaya is limited, its demand has recently increased. The plant has the potential to make a significant nutritional contribution to the vegetable diet as well, because of its high nutrient content. The development of chaya as a new horticultural crop would transcend the ethnic popularity and create a worldwide market for the plant and its products, whether as a leafy green vegetable and/or as a therapeutic herbal tea.

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CHAPTER 4

FOOD EXTRUSION TECHNOLOGY – AN OVERVIEW

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INTRODUCTION

As generation changes, changing in lifestyle and limited free time has brought a lot of behavioural changes toward foods. Now a day's consumers do choice for convenient ready to eat and ready to cook food with nutritionally rich and therapeutic benefits. Thus, to fulfil the demand of consumer, extrusion technology is used. Extrusion technology has become an important technique in food processing industries as it one of the cost-effective methods. Extrusion processing is defined as the process by which moistened, starchy and proteinaceous food materials are plasticized through a die by a combination of moisture, pressure, heat and mechanical shear. The extrusion process is an effective continuous process in which few unit operations like mixing, shearing, heating, pumping, forming, and sizing combines uniquely to from the products.

THE PROCESS OF EXTRUSION

Extrusion is a process used to create products of a fixed cross-sectional profile. Food extrusion is a form of extrusion used in food processing. It is a High Temperature Short Time (HTST) process. It is a process by which a set of mixed ingredients are forced through an opening in a perforated plate or die with a design specific to the food, and are then cut into a specific size by blades. The machine which forces the mix through the die is an extruder. The mix which is obtained is known as extrudate. The extruder consists of a large, rotating screw which is fitted to a stationary barrel, at the end of which is the die (Kendall et al., 2010).

Extrusion enables mass production of food by a continuous, efficient system that ensures uniformity of the final product. Food products manufactured using extrusion usually has high starch content. These include some pasta, breads, many breakfast cereals and ready-to-eat snacks, confectionery, premade cookie dough, some baby foods, full-fat soy, textured vegetable protein, some beverages, and dry and semi-moist pet foods. In the extrusion process, raw materials are first ground to the correct particle size, usually the consistency of coarse

flour. The dry mix is passed through a pre-conditioner, in which other ingredients are added depending on the target product; these may be liquid sugar, fats, dyes, meats or water. Steam is injected to start the cooking process, and the preconditioned mix (extrudate) is then passed through an extruder (Chen et al, 2011).

The extruder consists of a large, rotating screw tightly fitting within a stationary barrel, at the end of which is the die. The extruder's rotating screw forces the extrudate toward the die, through which it then passes. The amount of time the extrudate is in the extruder is the residence time. The extruded product usually puffs and changes texture as it is extruded because of the reduction of forces and release of moisture and heat. The extent to which it does so is known as the expansion ratio. The extrudate is cut to the desired length by blades at the output of the extruder, which rotate about the die openings at a specific speed. The product is then cooled and dried, becoming rigid while maintaining porosity. The cooking process takes place within the extruder where the product produces its own friction and heat due to the pressure generated (10–20 bars). The process can induce both protein denaturation and starch gelatinization under some conditions (Petitot et al., 2009).

The extrusion cooking technology is applied to the development of instant functional foods. It has advantages of low cost, sustainability, and versatility for production of a wide variety of food products. For formulation of functional foods, bioactive compounds are added to base mixtures, the main sources being fruits, vegetables, cereals, oleaginous plants, legumes, and industrial food by-product such as pomace

During the extrusion cooking process, ingredients are mixed, conditioned, and transformed to a melt fluid, thus causing degradation or a release of functional compounds because of structural and chemical changes caused by the effects of some process variables such as temperature, moisture content, screw speed, and inherent factors such as geometrical configuration of the extruder (Singh et al., 2007).

Knowing the factors affecting the different components that form a food matrix, such as composition, intrinsic characteristics (pH and ionic strength, among others) combined with some extrusion process variables may help a technologist to influence the characteristics or final properties of the desired product. In addition, the presence, incorporation, and stability of bioactive compounds for the development of functional extruded products are topics that must be studied to meet consumer demands (M N Riaz et al., 2000).

The processing methods designed to produce functional foods are diverse and technologically different because they depend on the type of product to be developed.

Consequently, there are different kinds of functional food products such as beverages and semisolid or solid foods. Extrusion cooking can be defined as a continuous process in which materials, such as proteins and starches, are plasticized to form a fluid melt in a chamber or barrel as a result of high temperature, pressure, and shear stress, causing the material to be conveyed and forced to flow through a die of specific shape. During processing of materials, raw materials are conditioned (cleaning, classification, grinding, and conditioning to required moisture levels) and mixed with various ingredients such as bioactive compounds to produce diverse types of products of different shapes (Navale et al., 2015).

Raw materials are fed into the extrusion equipment, where they are mixed and subjected to heating and friction. The solid phase is transformed into fluid melt at high temperature and pressure and forced to flow through the die. The processing conditions are determined by independent and dependent variables of the system. The independent variables are those that can be controlled, such as feed composition, moisture content, and rate of feed, screw speed, and barrel temperature. The dependent variables are those that assume a certain value that depends on the magnitude of an independent variable. These include the properties of extrudates, such as viscosity, which is affected by the composition, moisture content, temperature, and shear rate associated with the screw speed (Athar et al, 2006).

The flow rate is associated with configuration of the screw barrel, screw speed, viscosity, and pressure drop in the system; other properties that can be included here are pressure exerted on the system, power, specific energy, residence time, and product characteristics (texture, gelatinization, color, water absorption index, expansion index, density, and chemical composition, among others) (Maurya and Said, 2014).

TYPE OF EXTRUSION

1. Cold Extrusion

It is used to gently mix and shape dough, without direct heating or cooking within the extruder. In food processing, it is used mainly for producing pasta.

2. Hot Extrusion

This generally consist of thermo-mechanically transform raw materials in short time and high temperature (HTST) conditions under pressure. It is used mainly to produce textured food and feed products, such as ready-to-eat breakfast cereals, snacks etc (Maurya and Said, 2014).

3. Friction Extrusion

There's also friction extrusion. Invented by The Welding Institute in the 1990s, this modern extrusion process involves the automatic rotation of the metal slugs or billets based on the position of the die.

4. Micro Extrusion

Finally, micro extrusion is a relatively new type of extrusion process that's characterized by the ability to create small, micro-sized objects (J Akhtar et al., 2015)



EFFECTS OF EXTRUSION COOKING

(i) Changes in physical parameters

The changes in colour of product could be due to the non-enzymatic browning by Millard reaction between proteins and reducing sugars that occurs due to the high temperature. The process conditions used in extrusion cooking high barrel temperatures and low feed moistures favours the Millard reaction and also decreases the nutritional availability of lysine. Increasing protein content at constant feed moisture content causes an increase in brittleness, hardness and crispness but decrease colour intensity (Camire, 2007).

(ii) Changes in composition:

Extrusion results in changes in the chemical components of food. The changes are described below.

DIETARY FIBER

Fruit and vegetables contain large amounts of dietary fibre (DF), which benefits the physiological activities of humans by decreasing cholesterol levels, reducing hyperlipidemia and hypertension, and maintaining gastrointestinal health. Moreover, DF in vegetables and

fruits has a higher insoluble/ soluble dietary fibre (IDF/SDF) ratio. In particular, SDF is more effective than IDF in maintaining systemic health. An extrusion technology was successfully applied to orange pomace to increase its SDF fraction under optimal conditions. The increase in SDF content in the extrusion was mainly contributed by redistribution of IDF to SDF, which was likely due to modification of the cell-wall structure during extrusion, where degradation of IDF generally occurs (K K Sandey, 2018). **Protein**

The change in the screw-speed during extrusion leads to the variation in shear forces which play an important role in changing the nutritional value of proteinaceous materials. Researchers found behaviour of molecular aggregation and chemical cross-linking of soybean protein at both low and high moisture content during extrusion. The results showed that, hydrophobic interactions, hydrogen bonds, disulfide bonds, and their interactions collectively hold the structure of protein extrudate regardless of the location and moisture level in the extruder and the contribution of non-covalent bonds during process also exceeds covalent bonds to bring about the change. Denaturation of proteins at high temperature during extrusion cooking inactivates anti-nutritional factors (such as antitrypsin factor, lectins, etc.) and improves digestibility. The extrusion of soy protein reduces the undesirable volatile compounds and the bitter taste (Maurya and Said, 2014). Very high drying temperatures have shown to decrease in protein digestibility and lysine bioavailability (Singh et al., 2007).

Carbohydrate

During extrusion process, starch undergoes various structural changes including gelatinization, melting, and fragmentation and the extent of the transformation depends upon pressure, temperature, moisture content, and shearing force. Control of sugars during extrusion is critical for nutritional and sensory quality of the products. It is reported that sugar losses in extrusion and it may be explained based on the conversion of sucrose into glucose and fructose (reducing sugars) and loss of these reducing sugars during Maillard reactions with proteins. The destruction of these flatulence-causing oligosaccharides might improve the nutritional quality of extruded legume products (Singh et al., 2007).

Lipids

The changes in physicochemical properties of lipids during extrusion are complex and vary with the hydrophilic–lipophilic balance of lipids, amount, type and the materials being extruded. These are due to the binding of lipid with starch. High temperature decreases the

factors that favours free fatty acid development and oxidation of fatty acids because of the reduction in lipase and lipoxigenase activity (Agarwal and Chauhan, 2019).

Minerals and vitamins

Extrusion cooking have significant effect on the stability of vitamins in extruded snack food for example low feed moistures and higher barrel temperatures can lead to loss of ascorbic acid. They observed that extrudates obtained from short barrel (90 mm) extruders had a higher retention rate of B vitamin group (44–62%) compared to 20% for long barrel extruders. The stability of fat-soluble vitamins such as vitamin A and E are also impacted by the high temperature, short-time extrusion cooking (Tiwari and Cummins, 2009).

Anti-nutrients

Nutritional quality of legumes - cereals mixtures could be limited by the presence of anti-nutrients such as phytic acid, tannic acid, trypsin inhibitors, which inhibit protein digestibility. Extrusion process caused a significant reduction in phytic acid content ranged from 40.64% to 46.07% and tannic acid content ranged from 40.46% to 44.88% of the germinated dehulled chickpea incorporated corn blends (M N Riaz et al., 2000).

Antioxidant and total phenol content.

The antioxidants are substances that prevent the oxidation of the molecule especially, fat and fat containing foods. The antioxidant activity of most foods is mainly caused by phenolic compounds. extrusion process caused a significant increase in total phenolic content and antioxidant of the extrudates by 1.92 –7.94% and 1.07 –5.55%, respectively. This may be attributed to the increased release of the bioactive compounds from the cell wall matrix due to extrusion process thus accessible in the extraction (Zielinski et al., 2006).

Advantages and disadvantages of extrusion processing

Advantages of extrusion

Extrusion processing has continued to gain popularity as one of the most energy efficient and environmentally friendly processes for a wide range of food products. Extrusion cooking is thus one of the preferred food-processing techniques due to its continuous process with high productivity, high temperature and short time cooking period while destroying both harmful microbial organisms and anti-nutrient enzymes, resulting in significant nutrient-retention products with longer shelf life. Furthermore, nutritious foods can be designed through extrusion to meet societal needs in addressing malnutrition and food and nutrition insecurity.

Disadvantages of extrusion

Food processing includes a costly initial financial investment, and careful selection of process parameters such as moisture content, feed particle size, feed rate, screw speed, temperature, screw configuration and die shape to avoid reactive and harmful substance formation. Apart from the initial seed funding, the bulk of the disadvantage is purely technical know-how that can be obtained through short training courses.

CONCLUSION

Extrusion cooking technology is very efficient state of art technology adopted by snacks food industries due to its nature of versatile, handy and low cost. It is high temperature, short time high pressure, continuous process. Unit operations involved in extrusion cooking process are conveying, mixing, shearing, heating and shaping. Various types of extruders used by food manufacturers in snacks industries such as piston extruders, roller-type extruders and screw extruders (Single screw extruder and twin-screw extruders). Twin- screw extruder has better mixing ability and higher pumping efficiency than single screw extruders.

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CHAPTER 5

DIETARY HABITS AND LIFESTYLE CHANGES DURING COVID19

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INTRODUCTION

COVID-19 pandemic has had a global impact on daily diet among adults. Although it has not been possible to establish a correlation between weight gain and changes on eating behavior, an increased appetite accompanied by a higher consumption of snacks and a greater number of daily meals have been found. In the case of children, results appear to point at similar conclusions as the closure of school canteens has affected many families. This situation has worsened the quality of diet in families with little resources as well as in families in which all members were workers. Finally, regarding dependent persons such as the elderly, people with morbid obesity and people with other type of disabilities, scientific evidence has linked preventive measures of physical contact restriction to changes in eating behaviour. Those changes have been associated to a significant decline in health nutrition.

DIETARY HABITS

Prolonged staying at home may also support eating palatable meals, snacking, and alcohol consumption . It may further affect individual choices to cook more or buy prepared food more often. A healthy balanced diet is an integral part of a personal risk management strategy during pandemics, such as the one of COVID-19 .It does not entirely prevent the infection, although it may play a profound role in the host response to an infectious agent. Various macro-, micro-, and phytonutrients have immunomodulatory effects and are required for immunocompetence, whereas nutritional deficiencies are linked to higher host

susceptibility to viral infection and a more severe clinical course of disease. At the same time, nationwide lockdown due to disease outbreak may potentially alter dietary habits, as it forces the majority of individuals to stay at home for a prolonged period of time, often with unlimited access to food and lower physical activity. This is of particular concern in the case of individuals with pre-existing nutritional issues.

In addition, also diet seems to influence the quality of sleep, in fact very recently in a cross-sectional study included 172 middle-aged adults it has been reported that good sleepers had higher adherence to the Mediterranean diet (MD) and lower body mass index (BMI) compared to poor sleepers. Considering the smoking, there are a significant association exists between SARS-CoV-2 infection and air pollution, and in this context in smokers, more severe COVID-19 symptoms occur. Low physical activity levels have been suggested to interact both with body fat and appetite deregulation.

Eating habits and lifestyle modification may threaten our health. Maintaining a correct nutrition status is crucial, especially in a period when the immune system might need to fight back. In fact, subjects with severe obesity ($BMI \geq 40 \text{ kg/m}^2$) are one of the groups with the higher risk for COVID-19 complications. Obesity is an expansion of the adipose tissue, which produces cytokines and contributes to a pro inflammatory milieu. Moreover, in regards to pulmonary physiology, subjects with obesity have decreased expiratory reserve volume, functional capacity and respiratory system compliance. In patients with high abdominal fat, pulmonary function is further compromised in the supine position by decreased diaphragmatic excursion, making ventilation more difficult. The inflammatory state is also one of the most important factors of the severity of lung disease in COVID-19, which leads to the famous “*cytokine storm*” associated with the acute respiratory distress syndrome and multiple organ failure.



LIFESTYLE CHANGES DURING COVID 19

There are two major influences: staying at home (which includes digital-education, smart working, limitation of outdoors and in-gym physical activity) and stockpiling food, due to the restriction in grocery shopping. In addition, the interruption of the work routine caused by the quarantine could result in boredom, which in turn is associated with a greater energy intake. In addition to boredom, hearing or reading continuously about the COVID-19 from media can be stressful. Stress leads subjects toward overeating, especially ‘comfort foods’ rich in sugar, defined as “food craving”. Those foods, mainly rich in simple carbohydrates, can reduce stress as they encourage serotonin production with a positive effect on. However, this food craving effect of carbohydrates is proportional to the glycemic index of foods that is associated with the increased risk of developing obesity and cardiovascular diseases, beyond a chronic state of inflammation, that has been demonstrated to increase the risk for more severe complications of COVID-19 .

This new condition may compromise maintaining a healthy and varied diet, as well as a regular physical activity. For example, limited access to daily grocery shopping may lead to reduce the consumption of fresh foods, especially fruit, vegetables and fish, in favour of highly processed ones, such as convenience foods, junk foods, snacks, and ready-to-eat cereals, which tend to be high in fats, sugars, and salt. Moreover, psychological and emotional responses to the COVID-19 outbreak may increase the risk of developing dysfunctional eating behaviors. It is well known how the experience of negative emotions can lead to overeating, the so-called “emotional eating”. In order to contrast and respond to the negative experience of self-isolation, people could be more prone to look for reward and gratification physiologically associated with food consumption, even overriding other signals of satiety and hunger. In addition, boredom feelings, which may arise from staying home for an extended period, are often related to overeating as a means to escape monotony. On the other hand, negative experiences may lead to eating restriction, due to the physiological stress reactions that mimic the internal sensations associated with feeding-induced satiety.

Finally, lifestyle may be substantially changed due to the containment measures, with the consequent risk of sedentary behaviours, modification in smoking and sleeping habits. Of interest, different studies reported an association between sleep disturbances and obesity due to increase the secretion of pro-inflammatory cytokines by the increased visceral adipose that could contribute to alter the sleep–wake rhythm.

CONCLUSION

The COVID-19 outbreak led to changes in eating behaviour, which may have become less healthy during the pandemic. Although these changes could be a result of uncertainty and discomfort, adverse effects on health, especially for vulnerable population, would emphasize the need to promote healthy habits through preventive interventions and social actions supported by governments. Additionally, with the aim of assessing a more accurate framework of the stages through which eating behaviour changes evolved during this period, further research should be carried out. In this context, it would be important to focus on food intake but also on alcohol consumption and its consequences. By this, not only may a progression of ‘eating behaviour during a state of alarm’ be developed but also a benchmark for future directions can be established that will help improve guidelines for achieving proper nutrition aimed at the new normality.

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CHAPTER 6

NUTRITIONAL PROBLEMS IN ADOLESCENTS

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INTRODUCTION

India is home to 253 million adolescents (10 to 19 years) and stand with them at a crossroad between losing out on the potential of a generation and nurturing them to transform society. Adolescence is a nutritionally vulnerable time when rapid physical growth increases nutrient demands. Dietary behaviours established in adolescence may contribute to nutrition-related problems that have consequences for long-term health. This review explores nutritional problems during adolescents – underweight, overweight and obesity and micronutrient deficiencies.

Nutritional Problems in Adolescents

Adolescence is a time of transition when habits are formed that persist into adult life. Good habits, such as exercise and a healthy diet, are likely to bring many benefits, including improved performance in school (Doku et al., 2013). Nutritional habits are important, with high intake of processed, energy-dense foods, high BMI, and iron deficiency among the top 20 risk factors of disability-adjusted life years (DALYs) worldwide (WHO 2009). Such factors pose risks for later-life noncommunicable diseases, which are responsible for two of every three deaths globally (Sawyer et al., 2012).

The available studies suggest that adolescents are becoming more independent in their food choices, more likely to be influenced by their peers, and less likely to pick healthy foods

(Seymour, Hoerr, and Huang 1997). Other factors that affect their overall nutrition include the kinds of foods available at home, amount of time available to make food (Venter et al., 2010), knowledge of food content (Li et al., 2008), and ability to purchase snacks (Ahmed et al., 2006). Sociodemographic, behavioral, and environmental factors are also linked to different patterns of adolescent nutrition. Sociodemographic factors include socioeconomic status, age, sex, location, and degree of urbanization. Behavioral factors include patterns of beverage intake, portion sizes, and dieting, family dinners, eating in front of and viewing television, and skipping meals (especially breakfast).

Malnutrition implies to both extremes, under-nutrition on one side and over-nutrition on the other, causes a great deal of physical and emotional suffering and it is a violation of a child's human rights. They both increase the vulnerability of a child to a variety of diseases in later life.

UNDER NUTRITION

Statistics on under nutrition—including wasting, stunting, anemia, and vitamin A deficiency—in children younger than age five years are well known, but data on under nutrition specifically in adolescents are rare. In the least developed countries, the prevalence of adolescent underweight is 22 percent (UNICEF 2014) and is associated with various health risks. Under nutrition is linked to lower gut immunity, decreased protective secretions, and low innate and acquired immunity.

Undernourished adolescents have commonly experienced stunted growth in childhood. Under nutrition in early life can result in fewer pancreatic cells that produce insulin. Although this deficit is compensated for in adolescence, with stunted adolescents having more peripheral insulin receptors, this compensation contributes to increased accumulation of fat. Stunted children, adolescents, and adults have higher rates of later arterial hypertension. Under nutrition in childhood and adolescence also results in constant physiologic and psychologic stress, increasing the production of stress hormones that weaken the body and decreasing the production of thyroid hormones and insulin-like growth factor that regulate growth.

OVERWEIGHT AND OBESITY

Obesity and overweight are consequences of excess food intake, often combined with genetic factors. Childhood obesity and overweight have been linked to severe obesity in adulthood, with a stronger effect on men. Being overweight as an adolescent is strongly associated with



obesity as an adult .In Sub-Saharan Africa, being overweight as a child has been linked to significant morbidity and mortality as an adult, with higher BMI associated with type 2 diabetes, hypertension, coronary heart disease (although this effect is not independent of the effect of high adult BMI), asthma, polycystic ovary syndrome, and premature mortality.

Declining physical activity may also be a factor in increasing childhood overweight and obesity. In 85 countries, no more than 50 percent of boys or girls participated in 60 minutes or more of physical activity per day, with the Middle East and North Africa having the lowest ratios for girls.

MICRONUTRIENT DEFICIENCIES

Adolescents need more nutrients than adults because they gain at least 40 percent of their adult weight and 15 percent of their adult height during this period. Inadequate intake can lead to delayed sexual development and slower linear growth.

Cognitive growth also depends on micronutrients; B complex vitamins are important in neural communication, and their absence leads to depression. Vitamin B12, folate, and thiamine are important for neural pathways, and deficiency has been linked to impaired episodic memory and language issues. Iron is required for oligodendrocyte growth and neurotransmitter production, and deficiency affects cognition, memory, and social and motor development.

Iodine is involved in structural development, and its absence causes mental retardation. Zinc is found in the forebrain and hippocampus, and its deficiency is linked to impaired attention, learning, and memory, as well as to possible development of neuropsychological diseases.

Many children and adolescents have a micronutrient-deficient diet, and appropriate nutrient supplements are needed. Nutrients can be provided via tablets, powders sprinkled on food or mixed in water, and fortified spreads or snacks. Such foods need to have adequate amounts of

energy and micronutrients, taste good, be clean and hygienic, and have a long shelf life .There is some indication that supplementation is helpful for healthy children. Multiple-micronutrient supplementation has been associated with a marginal increase in fluid intelligence and improved academic performance; however, more research is needed.

CONCLUSION

In India, adolescents and young people aged 10-19 years, account for nearly one quarter of the total population. They deserve much needed attention as they hold the key to breaking entrenched cycles of poverty, inequity and deprivation. Appropriate nutrition during adolescence is important for the increased demands of growth and pubertal development and to decrease the risk of future chronic disease. Adolescents may be at risk for both nutritional deficits and excesses.

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CHAPTER 7

WASTAGE OF COOKED FOOD IN HOUSES

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INTRODUCTION

Food is any substance consumed to provide nutritional support for an organism. Food is usually of plant, animal or fungal origin and contains essential nutrients such as carbohydrates, proteins, fats, vitamins or minerals. The substance is ingested by an organism and assimilated by the organism's cell to provide energy, maintain life or stimulate growth. Different species of animals have different feeding behaviors that satisfy the needs of their unique metabolisms. Food loss and waste is food that is not eaten. The causes of food waste or loss are numerous and occur throughout the food system, during production, processing, distribution, retail and food service sales and consumption. Overall, about one- third of the world's food is thrown away. Food loss and waste is a major part of the impact of agriculture on climate change and other environmental issues. Moreover, food waste that is not handled or reclaimed properly, that is through composting, can have many negative environmental consequences.

Reducing food waste in all parts of the food system is an important part of reducing the environmental impact of agriculture, by reducing the total amount of waste, land and other resources used.

According to Kelleher and Robins (2013) 'avoidable food waste' consists of products that could have been eaten, such as leftovers, food left to go bad and food past its sell-by date, while, 'unavoidable food waste' is waste arising from food and drink preparation that is not, and has not been, edible under normal circumstances (eg: - meat bones, egg shells, pineapple skin etc). Fruits and vegetables, roots and tubers have the highest wastage rates of any food.

Globally, nearly one third of food produced for human consumption is lost or wasted. As the production of food is resource-intensive, food losses and wastes are indirectly accompanied by a broad range of environmental impacts, such as soil erosion, deforestation, water and air pollution, as well as greenhouse gas emissions that occur in the processes of food production, storage, transportation, and waste management.

FOOD WASTAGE

Food waste is one of the most challenging issues human kind is currently facing worldwide. Globally, nearly one third of food produced for human consumption is lost or wasted (Gustavsson et al., 2011).). As the production of food is resource-intensive, food losses and wastes are indirectly accompanied by a broad range of environmental impacts, such as soil erosion, deforestation, water and air pollution, as well as greenhouse gas emissions that occur in the processes of food production, storage, transportation, and waste management (Mourad, 2016).

TYPES OF FOOD WASTE

Food waste is defined as the use of food meant for consumption by humans for non-consumption purposes, the redirection of food to feed animals, or the disposal of edible food. It includes the edible as well as inedible parts of food that get removed from the food supply chain and which can be recovered or managed through disposal. Furthermore, food waste can be grouped into three different types: (a) avoidable waste, which is food that was edible at some point in time but has become inedible by the time it reaches disposal; (b) unavoidable waste, which refers to certain items, like eggshells, that are not edible; and (c) potentially avoidable food waste, which applies to particular wastes that are consumed at times, but not always, such as potato skins (Papargyropoulou et al., 2016).



Fig1 Types of food waste

(Source:https://www.epd.gov.hk/epd/english/environmentinhk/waste/prob_solutions/foodwrtips.html).

EFFECTS AND CAUSES OF FOOD WASTE

Food waste occurs within many different but interconnected practices of everyday life such as shopping routines, storage, cooking, and eating habits. Moreover, material properties of food itself and the material infrastructure in terms of living situation, available space for storing food, geographical access to stores and means of transportation have great impact on food waste as they influence every day routines. Food waste in households occurs because of how food is valued and also because of some incompatible values people try to live by (Hebrok and Boks, 2017).

A substantial amount of money is wasted producing food that is never used. Additionally, one must consider the wasted labor, material resources, time and energy that go into food production. It's nearly impossible to estimate the potential economic benefits from redirecting these resources, but the situation carries considerable gravity. The Food and Agriculture Organization of the United Nations (FAO) recently estimated annual losses of \$1 trillion from resource costs.

Higher prices and lower quantities of food invariably cause nutritional deficiencies for lower-income people. This, in turn, may result in externalities like higher healthcare costs and lost productivity from individuals weakened by nutritional deficiency and food insecurity. This cost is estimated by the FAO to be approximately \$900 billion per year. In terms of economic impacts, food waste represent high waste management costs and money is wasted, given the considerable amount of edible foods thrown away from every year (Koester, 2014).

REUTILIZATION METHODS AND FOOD WASTAGE DISPOSAL PRACTICE

Recycling refers to both the direct reuse of used products, combustible waste from households and waste wood that is not suitable for recycling undergo thermal treatment in waste incineration plants or waste wood furnaces. The heat released in the process is used to generate electricity and heat buildings.

Waste utilization is both a necessity and a challenge. In the food industry, the recovery and modification of wastes is becoming increasingly important. The aim is more complete utilization of the raw material, and minimization of the problems of pollution and waste treatment. Waste utilization is both a necessity and a challenge. In the food industry, the recovery and modification of wastes is becoming increasingly important. The aim is more complete utilization of the raw material, and minimization of the problems of pollution and waste treatment. Waste utilization is both a necessity and a challenge. In the food industry, the recovery and modification of wastes is becoming increasingly important. The aim is more complete utilization of the raw material, and minimization of the problems of pollution and waste treatment (Amihud Kramer and Itamar Ben-Gera, 1969). The necessity to carry out a proper utilization of food waste is underlined by the amounts of resources needed for food production, processing and transport (Daniel Pleissner, 2018).

CONCLUSION

Reducing food loss and waste is essential in a world where millions of people go hungry every day. When we reduce waste, we respect that food is not a given for the millions of people who go hungry every day. The causes of food waste can be classified as socio-demographic factors, the attitudes of the individual shopping too much and cooking too much, the attitudes of family members and problems with the cooling equipment and lack of storing equipment. Most of families waste very little amount of food and are very good in managing food waste. Food waste is disposed by simply removing, giving to domestic animals, Use for home garden, Use for making fertilizer or biogas, Composting etc. Amount of food waste can reduced by cooking accurate quantity of food. Through the sources of motivation for reducing food waste the idea of protecting materiality and spirituality, ensuring sustainability can enhance the overall development of the country.

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CHAPTER 8

BENEFITS OF FACE MASKS

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INTRODUCTION

A face mask is a covering that is worn over the face to prevent oneself from breathing bad air or from spreading germs or to protect face when one is in a dangerous situation. . Wearing a face mask will help prevent the spread of infection and prevent the individual from contracting any airborne infectious germs. When someone coughs, talks, sneezes, they could release germs in to the air that may infect others nearby. Face masks are part of an infection control strategy to eliminate cross-contamination.

It is an effective and humble tool to win the battle against infectious diseases. The practice of wearing the most affordable protection against viruses or pollution, the face mask, is not a new one. It has its roots in the history of medicine and science dating back to the spread of the 'Manchuria' epidemic in China. Later, face masks were used during the "Spanish- Flu" that cost over 40-million lives all over the world and the "Bombay Fever" during 1919-20. For over a century now, it has remained an effective and humble tool to win the battle against infectious diseases. Microorganisms may cause a health risk, furthermore protection against infectious micro-organisms has been of great importance. Here comesthe role of effective masks to provide protection against these micro- organisms.



FACE MASKS: A SIMPLE PROTECTION TOOL.

In the human population, social contact acts as a key for transmission of bacteria and viruses. The use of face masks seems to be critical to prevent the transmission, in which therapeutic interventions are lacking. Masks are designed to prevent the escape of a significant number of droplets expelled from our nose and mouth. A cough can produce as many as 3000 droplets and many spray thousands of microscopic droplets as one utters the phrase-'Wear a mask'.

In fact, the main purpose of using masks is to prevent inhalation and to trap the airborne particles (natural or man-made), the biological organisms (bacteria, viruses, prions, fungi. Airborne particles of natural origin (dust, storms, volcanic eruptions) and man-made (such as industrial emissions) are on a nanometer scale. Also, inhalation of these particles (particles smaller than 2.5µm) resulted in an 8.9 million deaths. Thus masks mainly keep you from unknowingly spreading the disease to others, but some studies indicate that they may help protect you from large droplets and serve as an indirect reminder to avoid touching your face. Controlling a respiratory infection at source by a face mask is a well-established strategy. For example, symptomatic patients with cough or sneezing are generally advised to put on a face mask, and this applies equally to patients with pulmonary tuberculosis (airborne transmission) and influenza (predominantly droplet-transmitted) with the large number of asymptomatic patients unaware of their own infection, the comparable viral load in their upper respiratory tract, droplets and aerosol dispersion even during talking and breathing and prolonged viral viability outside our body, there is an important role for the universal use of face mask as a means of source control in public places.

Achieving a mask with higher capacity, optimal comfort, as well as high efficiency in eliminating bio-aerosols and optimal filtration of airborne particles has always been one of the goals of studies conducted in this field. For this purpose, the factors affecting the determination of the final mask quality have been focused on increasing and improving the efficiency of the mask in the center of attention. In general, the filtering ability of a mask is influenced by the specification of the mask filter and external factors.

On the other hand, modelling and clarifying the mechanism of bio-aerosols penetration into the mask has high importance. This becomes important when contaminated particles and

microorganisms that have fallen on it, the contaminated particles can penetrate the mask by various mechanisms such as capillaries.

Masks should be cleaned after every wear. This frequency will vary depending on how often you need to wear the mask. The CDC recommends using a machine washer and dryer for proper cleaning.

TYPES OF MASKS

The different types of masks are:

Recommended

- Mask that fit properly (properly around the nose and itching with youknow larger gaps around the sides of the face)
- Mask made with the breathable fabrics (such as cotton)
- Mask made with the tightly woven fabric(that is fabric that do not allowlight to pass through when held up to a light source)
- Mask with two or more layer

Non-recommended

- Masks that do not fit properly (large gaps, too loose or too tight)
- Mask with exhalation valves or vents
- Mask made from loosely woven fabric or that are knitted that is fabrics that let light pass through.
- Wearing a scarf/ski mask as mask.

BANDANA

A bandana is a triangular or square piece of cloth that is often worn as a head or neck covering. Tying a bandanna over your mouth and nose is a timehonoured way to keep dust and other particles out of the respiratory system(that is why the Cowboys used them during round ups). Bandana provides some protection against droplets and cough or sneeze related pray.

Disposable surgical mask

These flat thin paper like masks are usually white and light blue. Surgical face masks can filter out about 60 percent smaller, inhaled particles.

They are primarily intended to stop droplets, sprays and splatters and studies have shown that diligently wearing surgical mask in public spaces can significantly reduce the spread of respiratory infection.

Cone style maskers

Manufactured cone style face mask are moulded masks that fit over the mouth and nose. Usually there is also a strip of metal at the top, so the wearer can secure the mask at the bridge of the nose.

N95 and other respirators

N95 face respirators offer the most protection against novel Corona virus and other respiratory disease. N95 protect the person wearing the mask because they filter out 95% particles from the air breathed in. Even more effective than N95 respirators are the N99 (99% filtration), N100 (99.97% filtration), R95 (95% filtration), P95 (95% filtration), P100 (99.97% filtration).

Homemade cloth mask

Single-layer cloth masks may only provide 1% particle filtration. A two-layer cotton mask filters out about 35% of small particles, so they offer personal protection to the wearer. Cotton face masks can decrease droplet spray from 8 feet to 2 1/2 inches, which reduces the amount of potentially virus containing particles you release into the air. The effectiveness of a homemade cloth face mask largely depends upon its construction. Single layer fabric masks are less effective than double layer masks which may be less effective than triple layer masks.

Neck gaiters and balaclavas

Outdoors enthusiasts often have neck gaiters (essentially, a tube of fabric that's worn around the neck and can be pulled up or down, as needed, to protect the face and neck) or balaclavas (tight-fitting garments that cover the head and neck) on hand. These can be used

as mouth and nose coverings and may provide some protection against spread of the novel coronavirus. Note: many gaiters are made of synthetic fabric, and synthetic fabric doesn't seem to be as effective in preventing the spread of small particles as natural fibers, such as cotton. What's more, a recent study found that neck gaiters made of synthetic fleece may do more harm than good because they aerosolize the wearer's respiratory droplets.

Cloth masks with filter

Some store-bought masks come with filter pockets; you can also make cloth masks with a pocket for a filter. You can use folded facial tissues as a filter. Simply slip the folded tissue into the filter pocket. Change the tissue filter daily. In an NPR report, May Chu, an epidemiologist at the Colorado School of Public Health, recommends using a filter of polypropylene material, a durable synthetic fabric often used in upholstery that can hold an electrostatic charge (which helps it trap small particles). Adding a polypropylene filter to a two-layer cloth mask can increase filtration efficiency from 35% to nearly 70%.

Store bought cloth mask

The effectiveness of a store-bought cloth mask will depend on its construction. According to Johns Hopkins Medicine, you should look for a mask with at least three layers of fabric; ideally, you want a mask constructed from tight-weave 100% cotton cloth. A typical cloth face mask "is probably at least 50 percent" protective, while "high quality masks could be 80-95 percent protective, and even low-quality masks made of very thin materials could still be 10-20 percent protective," according to Steffen Eikenberry, a postdoctoral scholar at Arizona State University studied the effectiveness of masks.

T shirt mask

Numerous online tutorials show how to craft a face mask from an old T-shirt. T-shirt masks are cheap and easy to make, but they're not the most effective. According to a 2013 study published in *Disaster Medicine and Public Health Preparedness*, T-shirt masks are one-third as effective as disposable surgical masks. The upside of T-shirt masks: they're comfortable, as the slightly stretchy material conforms to the face. You may be able to increase the effectiveness of a T-shirt mask by using more than one layer of material.

Benefits of mask wearing

It is not just others you are protecting. You are also protecting yourself when wearing a mask. It will reduce your own exposure to other people's respiratory droplets. Wearing

face masks is one of the most effective prevention measures people can take to protect themselves and others from becoming infected. How well it protects you from breathing in the virus likely depends on the fabrics used and how your mask is made (e. g, the type of fabric, the number of layers of fabric, how well the mask fits).

FACTORS AFFECTING THE EFFICIENCY OF FACE MASKS

Size of Respiratory Droplets

It is important to note that viral particles are expelled from the respiratory tract as relatively large droplets whenever an infected individual talks, coughs, or sneezes, less so by simply breathing. Larger droplets fall to the ground while smaller droplets are generally suspended in the air then evaporate a few seconds later, downsizing to smaller droplets of about 5-10 micrometers that can float longer in the air. Therefore, masks to be efficacious, they must be able to filter particles of the aforementioned sizes. It is therefore important to consider the type of material used to make the face masks and what each is approved for filtering.

Mode of The Expulsion of Respiratory Droplets

Earlier studies suggested that virus was spread mainly through coughing, but recent studies suggest that talking is also an important mode of transmission. The louder you speak, the more droplets are expelled and therefore there is a higher viral load transmission and an increased chance of transmitting the virus. Coughing will force droplets into the air at more considerable force, allowing them to travel further distances and widening the infectious perimeter around the infected party

Material of Face masks

Center for Disease Control and Prevention. National Institute for Occupational Safety and Health (NIOSH) and the Occupational Safety and Health Administration (OSHA) regulate N95 respirators. They are tested for fluid resistance, filtration efficiency (particulate filtration efficiency and bacterial filtration efficiency), flammability and biocompatibility. Non-medical masks are made from different materials and designs with or without filter papers. The combination of material, amount of layers, the presence of filter and how tightly the material is woven will affect the efficiency of the face mask.

Fit of Face masks

The fit of the masks is very important to consider for protecting yourself against covid-19. It should fit tightly enough to create a seal but comfortably enough to prevent frequent repositioning.

“In general, a mask is less helpful or counterproductive if it is not covering the nose and mouth, such as worn down around the neck for extended periods of time or if it is poorly fitting to the point that it requires frequent adjustment, which brings your hands close to your face repeatedly ”said Dr. George Anesi, director of the Medical Critical Care Bio response team at Penn Medicine(Covid-19 Dashboard by the center for Systems Science and Engineering (CSSE) at Johns Hopkins University .

THE TECHNIQUE USED IN DONNING, REMOVING AND REUSING FACEMASKS:

WHO recommends extended use (up to 6 hours) over reuse but in extenuating circumstances, such as short supply, face masks can be re- processed and reused. Extended use is accepted if the face mask is damaged, soiled or wet. For non-medical settings, cloth masks should be washed frequently for the most effective outcome.

The masks have always been mentioned as an effective tool against environmental threats. They are considered as protective equipment to preserve the respiratory system against the non-desirable air droplets and aerosols such as viral or pollution particles .The aerosols can be pollution existence in the air or the infectious air borne viruses initiated from the sneezing, coughing of the infected people. The filtration efficiency of the different masks against these aerosols are not the same, as the particles have different sizes, shapes and properties. Therefore, the challenge is to fabricate the filtration masks with higher efficiency to decrease the penetration percentage at the nastiest conditions. To achieve this concept, knowledge about the mechanisms of the penetration of the aerosols through the masks at different effective environmental conditions is necessary.

CONCLUSION

Face masks have long been used in health care, often for the simple reasons that they protect doctors and nurses from splashes of body fluids during procedures but also for the purpose of blocking the transmission of respirator droplets. Acute respiratory infections are prevalent and pose a constant threat to the society. The use of face mask has proven to be an effective barrier to curb the aerosol spread of such diseases. Masks should be used as a part of comprehensive strategy of measures to suppress transmission of infections and save lives. The appropriate use, storage and cleaning or disposal of masks are essential to make them as effective as possible. Proper fit and use of certain materials are also important for achieving the level of effectiveness.

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CHAPTER 9

HEALTH BENEFITS OF FICUS CARICA

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INTRODUCTION

Fruits are truly among nature's great gifts because they provide many nutrients that are essential for the health and maintenance of our bodies. Medicinal plants and their constituents have been extensively used as health promoting effect. Epidemiological studies have proven that natural product has disease cure potentiality through modulation of physiological and biological activities. Medicinal plants and its constituents have confirmed their role in diseases prevention and treatment. In this vista, *Ficus carica* and its ingredients have confirmed disease preventive ability.

Ficus carica, commonly known as fig, is one of the nutritious fruits which is rich in fibre, potassium, calcium and iron. It is eaten both dry and fresh, however it is most consumed as dry in our locality. Most of the people are unaware of the of including this nutritious raw fruit in their diet. *Ficus* is one of the largest genera of angiosperms from the mulberry family with more than 800 species of trees, shrubs, hemi epiphytes, climbers and creepers in the tropical and subtropical region all over the world. The most significant species of *Ficus* found in India, are *F. bengalensis*, *F. carica*, *F. racemosa* and *F. elastica*. *Ficus carica* belongs to Moraceae family and is commonly known as "Fig" (Anjir in Hindi) in India. Fig trees are commonly cultivated in warm and dry climates.

F. carica has been cultivated for a long time in various places worldwide for its edible fruit. It is supposed to originate from Western Asia and spread to the Mediterranean by humans. It is also an imperative world crop today. Turkey, Egypt, Morocco, Spain, Greece, California, Italy, Brazil, and other places with typically mild winters and hot dry summers are the major producers of edible figs. Fruits can be eaten raw, dried, canned, or in other preserved forms.

Fig fruit is a well-known nutritious and delicious fruit of the Indian subcontinent. Its cultivation is restricted and done locally, which makes it an underutilized fruit crop. Fig fruit is attractive, energy dense and rich in nutritive value. Daily consumption of figs can provide almost 20 per cent of the recommended dietary fibre per serving. It also helps to regulate blood pressure and blood cholesterol due to the presence of potassium, omega 6 and omega 3 fatty acids. High medicinal value of figs is attributed to presence of different phytochemicals.

FICUS CARICA

Ficus (Moraceae) comprises one of the largest genera of angiosperms with more than 800 species of trees, shrubs, hemi epiphytes, climbers, and creepers in the tropics and subtropics worldwide. This genus is an important genetic resource due to its high economic and nutritional values and also an important part of the biodiversity in the rainforest ecosystem. It is also a good source of food for fruit-eating animals in tropical areas. The genus is divided into six subgenera based on preliminary morphology. The monoecious subgenus *Urostigma* is the largest with about 280 species all inclusive, and most of them display distinctive hemiepiphytic habits. *Ficus* includes 23 species of hemiepiphytes and lithophytes which produce aerial and creeping root systems (N. Ronsted et al.,2008).

Ficus carica is usually a 15–20 ft tall deciduous tree, with numerous spreading branches and trunk rarely more than 7 ft in diameter. The edible seeds are numerous and generally hollow, unless pollinated. Pollinated seeds provide the characteristic nutty taste of dried figs. The interior portion is a white, inner ring containing a seed mass bound with jelly-like flesh. The latex of the plant is milky white and mainly contains ficin, i.e., protein hydrolytic enzyme (Badgular, 2011).



PHYTOCHEMISTRY

Phytochemical studies on *F. carica* revealed the presence of numerous bioactive compounds such as phenolic compounds, phytosterols, organic acids, anthocyanin composition, triterpenoids, coumarins, and volatile compounds such as hydrocarbons, Aliphatic alcohols, and few other classes of secondary metabolites from different parts of *F. carica*. Most species of *F. carica* contain phenolic compounds, organic acids, and volatile compounds (A.P. Oliveira et al., 2009).

Organic Acids

Organic acid profile of fig leaves is composed by six organic acids: oxalic, citric, malic, quinic, shikimic, and fumaric acids (Oliveira et al., 2009).

Amino Acid

The amino acid profile of *Ficus carica* latex was identified by High-Performance Liquid Chromatography coupled to ultraviolet–visible spectroscopy (HPLC/UV-vis). There are 13 amino acid compounds present in *Ficus*, comprising five essential amino acids (leucine, tryptophan, phenylalanine, lysine, and histidine) and eight non-essential amino acids (asparagine, alanine, glutamine, serine, glycine, ornithine, tyrosine, and cysteine). Tryptophan, cysteine, and tyrosine are found in higher quantities relative to the other amino acids (Oliveira et al., 2010).

Fatty Acids

The fatty acid profile of *Ficus carica* latex was determined by gas chromatography ion trap mass spectrometry (GC-ITMS). It revealed the presence of 14 major detectable fatty acids. These acids are identified as myristic, pentadecylic, palmitic, margaric, *cis*-10-heptadecenoic, stearic, oleic, elaidic, linoleic, arachidic, heneicosylic, behenic, tricosylic, and lignoceric (Oliveira et al., 2010).

Flavonoids

The main free flavonoid (non-glycosylated) in *Ficus carica* was found to be luteolin, which was also discovered to be the main free flavonoid in *Pistacia lentiscus* Linn (Anacardiaceae) locally named as Mastic tree. Luteolin (5,7,3'4'-tetrahydroxy-flavone) turned out to be the major flavonoid in the *Ficus* leaf, with a slightly higher flavonoid content than quercetin.

Another flavonoid identified in the *Ficus* is 5,7-dihydroxy-4'-methoxy-isoflavone, present mainly as a free aglycone (Vaya & Mahmood, 2006).

Phenolic Compounds

Phenolic compounds are ubiquitously distributed in fruits, where they exert specific functions and are very important for sensory properties, i.e., flavor and color. Moreover, phenolic compounds have become popular among scientists and consumers for their health-promoting properties, mainly for their antioxidant property (Caro & Piga, 2008). The phenolic profile of fig leaves is composed by seven phenolic compounds, namely 3-CQA [3-*O*-caffeoylquinic acid], 5-CQA [5-*O*-caffeoylquinic acid], Q-3-Glu [quercetin 3-*O*-glucoside], Q-3-rut [quercetin 3-*O*-rutinoside], ferulic acid, psoralen, and bergapten (Oliveira et al., 2009).

BIOLOGICAL PROPERTIES

Antioxidant Activity

F. carica contains many phenolic compounds that play many physiological roles in plants. Some of them are also favorable to human health, since they are able to act as an antioxidant by different ways: reducing agents, hydrogen donators, free radical scavengers, singlet oxygen quenchers, and so forth. Fruits contained the highest levels of polyphenols, flavonoids, and anthocyanins and exhibited the highest antioxidant capacity.

Anticancer Activity

A mixture of 6-*O*-acyl- β -d-glucosyl- β -sitosterols has been isolated as an effective cytotoxic agent from fig (*F. carica*) latex that showed *in vitro* inhibitory effects on proliferation of various cancer cell lines (S.D Yanjeva et al., 2005).

Hepatoprotective Activity

The petroleum ether extract from leaves of *F. carica* was evaluated for hepatoprotective activity on rats treated with 50 mg/kg of rifampicin orally, and significant reversal of biochemical, histological, and functional changes induced by rifampicin on rats indicated potential hepatoprotective activity (N.Y. Gond et al., 2008).

Antihelmintic

As per WHO, only a few drugs are frequently used in the treatment of helminths in human beings. Anthelmintics from the natural sources may play a key role in the treatment of parasite infections. Antihelmintic activity of aqueous, petroleum ether, chloroform, and methanol extract of leaves of *Ficus carica* was investigated against *Pheritima posthuma* in comparison with mebendazole as a standard drug (Patil et al., 2010).

Anticonstipation Effect

Constipation is one of the most common gastrointestinal complaints worldwide. This study examined the effects of fig paste for the treatment of loperamide-induced constipation in a rat model. For this purpose, animals were divided into one normal control group and four experimental groups (0, 1, 6, and 30 g/kg). Loperamide (2 mg/kg, twice per day) was injected intraperitoneally to induce constipation in the four experimental groups. Fig paste was administered for 4 weeks to assess its anticonstipation effects. In progress, fecal pellet number, weight, and water content were increased in the fig-treated groups as compared with the control group. Reductions in body weight and increased intestinal transit length were observed in the fig-treated groups. Fecal pellet number was reduced in the distal colons of the fig-treated rats. Exercise and ileum tension increased in the experimental groups as compared with the control group. Constipation was decreased when the fig fruit was fed to rats (Lee et al., [2012](#))

Antipyretic

Commonly used antipyretic drugs are toxic to liver cells and cause complications. Antipyretic effect of ethanol extract of leaves was evaluated and extract at doses of 100, 200, and 300 mg/kg body wt. showed significant dose-dependent reduction in normal body temperature and yeast-provoked elevated temperature.

Anti-inflammatory

Petroleum ether (PEE), chloroform (CE), and ethanol (EE) extracts of *Ficus carica* leaves are reported for anti-inflammatory activity against carrageenan-induced rat paw

edema. The EE exhibits greater anti-inflammatory effect than PEE and CE of *Ficus carica* as compared with the standard drug, indomethacin (Patil & Patil, 2011).

Antispasmodic and Antiplatelet

The aqueous ethanol extract (AEE) of *Ficus carica* fruit was studied for antispasmodic effect on rabbit jejunum preparations and for antiplatelet effect using *ex vivo* model of human platelets. When AEE is tested in isolated rabbit jejunum, it produced relaxation in a spontaneous way. AEE also inhibits the adenosine 5'-diphosphate and adrenaline-induced human platelet aggregation. This study exhibits the remarkable spasmolytic property in the ripe dried fruit of *Ficus carica* along with antiplatelet activity that provides sound pharmacological basis for its medicinal use in the gut motility and inflammatory disorders (Gilani et al., 2008).

Traditional and contemporary uses

Ficus carica has been extensively used in traditional medicine for a wide range of ailments. Its bark, fruit, leaves, roots, and latex are medicinally used in different forms. Also, it is used in combination with another medicinal plant. In addition, in Mediterranean countries, the fig is so widely used both fresh and dried that it is called “the poor man’s food”. In Unani medicine, *Ficus carica* is used as a mild laxative, expectorant, diuretic; also, in treatment of diseases of liver and spleen as deobstruent and anti-inflammatory agent. In ethnomedicine, fruits are used in leprosy and nose bleeding, and are used as antipyretic, aphrodisiac, lithotriptic, hair-nutritive, emollient, demulcent, laxative, and in the treatment of various inflammations, paralysis, liver diseases, chest pain, and piles. Roots are used as tonic in the treatment of leukoderma and ringworm infection (Manjula et al., 2011). Latex is used as expectorant, diuretic, anthelmintic and anemia. Leaves are used as antidiabetic, vermifuge, and contact dermatitis in humans, phototoxicity in animals. Seeds are used as edible oil and lubricant.

F. carica has been traditionally used for its medicinal benefits as metabolic, cardiovascular, respiratory, antispasmodic, and anti-inflammatory remedy. It is commonly referred to as “Fig”. Leaves, fruits, and roots of *F. carica* are used in native medicinal system in different disorders such as gastrointestinal (colic, indigestion, loss of appetite, and

diarrhoea), respiratory (sore throats, cough, and bronchial problems), inflammatory, and cardiovascular disorders. Fruits of *F. carica* can be eaten fresh or dried or used as jam. Figs are used as an excellent source of minerals, vitamins, carbohydrates, and dietary fibre because it is fat and cholesterol free and contain high number of amino acids. It is also reported that figs have been conventionally used for their therapeutic benefits as laxative, cardiovascular, respiratory, antispasmodic, and anti-inflammatory remedies.

CONCLUSION

Ficus carica has emerged as a good source of traditional medicine for the treatment of various ailments such as anemia, cancer, diabetes, leprosy, liver diseases, paralysis, skin diseases, and ulcers and also have important nutritional value. It is a promising candidate in pharmaceutical biology for the development/ formulation of new drugs and future clinical uses.

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CHAPTER 10

GREEN LEAFY VEGETABLES: A POTENT FOOD SOURCE

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INTRODUCTION

India, endowed with climatic conditions provides opportunities for growing an array of green leafy vegetable, which form second important category of vegetables. These green leafy vegetables are mostly rich in essential minerals, vitamins and dietary fibre and have therapeutic properties. A number of greens are cultivated in India throughout the year. Some are suitable for growing during winter eg. Palak, spinach, fenugreek and mustard and others such as amaranthus, portulaca and poi are suitable for growing during summer. The ten most popular green leafy vegetables are spinach, amaranthus, fenugreek, agathi, mustard, mint, gogu, alternanthera, drumstick leaves and coriander. Besides these, great variety of less familiar green leafy vegetables are also used locally in different parts of the country. GLVs (Green Leafy Vegetables) are vegetables whose young shoots, leaves and flowers are edible. They have excellent nutritional value and can be used for medicinal benefits. Concentration of functional compounds varies according to the climate season, their growth phase and their existence in particular plant.

Dark green leafy vegetables are good sources of minerals like iron, calcium, potassium, and magnesium and vitamins including K, C, E, and many of the B vitamins. They also provide a variety of phytonutrients including beta-carotene, lutein, zeaxanthin, and Omega- 3 fatty acid which protect cells from damage and age-related problems (Sreenivasa Rao, 2017).

PHYTOCHEMICALS IN GREEN LEAFY VEGETABLES:

The phytochemicals present in green leafy vegetables includes phenolic acids, flavonoids, carotenoids, polyphenols, glucosinolates, isothiocyanate, allylic sulfides, phytosterols, and monoterpenes .

COMPONENTS OF GREEN LEAFY VEGETABLES:

Green leafy vegetables mostly contain antioxidants, dietary fibers, minerals, α -linoleic acid, and vitamins. Antioxidants reduce ferric ions and mitigate oxidative stress. Dietary fiber delay absorption of carbohydrates and improve insulin secretion. Minerals such as magnesium and phosphorous protect against gestational diabetes. α linoleic acid determines composition of phospholipid bilayer and insulin sensitivity within skeleton muscles. Vitamins such as α -tocopherol(Vit. E), β -carotene (Vit. A), ascorbic acid (Vit. C) Reduces oxidative stress.

HEALTH BENEFITS:

Green leafy vegetables with phytochemicals and enormous antioxidants have potential to work as: anti-diabetic prevents CVD, anti-hypertensive, anti-carcinogenic, anti-anemic, improves gut health.

GREEN LEAFY VEGETABLES AND ANTI-DIABETIC PROPERTIES:

Diabetes Mellitus is spreading everywhere in the world and it is categorized as a non-communicable disease. By 2025, it has been proposed that approximately 300,000,000 people would be affected by this disease. GLVs (Green leafy vegetables) contain decent quantity of minerals, alpha tocopherols, vitamins, flavonoids, α -linoleic acid, phytochemicals.

It has been seen in one of the studies that females who consume leafy green vegetables are at low risk to develop type 2 diabetes. Green leafy vegetables can decrease the chance of developing type 2 diabetes because of magnesium present in these vegetables as one of the researches has proved that magnesium can decrease the risk of type 2 diabetes development.

GREEN LEAFY VEGETABLES AND ITS CARDIO PROTECTIVE EFFECTS:

CVD includes the diseases related to heart and blood vessels ¹² like stroke hemorrhage, heart failure.¹³It has been reported that about 80% of males and 75% of females died annually due to cardio vascular diseases.¹² In Pakistan, 30 to 40 per cent of all deaths.The risk factors for CVD includes smoking, age, physical inactivity, alcohol consumption, obesity, family

history, diabetes mellitus, high blood cholesterol level, poverty and inadequate vegetables and fruits consumption. There is very low data available on the effect of vegetables and fruits in lowering the risk of heart diseases. One of the researches conducted to observe the effect of consumption of fruits and vegetables in lowering risk of heart diseases. It was observed that people who consume fruits and vegetables especially leafy green vegetables have low risk to develop CVD as compare to those who does not consume them.



In another study researchers studied the mechanism of green leafy vegetables related to the protection against heart diseases. Researchers noticed that inorganic nitrate present in green leafy vegetables was converted to nitric oxide and nitrite in oral cavity which were seen to have vasodilation property and tissue protective effect, thus lowers the risk of CVD. In different Indian areas, a clear difference has been seen in the prevalence and mortality due to cardiovascular disease. An investigation was done to examine the importance and numerous dietary factors and other variables in everyday life to describe the variation death rate of cardiovascular disease. Survey results showed that death due to cardiovascular disease was linked with literacy level, smoking, prevalence of overweight and obesity, prevalence of stunted growth at 3-years, dietary consumption of calories, adult mean body mass index, green leafy vegetables, cereals and pulses, roots, milk and milk products, tubers and other vegetables, sugar, jaggery and fats and oils. A noteworthy negative link of cardiovascular disease mortality with green leafy vegetable intake was seen. On the contrary, a positive link between cardiovascular disease mortality with intake of milk and milk products, sugar and prevalence of obesity was observed. A meta-analysis was done to see that intake of GLVs (green leafy vegetables) as well as cruciferous vegetables considerably decreases the incidence of CVD

(cardiovascular disease). Studies examined the positive correlation between the intake of GLVs (green leafy vegetables) and occurrence of CVD (cardiovascular disease) and met the encompassing criteria. With different constituents of minerals, vitamins, dietary fiber, bio-active phytochemicals and carotenoids, vegetables and fruits make a heterogeneous food group.

A research was done to study the association between stroke risk in Swedish men and women and specific intake of fruits and vegetables subdivisions. This study was restricted to persons without High blood pressure (hypertension). Results concluded that risk of stroke is negatively associated with intake of fruits and vegetables especially intake of green leafy vegetables and pears and apples was negatively linked with stroke. Leafy vegetables produce reactive oxygen species and decrease the LDL oxidation and also low the monocyte adhesion to endothelial cell which lowers the chances of atherosclerosis Green Leafy vegetables and anti- hypertension effect:

Bioactive component of green leafy vegetables that prevent from hypertension includes alpha-tocopherol, Carotenoids, coumarins , omega-3-fatty acids. The antioxidants present in green leafy vegetables helps in protection against cardiovascular diseases by free radical scavenger, Induction response element, and helps in lowering oxidize LDL, lowering blood pressure, and lowering blood glucose level.

Green leafy vegetable, that are rich source of dietary nitrate and defensive against stroke and cardiovascular diseases are suggested by Epidemiological studies. The major risk factor of stroke is High blood pressure (BP) and the use of inorganic nitrate has shown to lessen the blood reassure. Analysis of the theory that vegetables containing high nitrate diets would enhance plasma nitrate and concentrations of nitrate whereas in healthy women reduce blood pressure was aim of the study. The high omega-6: omega-3 fatty acid ratio (FAR) in typical Western dietary pattern may aggravate the possibility of chronic disease. Contrarily, disease risk has been reducing by the intake of green leafy vegetable (GLVs).

The limited use of spinach has been assumed; a high dietary nitrate content containing vegetables can influence the central and peripheral blood pressure (BP) and arterial waveform analytical of arterial stiffness. Healthy candidate were erratically allocate to obtain either a low-nitrate or high-nitrate soup, by using a placebo-controlled, crossover design. The result shows that vegetable-rich diet may contribute beneficial hemodynamic effects of dietary nitrate from spinach and underline the elevated BP the management.

GREEN LEAFY VEGETABLES AND ANTI-CANCEROUS PROPERTIES

Crucified family members are planted and consumed worldwide on regular bases. The main vegetables include banana, broccoli, radish, cauliflower, cabbage, Brussels sprouts and watercress which can be fresh (salad), steamed or cooked. In addition to nutrients, these vegetables also have health-beneficial secondary metabolites, including S-methylcysteine sulfoxide and sulfurcontaining flavonoids, glucosinolates, anthocyanin, coumarin, carotenoids, and other antioxidant enzymes. Some specific mechanisms of cancer prevention include NRF2, anti-inflammatory, polymorphism, inhibition of histone deacetylase activity, and effects on estrogen metabolism. "Bioactive compounds" are extra-nutritional components that usually happen in minor amounts in food. Their benefits on health are studied comprehensively. The epidemiology of this scientific research has resulted in numerous epidemiological studies showing the heart healthy benefits of a plant based diet on cancer and heart disease.

A powerful carotenoid, lycopene which is present in tomatoes and other fruits inhibits the growth of tumor cells in animals and also protect from prostate and other cancers. In experimental models, onion and garlic contain organo sulfur compounds, monoterpenes in citrus fruits, isothiocyanates in cruciferous vegetables, cherries and monoterpenes have cardio protective effects as well as anti-cancer activity.

In order to make science-based dietary recommendations many scientific researches needs to be conducted. However, there is ample proof that bioactive compounds are rich in dietary sources. So it is best to recommend whole grains, legumes, oils, nuts, fruits and vegetables rich diets.

The minimum carcinogen threat and low toxins levels of fruits and vegetables recommended that precise amount of antioxidants agents from these food sources can cause anticancerous effects without producing significant toxins. This review provides a comprehensive overview on major findings from studies on the effects of dietary antioxidants on lungs, skin, breast, prostate, and liver cancers for example curcumin, resveratrol, tea polyphenols, lycopene, genistein, lupole and pomegranate. Green leafy vegetables as anti-anemic. In anemia body have not the adequate amount of healthy red blood cells which carry appropriate amount of oxygen to the tissues of body. The very common or induced types of anaemia are included megaloblastic anaemia and Iron deficient anaemia.

IRON DEFICIENCY ANEMIA AND GREEN LEAFY VEGETABLES:

Folate and prevention of anemia:

The risk of chronic disease increases due to the deficiency of folate, megaloblastic anemia. A study that is conducted in China shows the link between the green leafy vegetables and their contribution in the intake of folate. Similar results show that population that consume green leafy vegetables have better source of folate than those who consumes fruits and root vegetables.

Megaloblastic Anemia and green leafy vegetables:

70 out of 100 patients with megaloblastic anemia significantly were delivered with green leafy vegetables in the 6 months more than in the other half of the year. So the study showed that the higher incidence of onset in winter and spring may be related to an inadequate intake of folic acid due to seasonal low consumption of fresh green vegetable.

Green leafy vegetables and gut health:

Dietary fiber is a major component of vegetables, coming in the form of cellulose (polysaccharides and lignin). Two types of dietary fibers are soluble and insoluble.

Insoluble dietary fiber and Constipation:

Insoluble fiber does not dissolve in water and is left intact as food moves through the gastrointestinal tract. The insoluble dietary fiber has long been known to relieve constipation. Insoluble fiber adds bulk to the diet and performs the role of cleansing the digestive tract

Soluble dietary fiber:

Soluble dietary fibre absorbs water from the digestive tract and become viscous and gelatinous in nature, thereby improves stool consistency .Because of these properties of GLV helps to relief constipation and hemorrhoids. Inulin is now also included in this class. 30-40% dietary fibers come from green leafy vegetables.

Green leafy vegetables and dietary fiber:

Gut health has been influenced by the dietary fiber comes from green leafy vegetables, effecting the spread of disease causing bacteria. GLV can protect against or else improve

enteric infections, balance and upheld with the metabolism and immune system and fermentation of non-digestible dietary components in the large intestine.

Benefits of dietary fibers:

A good intake of dietary fibers provides us benefits such as improves the serum lipid concentration, blood glucose control, regularity gets promote, lower the blood pressure, helps in losing the weight moreover improves the immunity.

CONCLUSION

The dark-green leafy vegetables made a significant contribution towards total nutrient intake of two-to five year-old children for several of the micronutrients. This contribution can potentially be increased and these vegetables be consumed more frequently and by a larger proportion of the children. This can be achieved through appropriate promotion and nutrition education programmes, e.g. promote as nutritionally rich traditional green leafy vegetables. Promotion of kitchen garden / nutrition garden for more intake of greens India is the richest source for vegetables and greens. A survey can be taken up to identify the non-traditional green leaves and their nutrient contents. The crops which are rich in nutrients can be commercially exploited.

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